

IN-PERSON ASSESSMENTS

EXIT-INTERVIEW RESULTS REPORT

BOSTON, MA

Helping us understand the impact of professional
football on the health and well-being of former and
current players

Introduction & Disclaimers

Thank you for participating in the In-Person Assessments Study; part of the Football Players Health Study at Harvard University. We hope you found this experience rewarding. Your invaluable contribution to this research will help us better understand the impact of professional football on the health and well-being of former and current players.

These assessments were conducted for RESEARCH PURPOSES ONLY. These assessments are not intended to be diagnostic of any disease process. If there is a finding that may have an impact on your health, you will be informed and encouraged to seek medical follow-up with your health care provider. All reports and/or images (e.g., MRI, x-ray, etc.) are available upon request through the Medical Navigation Registered Nurse.

None of your individual research results will be provided to anyone outside of the study team, yourself, or those who you have agreed to share your results with, (for example, your doctor). Please remember that the study has obtained a Certificate of Confidentiality from the National Institutes of Health in order to best protect your privacy. Please refer to your consent form or ask the study doctor or Medical Navigation Nurse to discuss this with you.

Medical Navigation

The Medical Navigation Registered Nurse is available to you for the duration of your participation with the Football Players Health Study. The Nurse is a resource for you and is available to answer questions, explain any research results, and provide additional information should you request it. The Nurse can also assist you in finding a medical provider in your area if you seek any follow up care. Not all of the assessment results being returned to you will be available at the end of your participation in the study. The Nurse will call you with those results as they become available. If you would like to have another person on the phone with you (spouse, adult child, for example) when you are called you are welcome to do so. Receiving results is optional; you do not have to receive them if you do not wish to.

Please note – the Medical Navigation RN is not responsible for providing you with medical advice.



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Overview

This report provides some of the results of the assessments that were completed over the past 3 days. There is also information about assessments that won't generate individual results and information about future results that you can anticipate receiving. The following is an outline of what you will find in this report:

Initial Results: General Assessment Information

- Anthropometrics (body measurements)
 - Vital Signs
 - Blood test results
 - Body composition
- Magnetic Resonance Imaging (MRI) studies
- Neuropsychiatric Testing

Educational Information: No Returnable Results

- Sense of Smell Testing
- PET/CT Imaging
- Transcranial Magnetic Stimulation (TMS)

Educational Information: Future Results

- Sensory Testing
- Liver Magnetic Resonance Imaging (MRI)
- Physical Function Assessments
- Electroencephalogram (EEG)
- Sleep Assessment
- Cardiac Testing
- X-ray Assessment

General Information

On the first day, a general assessment was completed that included collecting body measurements (anthropometrics), vital signs, a fasting blood collection, and a body composition measurement. These results are shared below along with some additional information about the varying results.

Anthropometrics

Anthropometrics are measurements of size and proportion of the body. The following assessments were completed by an individual trained in the collection of accurate and standardized measurements.

Weight (pounds) _____
Height (inches) _____
Neck circumference _____
Chest circumference _____
Waist circumference _____
Hip circumference _____
Waist-hip ratio _____

Vital Signs

Vital signs are measurements of the body's most basic function. The following vital signs were measured at your initial visit: blood pressure, pulse and temperature.

Seated blood pressure	Seated pulse rate	Temperature

When your heart pumps blood into your arteries, it pushes the blood along under pressure. We measure blood pressure as a way of assessing the force being exerted by this moving blood against the walls of your arteries. A "normal" blood pressure is less than 120/80.

A normal pulse is 60 to 100 beats per minute. A lower heart rate at rest implies more efficient heart function and better cardiovascular fitness.

Blood Test Results

On your first day you had an exam that included blood work. The results of that blood work are below. We recommend you see your primary care physician if any of the following test results are abnormal.

Complete Blood Count (CBC)

A CBC is a test that measure the cells that are in your blood: red blood cells, white blood cells and platelets.

