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Risk of cancer mortality among LSAH participants compared with general population

A significant health concern associated with space travel is the potential exposure to radiation. NASA has addressed this concern with medical projects that monitor exposures and maintain lifelong exposure records. Early detection of precancerous conditions is a primary effort of the occupational physical examinations provided to astronauts and to the LSAH comparison population. A task of LSAH is to monitor the incidence of medical events and to provide data to NASA Medical Operations management to aid program decision making.

We have recently reviewed the cancer mortality rates and the news is promising for the LSAH population as a whole. The cancer mortality rates among LSAH participants have been compared with the cancer mortality rates for the general population of the Texas Gulf Coast area residing in Public Health Region 6 (see Table 1). Public Region 6 includes Harris County and the surrounding counties of Austin, Colorado, Montgomery, Wharton, Brazoria, Fort Bend, Liberty, Walker, Chambers, Galveston, Matagorda, and Waller. The age-specific average annual cancer mortality rates for the years of 1987 through 1993 were obtained for this area from the Texas Cancer Data Center.

Table 1. Comparison of cancer mortality rates among male LSAH participants, 1959-1996, with the cancer mortality rate among the male general population of Texas Public Health Region 6, 1987-1993 (Texas Cancer Data Center)

Population	*Expected Cases*	*Observed Cases*	*SMR*	*Lower CI*	*Upper CI*
Astronauts	6.3	3	47	9.6	105.1
Comparisons	17.3	3	17	3.5	37.9

Table 2. Comparison of cancer mortality rate among male astronauts with rate among the male LSAH comparison participants

Population	*Expected Cases*	*Observed Cases*	*SMR*	*Lower CI*	*Upper CI*
Astronauts	0.87	3	345	69.5	756.2

The rate of the astronauts has also been compared with the rate of the LSAH comparison participants (see Table 2). Both the astronauts and the comparison group currently have lower age-specific rates of total cancer mortality than that seen in the general population residing in the Texas Gulf Coast area. The rate among the astronauts is somewhat higher than the comparison participants but not significantly higher. The difference may be by chance alone.

All cancer deaths among the LSAH population have been among males, therefore only males were included in these analyses. This is a conservative analysis approach since the denominator used in the rate calculation is based on the total population being examined. Given a consistent numerator (the number of cancer cases) the smaller denominator obtained by including only males results in a higher rate. All males selected as astronauts between 1959 and 1995 (210) and male comparisons for the same time period selected from the JSC employee population (618) as participants in LSAH were included in this cancer mortality investigation. Person years of follow-up time for each of the two study groups were calculated for the same age-specific groupings identified in the reference population of Public Health Region 6. The expected rates of cancer mortality are obtained by applying the age-specific rates of the reference population to the study population. The results are those rates that would be expected if the study population had experienced the same cancer mortality as the reference population. The observed rates of cancer mortality in each of the two LSAH study groups were compared with the expected rates.

The ratio of the observed rate to the expected rate is known as the Standardized Mortality Ratio (SMR). An SMR of 100 indicates that identical rates exist for two groups. Confidence intervals (CI) around the SMRs (CI, 95%) were calculated.

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Vitamin D plays important role in winter wellness

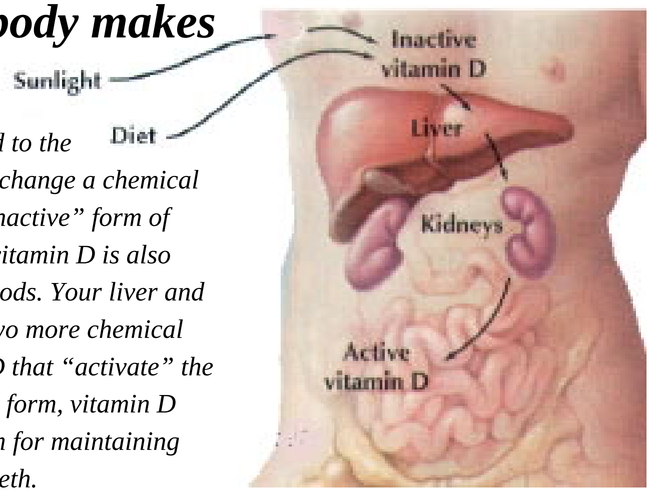
It is well-known that space travelers experience loss of skeletal calcium during space flight. However, even people who never travel in space can experience calcium loss and bone demineralization under certain circumstances.

Osteoporosis receives a lot of publicity as a disorder of post-menopausal women. Osteoporosis is a disorder of the bone characterized by decreased bone density, resulting in increased bone fragility and increased risk of fracture. However, during the winter, otherwise healthy adults may be at increased risk of osteoporosis and a related disorder, osteomalacia, if intake of vitamin D and calcium are insufficient.

