The four basic types of diabetes include:

Type 1 diabetes, formerly known as insulin-dependent diabetes mellitus or juvenile-onset diabetes, makes up 5 to 10% of all diagnosed cases. It usually occurs abruptly in individuals less than 30 years of age. Risk factors include autoimmune, genetic, and environmental factors.

Type 2 diabetes, formerly known as non-insulin dependent diabetes mellitus or adult-onset diabetes, makes up 85 to 95% of all diagnosed cases. It usually occurs gradually in individuals age 40 and older. Risk factors include increasing age, obesity, family history, impaired glucose tolerance, and sedentary lifestyles. Gestational diabetes occurs in 2 to 5% of all pregnancies and typically resolves after the pregnancy. Risk factors include family history and obesity. The remaining diagnosed cases are due to a variety of conditions including genetic syndromes, surgery, drugs, malnutrition, infections, and other illnesses.

The American Diabetes Association recommends three methods of diagnosing diabetes:

1. Symptoms of diabetes and a plasma glucose concentration >200 mg/dl during an Oral Glucose Tolerance Test. A positive test should be followed by a repeat test on a different day. Testing should be considered for individuals age 45 years of age and older as well as younger individuals if they exhibit any of the risk factors.

2. Blood pressure continually varies to meet the ever changing needs of the body and is normally regulated very tightly by the brain. The body's demand for oxygen and nutrients is met by the heart pumping blood to the various organs. Blood pressure is the force of the blood pushing against the walls of arteries.

Blood pressure can be traced to a known cause like tumors of the adrenal gland, chronic kidney disease, hormone abnormalities, use of birth control pills, or pregnancy. This is called secondary hypertension, and is usually cured if the underlying cause passes or is corrected.

Diabetes is becoming increas-ingly more common, costly, and complex. Clinical trials are being conducted to determine if types 1 and 2 can be prevented and if effective intervention programs can be established.

For most people, there is no single known cause of high blood pressure. This type of high blood pressure is called primary or essential hypertension. Essential hypertension can’t be cured, although in most cases it can be controlled. In some cases, high blood pressure can be traced to a known cause like tumors of the adrenal gland, chronic kidney disease, hormone abnormalities, use of birth control pills, or pregnancy. This is called secondary hypertension, and is usually cured if the underlying cause passes or is corrected.

Classification of hypertension by its severity is somewhat arbitrary, because there’s no precise level of pressure above which it suddenly becomes dangerous. The traditional view of the risks associated with high blood pressure was that diastolic pressure was most important. Several recent studies, mostly conducted in people over the age of 50, have shown that systolic pressure is a better predictor of subsequent adverse events than diastolic pressure. 

continued on page 3
Diabetes Among the LSAH Participants

State of the art medical and technological advancements have resulted in increased life expectancies worldwide. These advancements have also shifted the major causes of illness and death from infectious diseases — those caused by microorganisms — to chronic diseases — those of slow progression and long duration. Diabetes is one of such chronic diseases of major concern to the medical community due to its sizable increase from 1958 to 1997 and an associated cost of $98 million. Diabetes is a group of disorders of carbohydrate metabolism. It results in an inadequate production or utilization of insulin, which is essential to maintain the body’s proper blood sugar level. Symptoms include but are not limited to frequent urination, extreme thirst, unexplained weight loss, or extreme hunger. Complications may include blindness, high blood pressure, amputations, or disease of the heart, kidney or nervous system.

In 1997, diabetes was ranked as the seventh leading cause of death in the United States with an abundance of 60,000.

Epidemiology continued from page 1

is minimized through the study design. For example, recall bias can occur when study participants are asked for their last recorded blood pressure; many participants may not be able to remember that value. Confounding happens when a third factor, while associated with exposure, is a risk factor for the disease independent of the exposure. An example of this is the confounding factor of age in the association between increased physical activity and a decreased risk of myocardial infarctions. Those who are physically active tend to be younger; at the same time, younger individuals have a lower risk of myocardial infarction than older ones, regardless of their physical activity. The confounding of confounding is also done through study design. The third explanation, chance, is measured through statistical testing. The result of this statistical testing is given by a p-value, which is the probability that the outcome arises from chance alone, assuming that there is no association between exposure and disease. By convention, a probability of 0.05 or less leads to rejection of chance being the explanation of the disease, and hence rejection of the hypothesis of no association between exposure and disease. Note that statistical significance does not necessarily confer biological importance to the results. A sound epidemiological study aims to minimize the contribution of bias, confounding and chance to the outcome so that a causal relationship becomes a valid explanation for the outcome. Even then, valid results of more than a single study are needed before causation between a disease and a disease can be established.

LSAH study design

LSAH compares incident rates of diseases/disorders of the astronaut to that of comparison participants to determine whether an astronaut occupational exposure leads to increased diseases/disorders rates. Because of the nature of the astronaut program, some unavoidable differences exist in the amount and kind of medical information gathered between the astronaut and comparison participants. Therefore, care is taken to compare only those data that are collected under similar conditions for each of the two groups to minimize bias. Matching of the comparison participant group to the astronaut group in some demographic variables helps reduce the role of confounding factors in comparing the health outcomes of both participant groups. Finally, the role of chance as the explanation for the outcome is evaluated through the appropriate statistical testing when comparing the data between astronauts and comparison participants.