Lab Value	Result	Normal Range	Indication
Hematocrit		38.5-50.0%	Red blood cells carry oxygen. The hematocrit level measures the percent of red blood cells present in your blood. If your hematocrit is low or high, it can be a sign of certain diseases. This test also tells if you have anemia.
White Blood Cell Count		3.8-10.8 thousand/ μ L	A white blood cell count can be an indication of infection or inflammation.
Platelets		140-400 thousand/uL	Platelets play a role in helping your blood clot. If you are taking blood thinners or your platelet count is low, it takes longer to stop bleeding.

Electrolytes

Electrolytes are minerals in your blood and body that can be measured in your blood. The balance of electrolytes in your body is essential for normal function of your organs.

Lab Value	Result	Normal Range	Indication
Sodium		135-146 mmol/L	Sodium regulates the total amount of water in the body. The brain, nervous system, and muscles, require electrical signals for communication. sodium is critical in the generation of these electrical signals.
Potassium		3.5-5.3 mmol/L	Potassium is essential for normal cell function. Among the many functions of potassium in the body are regulation of the heartbeat and the function of the muscles.

Calcium		8.6-10.3 mg/dl	Calcium is essential to strong bones, but also plays a role in the health of the heart, nerves, kidneys, and teeth.
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Kidney Function

Kidney function tests are done to measure overall kidney health and function. The kidneys filter the blood in your body and filter out what your body does not need. The kidneys are important for maintaining overall fluid balance in your body.

Lab Value	Result	Normal Range	Indication
Creatinine		<u>Age</u> 20-49 years 0.60-1.35 *50-59 years 0.70-1.33 60-69 years 0.70-1.25 70-79 years 0.70-1.18	Creatinine is a chemical waste product that is produced by your muscle metabolism and to a smaller extent by eating meat. Healthy kidneys filter creatinine and other waste products from your blood. This provides an estimate of how well your kidneys filter (glomerular filtration rate).
*For patients >49 years of age, the upper reference limit for creatinine is approximately 13% higher for people identified as African-American. Baseline creatine levels are higher in African Americans than in other ethnicities which may be due to genetic factors associated with common African ancestry.			
BUN		7-20 mg/dl	A BUN test is done to see how well your kidneys are working to remove urea from your blood. It is commonly done with a creatinine.
Estimate GFR		≥ 60 mL/min/1.73m ²	An estimated GFR provides information about how well your kidneys are filtering waste.

Liver Function

Your liver helps your body digest food, store energy, and remove poisons. Liver function tests are blood tests that check to see how well your liver is working. They check for liver damage, and can help diagnose liver diseases such as hepatitis and cirrhosis.

Lab Value	Result	Normal Range	Indication
ALT		9-46 U/L	ALT and AST can both help identify liver toxicity, liver disease or liver damage.
AST		20-49 years: 10-40 U/L ≥ 50 years: 10-35 U/L	

Alkaline Phosphate		40-115 U/L	Alkaline phosphate elevations can indicate an issue with your liver, bones or gallbladder.
Total Bilirubin			Bilirubin is an orange-yellow pigment that occurs normally when part of your red blood cells break down. This test is used to help find the cause of health conditions like jaundice, anemia, and liver disease.

Cholesterol Measurements

A complete cholesterol test is also called a lipid panel or lipid profile. Your doctor can use it to measure the amount of “good” and “bad” cholesterol and triglycerides, a type of fat, in your blood. Cholesterol is a soft, waxy fat that your body needs to function properly. However, too much cholesterol can lead to heart disease, stroke, and atherosclerosis, a clogging or hardening of your arteries.

Lab Value	Result	Normal Range	Indication
Total Cholesterol		<200 mg/dl	The total cholesterol is the total amount of cholesterol in your blood. This includes LDL, HDL and a percent of your triglycerides.
LDL (“bad” cholesterol)		<20 years: <110 mg/dl ≥20 years: <100 mg/dl	Low-density lipoprotein (LDL) contributes to arterial disease and plaque formation
HDL (“good” cholesterol)		<20 years: >45 mg/dl ≥20 years: <40 mg/dl	High-density lipoprotein (HDL) helps prevent heart disease by removing cholesterol from your arteries.
Triglycerides		≥20 years: <150 mg/dl	Triglycerides are the most common type of fat in your body. Increased levels can be linked to heart disease and diabetes

Blood Sugar Measurements

Blood sugar tests measure the amount of sugar, or glucose, in your blood. Your doctor may order these tests to help diagnose diabetes.