Vitamin D was first identified as an essential nutrient in the late 1920s when doctors discovered that a deficiency of it caused rickets. Rickets is a childhood disease where bones fail to develop properly, leading to skeletal deformities such as bowlegs and knock-knees. Long-term vitamin D deficiency in adults results in a different disorder, osteomalacia, in which bones become soft and misshapen and more prone to fracture.

Osteoporosis and osteomalacia are disorders in which insufficient calcium is retained in the bones. Humans only absorb about 25-35 percent of the calcium in our diet, and net retention of dietary calcium after processing by the kidneys is about 5-10 percent. Vitamin D increases the efficiency of absorption of dietary calcium in the intestines, thus increasing the amount of calcium available. Calcium in circulating blood is used in neuromuscular and cellular functions, and calcium in bone is used for maintenance of the skeleton.

How your body makes vitamin D



When you're exposed to the sun, ultraviolet rays change a chemical in your skin to an "inactive" form of vitamin D. Inactive vitamin D is also contained in some foods. Your liver and kidneys then make two more chemical changes to vitamin D that "activate" the nutrient. In its active form, vitamin D helps absorb calcium for maintaining healthy bones and teeth.

Humans get their vitamin D from two sources: sunlight and food. Dietary sources of vitamin D include fatty fish such as cod, tuna, and salmon; fish oils; liver; eggs; butter; and foods fortified with vitamin D such as milk and some cereals and bread products. Before food fortification became widespread in the United States, many people relied on cod liver oil to provide vitamin D and vitamin A. The Recommended Daily Allowance (RDA) of vitamin D for adults age 25 to 50 is 200 International Units (IU). Two cups of fortified milk per day will provide the RDA of vitamin D, but most people do not meet the RDA for vitamin D through diet.

Fortunately, most people get sufficient amounts of vitamin D through exposure to sunlight. When ultraviolet rays are absorbed by skin, a chemical (7-dehydrocholesterol, a precursor to cholesterol) in the skin is converted into inactive vitamin D. This inactive form of vitamin D is converted by the liver and kidneys into active vitamin D which helps absorb dietary calcium and maintain the balance of calcium in the blood and bones. Exposure to summer sun for 10 to 15 minutes, two or three times a week, creates sufficient vitamin D for good health. Brief sun exposure like this will not increase the risk of skin cancer, but sunscreen should be worn for longer exposures. The excess vitamin D created during summer is stored in the liver for use in the first several months of winter.

For people in southern latitudes, such as here in Houston, Texas, winter sunlight also provides enough ultraviolet light to continue vitamin D formation during the winter months. However, winter sunlight in northern latitudes, such as Boston and Moscow, is ineffective for production of vitamin D. This is because the angle of the sun to these regions in the winter causes the ultraviolet light to scatter and be absorbed by ozone before it reaches the earth. In addition, people wear more clothing, which blocks ultraviolet light from skin, and they spend less time

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ICD-9-CM facilitates comparison of LSAH data with other population data

The purpose of the LSAH is to assess the health risks of the occupational exposures of the astronauts. To accomplish this, the medical events experienced by the LSAH participants are coded in a standardized system so that objective comparisons can be made with the LSAH comparison population and other populations using the same coding system.

The International Classification of Diseases (ICD) was developed specifically for this kind of research and is revised every 10 years to keep up with the advances of medicine. The World Health Organization has been responsible for the organization, coordination, and execution of activities related to ICD since 1948 (Sixth Revision of the ICD) and is now proceeding with the Tenth Revision.

ICD-9-CM is a clinical modification of the World Health Organization's Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, Ninth Revision (ICD-9). Both ICD-9 and ICD-9-CM are statistical classification systems. A classification system is an arrangement of the elements of a subject into groups according to preestablished criteria. In ICD-9 and ICD-9-CM, the elements to be arranged are diseases and injuries, which are grouped into appropriate chapters, sections, categories, and subcategories.

The LSAH uses ICD-9-CM when coding medical examination records for study participants. An example would be a participant diagnosed with the flu. The code used would be 487.1, listed under the axis of diseases of the respiratory system. However, symptoms of general chills and pain would be diagnosed under the axis of symptoms, signs, and ill-defined conditions, requiring a code of 780.9. Another case in point might be someone coming in with a sprained ankle resulting from falling off a ladder, while shifting books at a part-time job at the library. This time, one would not only code the sprained ankle (845.00), but also external causes (E codes) for the accidental fall from the ladder (E881.0) and place of occurrence (workplace—E849.3).