We hope that this brief explanation of the basic principles behind LSAH is helpful in better understanding the study results presented in this newsletter and other publications.

Test Your NASA/JSC Knowledge

1. When did the Johnson Space Center (JSC) open? 2. Who was the first director of JSC? Who is the current director? 3. Who was the first U.S. astronaut to orbit the earth? 4. How many buildings are there at JSC? 5. What is the name of the rocket in Rocket Park? What was it used for? 6. How many NASA affiliated astronauts have been selected to the Astronaut Corps? 7. How many NASA Centers are there? 8. What are the names of the four Space Shuttle Orbiters currently in use? 9. What is the name of the astronaut band?

Hypertension continued from page 1

risk of strokes and cardiovascular disease than diastolic pressure. It has also been reported that pulse pressure (the difference between systolic and diastolic pressures) may be the best predictor of all; people who had the largest pulse pressure and high time period strokes. These findings suggest that it is better for people with high systolic pressure to have a correspondingly high diastolic pressure than a low diastolic pressure.

This lower rate of hypertension may be an effect of being a healthy working population.

Most cases of hypertension can be controlled through lifestyle changes, such as maintaining a healthy body weight, limiting sodium and alcohol intake, and increasing aerobic exercise. For others, lifestyle changes are not enough, and one or a combination of medication(s) is needed to control their hypertension.

According to data from the third National Health and Nutrition Examination Survey conducted from 1988-1991 (NHANES III), 20.4% of the US adult population are hypertensive (defined as systolic pressure of at least 140 mmHg or diastolic pressure of at least 90 mmHg). Annual examination data for active and inactivate NASA astronauts between 1959-1999 show 5.5% of them (21 of 394) have been diagnosed with hypertension. In comparison, data from the annual examinations of comparison participants over a similar time period show 13.9% (121 of 870) had corresponding hypertension diagnoses. As physical fitness is a requirement for astronauts, they are expected to show a lower rate of hypertension as compared to the general population. The comparison participants had even more double the hypertension rate of the astronauts, but still had a lower rate than the general population.

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Prevalence of Hypertension in LSAH Participants

Blood pressure is the force of the blood pushing against the walls of arteries. It is measured in millimeters of mercury (mmHg), and gives blood pressure in two numbers. The higher number indicates systolic pressure, which is the amount of force exerted on the walls of arteries within and leading from the heart when it contracts (i.e., during systole). The lower number is the diastolic pressure, which is the force existing between contractions (i.e., during diastole).

Blood pressure continually varies to meet the ever changing needs of the body and is normally regulated very tightly by the brain. The body's demand for oxygen and nutrients, which are carried by blood, is influenced by the heart's function and the amount of oxygen and nutrients in the blood stream. The body is not able to function properly if its blood pressure is too low or too high. Blood pressure can be traced to a known cause like tumors of the adrenal gland, chronic kidney disease, hormone abnormalities, use of birth control pills, or pregnancy. This type of high blood pressure is called secondary hypertension, and is usually cured if the underlying cause passes or is corrected.

Blood pressure in the general population, based on a single measurement, is shown to be 120/80 mmHg. A blood pressure reading above 140/90 mmHg indicates hypertension. If you have a blood pressure reading above this level, you are at risk for developing heart disease and other chronic conditions as you get older. hypertension was the most important. Several more recent studies, mostly conducted in people over the age of 50, have shown that systolic pressure is a better predictor of mortality than diastolic pressure.

What is Epidemiology?

The Longitudinal Study of Astronaut Health (LSAH) follows epidemiological principles in examining basic medical data to determine whether the unique occupational exposures encountered by astronauts are associated with increased health risks. However, the concept of epidemiology and how it determines the association between exposure and modern medicine in an individual patient is the key to understanding the role of epidemiology in the modern healthcare system. Epidemiology can be described as "a branch of medical science that deals with the incidence, distribution, and control of disease in a population" or as the "study of the distribution and determinants of disease frequency in human populations". Three elements of epidemiology emerge from these definitions. The first is frequency: how often a particular disease is found within a population. The second element concerns the distribution of the disease: who gets it, where, and when they get it. From these two elements the third one, determinants, can be derived. By describing the patterns of the disease, possible causal and/or preventive factors may be determined. Over time, the concept of epidemiology has been broadened to include the study of chronic diseases (e.g., cardiovascular disease) along with the original study of infectious diseases. Research in epidemiological methods was subsequently developed to reflect the less clear cut causal relationships between a host of factors over a long period of time and the chronic disease, as compared to the traditional view of the risks associated with high blood pressure was that it is a modifiable risk factor. Recent studies, mostly conducted in people over the age of 50, have shown that systolic pressure is a better predictor of cardiovascular disease than diastolic pressure.

Association vs. causation

Causation is only one out of four possible explanations for the outcome of the exposure; the others are bias, confounding and chance. Bias is the systematic error in collecting or interpreting data, and...