Lab Value	Result	Normal Range	Indication
Hemoglobin A1c		Normal 4%-5.6% Pre-diabetes 5.7%-6.4%	A hemoglobin A1c (HbA1c) test measures the amount of blood sugar (glucose) attached to hemoglobin. An HbA1c test shows what the average amount of glucose attached to hemoglobin has been

		Diabetic >6.5%	over the past three months. It's a three-month average because that's typically how long a red blood cell lives. This is a way to measure how your blood sugar levels are over time.
Fasting glucose		Normal - < 100 mg/dl Pre-diabetes 100-125 mg/dl Diabetes >126 mg/dl	A fasting glucose is the first part of the oral glucose tolerance test or can be done as a one-time test. An increased fasting blood sugar can indicate that you are at risk for diabetes.
2-hour oral glucose tolerance test (OGTT)		Fasting: < 100 mg/dL 1 hour: < 200 mg/dL 2 hours: < 140 mg/dL 30 min _____ 60 min _____ 90 min _____ 120 min _____	An OGTT is a test to see how well your body handles glucose (sugar). Your blood is tested over time points after you drink a sugary liquid.

Body Composition Test

The Whole-Body Composition Test, or DEXA scan, provides an accurate, in-depth body composition analysis of your fat, muscle, bone and water mass. This can be used to identify health risks and pinpoint problems in the body before they occur. Visceral fat surrounds your organs and can be linked to metabolic disturbances, such as cardiovascular disease and Type 2 diabetes. These chronic conditions are influenced by genetics and hormones and can also be linked to higher cholesterol and insulin resistance. The test will also show the exact location of your lean muscle mass. Evaluating and improving lean muscle mass is important for preventing osteoporosis, pathological conditions and chronic diseases.

Bone mineral density (BMD)	_____ (g/cm ²)
T-score*	_____
Total body % fat	_____
Fracture risk	<input type="checkbox"/> Not increased <input type="checkbox"/> Increased <input type="checkbox"/> High
Lean muscle mass	<input type="checkbox"/>

The T-score shows how much your bone mass varies from the bone mass of an average health 30-year old adult.

- A T-score of +1 to -1 = normal bone mineral density
- A T-score of -1 to 2.5 = osteopenia
- A T-score of -2.5 or lower = osteoporosis

A low T score puts you at greater risk for a fracture. However, T-scores alone do not reveal the entire picture. Your physician will help you understand your results and assess your risk of breaking a bone in the future in relation to your medical history and overall health status.

Magnetic Resonance Imaging (MRI)

On day 2, you had two different Magnetic Image Resonance (MRI) scans, one of your brain and one of your liver. MRI is a non-invasive, painless scan that uses a magnetic field and radio waves to produce images. This test is different from a CAT scan because it does not use radiation. While these are the same tests you would have to diagnose a medical issue, this particular testing is not as comprehensive as an exam would be for diagnosis. Your brain MRI has been reviewed, but your liver MRI results will not be available until a later date. This information will be included in the post-visit report described below. MRI images are available upon request.

Brain MRI

The brain MRI that you have undergone produced detailed images of your brain. This test is similar in some ways to a CT scan, but different in other ways. For example, whereas CT involves some exposure to radiation, MRI does not.

The brain is one of the largest and most complex organs in the human body, weighing approximately 2 to 3 pounds. It has a soft, gel-like consistency, and is composed mainly of two different types of tissue, which are called gray matter and white matter, respectively, because of their slightly different colors. MRI can detect many types of problems that can occur in the brain, such as brain tumors or stroke. MRI can also detect signs of the bleeding that can be caused by head trauma, even if that bleeding happened years ago. However, some kinds of traumatic brain injury, including that associated with chronic traumatic encephalopathy (CTE), is not easily detected by today's MRI techniques.