The ICD-9-CM is recommended for use in all clinical settings but is required for reporting diagnoses and diseases to all U.S Public Health Service and Health Care Financing Administration programs. It represents the best in contemporary thinking of clinicians, nosologists, epidemiologists, and statisticians from both public and private sectors.

Vitamin D, continued from page 2

outside. Sunlight that has passed through window pane glass or Plexiglas will not produce vitamin D in the skin because glass and most plastics efficiently absorb ultraviolet B radiation. Research has shown that little, if any, vitamin D is formed by the skin between November and March in northern latitudes.

The RDA for vitamin D and the other nutrients is based on the nutritional needs of the average adult living in the United States. However, in elderly people the absorption of dietary calcium decreases from 25-30 percent to 15 percent or less. The RDA for calcium is increased in women after menopause. Elderly men and women have a greater tendency toward insufficient sun exposure. Elizabeth Dawson-Hughes, of the Jean Mayer U.S. Department of Agriculture Human Nutrition Research Center on Aging at Tufts University in Boston, Massachusetts, recommends that postmenopausal women consume 1000-1500 mg of calcium and 400-800 IU of vitamin D per day to minimize bone loss.

People who live in northern latitudes during the winter either permanently or temporarily (such as NASA employees on assignment to Russia) may be at increased risk for vitamin D deficiency and may want to consider vitamin D supplementation of 400-600 IU per day.

These are general recommendations, and of course, everyone should talk to a physician before making changes in health habits. Dietary supplementation may be ill-advised for people with certain medical conditions. It is also important not to take excessive amounts of vitamin D (doses of more than 50,000-100,000 IU per day) because vitamin D is fat-soluble. That means that unused vitamin D is stored in the liver. In normal amounts, this is helpful for providing vitamin D in the early months of winter. However, overdoses of vitamin D can induce hypercalcemia (excess calcium in the blood) resulting in nausea, weight loss, irritability, depression, muscle weakness, and formation of calcium deposits in the lungs, kidneys, and soft tissues.

LSAH Sample Size Expands to Over 1000

The 1996 astronaut selection class added 44 new astronauts and international mission specialists to the corps. Consequently, LSAH is in the process of selecting comparison participants to match this class. Invitational letters have been mailed to potential comparison participants who met specific matching criteria for the 1996 astronaut class. When this recruitment is finalized, the total number of study participants will be 1138 (285 astronauts and international mission specialists and 853 comparisons).

A question occasionally posed by potential comparison participants is whether they are required to complete every phase of every examination. There are times when job requirements for physical examinations are somewhat different than the standard LSAH examination. LSAH participants are encouraged to participate in the study examination to the fullest extent that is reasonable, but it is understood that occasionally individual participants have overriding issues in their lives. Your participation is appreciated.

Cancer mortality rates, continued from page 1

There have been three cancer deaths among the astronaut population. The SMR of 47 indicates that the observed cancer deaths among the astronaut population are 53 percent less than the 6.25 expected deaths. The confidence intervals (see Table 1) indicate that, even though the observed rate of cancer mortality is noticeably lower than expected, it is not statistically different from the general population.

There have also been three cancer mortalities among the LSAH comparison population versus an expected 17.3 cases (see Table 1). The resulting SMR of 17 (CI = 3.5, 37.9) is significantly lower than expected.

The particular type of cancers experienced among the LSAH population are relatively rare among the general population. Conversely, the more common cancers among the general population (lung, colorectal, prostate) have not been identified as causes of mortality among the LSAH population.

Comparisons made between astronaut health data and general population health data should be viewed with some skepticism because of the differences between the astronauts and the general public. Risk factors associated with many cancers are also associated with life-styles and education. The astronauts are highly educated and receive routine preventive medical care. They are, in general, physically fit and nonsmokers. Because of the difficulties associated with making comparisons between the astronauts and the general population, the comparison population was selected from the JSC employees. Age, sex, and body mass index were used as matching criteria, and all JSC employees have access to preventive medical care through the Occupational Medicine Clinic. A comparison of cancer rates between these two groups is much more statistically sound than comparisons made with the general public.

If the astronauts experienced the same age-specific rates of cancer as the comparison participants, 0.87 deaths would have been expected compared with the three observed deaths. This results in an SMR of 345 (CI = 69.5 to 756.2), as shown in the Table 2. The rate of total cancer mortality among the astronauts is elevated when compared with the LSAH comparison participants, but not significantly different.

Any report of cancer is frightening and serious, but these relatively low rates help to put the issue as a population problem in perspective. Personal efforts to maintain a healthy life style are important and programmatic efforts to limit occupational exposures to carcinogens continues to be high priority.

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) 212-1362 or (281) 483-5785 or write us at:

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