The images from your brain MRI scan have been reviewed by a doctor who specializes in interpreting brain MRI images. If your scan revealed any areas of potential concern, we will notify you at the conclusion of your study visit, and may recommend that you speak with your doctor to determine if any follow-up is necessary.

Neuropsychological Testing

Your Perception of Your Health and Well-Being

While participating in this study, you completed a variety of questionnaires about your psychological health, general well-being, and cognitive functioning.

Some examples of how you rated yourself on questions relating to meaning, purpose, and satisfaction with life are presented below.

Meaning and Purpose	Strongly disagree	Disagree	Neither agree Nor disagree	Agree	Strongly agree
My life has a clear sense of purpose.					
I generally feel that what I do in my life is valuable and worthwhile.					
My daily life is full of things that are interesting to me.					
Satisfaction	Not at all	A little bit	Somewhat	Quite a bit	Very much
I am satisfied with my ability to do things for my family					
I am satisfied with my ability to meet the needs of my friends					
I am satisfied with my ability to do the work that is really important to me (include work at home)					

Some examples of how you rated your cognitive functioning over the past week are presented below.

Cognitive Functioning	Never	Rarely	Sometimes	Often	Very Often
In the past 7 days....					

I had to read something several times to understand it					
I had trouble concentrating					

Some examples of how you rated your cognitive functioning over the past week are presented below.

Cognitive Functioning In the past 7 days...	Never	Rarely	Sometimes	Often	Very Often
I had to read something several times to understand it					
I had trouble concentrating					

Some examples of how you rated your level of stress, worry, and sadness, over the past two weeks, are presented below.

Stress, Worry, and Sadness	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious, or on edge				
Worrying too much about different things				
Trouble relaxing				
Becoming easily annoyed or irritable				
Feeling down, depressed, or hopeless				

Some examples of how you rated your sleep and fatigue, over the past two weeks, are provided below.

Sleep and Fatigue	Not at all	Several days	More than half the days	Nearly every day	Not at all
Trouble falling or staying asleep, or sleeping too much					
Feeling tired or having little energy					

Some examples of how you rated how much pain interferes with your life, over the past week, are provided below.

Life Interference Due to Pain In the past 7 days...	Not at	A little	Somewhat	Quite a	Very much

	all	bit		bit	
How much did pain interfere with your day to day activities?					
How much did pain interfere with your enjoyment of life?					
How much did pain interfere with your enjoyment of social activities?					
How much did pain interfere with your family life?					

Cognitive Test Results

You completed a variety of different cognitive tests. Your results were derived by comparing your scores to the scores of healthy individuals with similar demographic backgrounds (for example, men of similar age and education). Your results are presented in the table below.

	Scores Compared to Healthy Men of Similar Age and Education		
Cognitive Domain	Lower 25%	Middle 50%	Upper 25%
Attention, Concentration, & Working Memory			
Learning and Memory			
Processing Speed			
Executive Functioning			
Vocabulary			

Attention, Concentration & Working Memory

Your ability to focus on specific information while ignoring distractions, concentrate, and hold information in your mind for a short period of time. Working memory is like a mental sticky note that helps you keep track of and manipulate information.

Learning and Memory

This is the process by which we take in, store, remember, and retrieve new information. We tested your ability to learn and remember a list of words; short story; a name, address, and phone number; and sequencing of pictures.

Processing Speed

Processing speed is a cognitive ability that could be defined as the time it takes a person to do a mental task. We tested your ability to rapidly read words, rapidly name colors, and rapidly process patterns.

Executive Functioning

Executive functions refer to a variety of higher-order cognitive skills. Executive functioning skills are important when we are involved in novel or complex tasks for which we do not have an established routine. Aspects of executive functions that are assessed during the evaluation process included problem-solving, rapid shifting of attention, inhibition (ability to hold back an instinctual response in order to respond in a different way), and cognitive flexibility (ability to adapt when the task rules are switched).

Vocabulary

Your word vocabulary when given a description of something and your word vocabulary tested by you describing the best word for pictures.

Should You Follow-Up with a Health Care Provider?

During your research participation, you completed a mental health interview, psychological health questionnaires, and cognitive testing. Several topics were covered, like depression, anxiety, alcohol use, substance use, and cognitive functioning.

- Your results suggest you may be experiencing difficulties related to [*insert area of possible concern*]. It may be helpful for you to seek additional services related to those difficulties if you feel they are warranted. Our Medical Navigation Nurse can provide you with additional information relating or follow-up care. **OR**
- During your research visit, your results suggest you are not experiencing significant difficulties with depression, anxiety, alcohol abuse, or cognitive functioning.
- If you believe you are experiencing difficulties with depression, anxiety, substance abuse, or cognitive functioning, now or in the future, we encourage you to discuss this with your family doctor.

EDUCATIONAL INFORMATION

Have No Returnable Results

These assessments, while very important, are not meaningful individually. The overall results of this testing will be examined after several or all of the people have taken part in the study. It will be necessary to compare several people in order to understand these assessments in relation to overall health. Eventually, these group results will be shared with you, but please remember that process may take months, or even years to complete.

Sense of Smell Testing

Our sense of smell, if measured carefully, may help detect subtle changes in brain health. Our study measured aspects of your sense of smell, called olfaction, including how well you can identify and remember what you smell and how well you can tell odors apart from each other. Over the next several years, these results will be analyzed with the other brain imaging, neuropsychological results, sleep study results, EEG results, and metabolic results in order to fully understand the impact of these results and determine the relationship between the sense of smell and the state of brain health and disease.

PET/CT

The “PET imaging” you underwent involved the use of Positron Emission Tomography (PET) radiotracers, and Computed Tomography (CT). PET/CT allows us to take pictures of what is going on inside the body. The PET scanner used special dyes with radiation to “light up” inside the body to make a picture. These special dyes are known as “radiotracers”. The CT scanner uses x-rays and computer technology to make detailed pictures of the inside of the body. These are both tests routinely used in the hospital, although the dyes used in this study are only used in research.

You underwent 2 PET/CT scans to image your brain with the use of different radiotracers – Amyloid PET and Tau PET.

- The Amyloid scan is intended to detect a protein in the brain called amyloid-beta, which is associated with Alzheimer’s disease.
- The Tau scan is intended to detect a protein in the brain called tau protein, which is associated with many diseases such as Alzheimer’s disease and traumatic brain injury.

As a reminder, these scans were not performed to be diagnostic or with any clinical relevance, therefore, the medical value is not known. The purpose of researching these investigational radiotracers is to allow us to explore and evaluate these scans in the context of football player's health. As such, individual results will not be provided to you.

Transcranial Magnetic Stimulation (TMS)

TMS is a noninvasive way to study how the brain works. For example, TMS can help researchers learn about how the brain is organized and how brain activity may be different in individuals with different diseases or conditions. As you know, the TMS is delivered by holding a coil on your scalp. The coil delivers magnetic energy when it is turned on called a "pulse". This creates a current that briefly stimulates a small part of your brain. Your brain's response to the TMS stimulation was measured in this study using two methods:

- Electromyography (EMG)
 - EMG was measured using the electrodes placed on your hand. When the part of your brain that is responsible for movement (motor region) was stimulated by the TMS, the muscle movement in your hands was measured. This can help us understand the responsiveness of the brain when stimulated with TMS.
- Electroencephalography (EEG)
 - EEG was measured using the electrodes that were placed on your head. The EEG recorded your brain's response to the TMS stimulation. EEG is capable of measuring how your brain responded not only to the brain area that was stimulated, but to all of the brain areas. Therefore, using EEG can help us to understand how the brain responds to stimulation outside of the area responsible for muscle movement. EEG can also help us understand how stimulating one small brain area can interact with other brain areas to learn more about brain connections.

The measurements that are collected during TMS will be compared across all of the former players that participate in the study. This will allow us to look at the differences and similarities to how the brain responds across everyone in the study. For example, we will compare participants who may have medical problems to those who don't to see if there are differences in the EMG or EEG measurements. Learning more about these differences can help us better understand the effects of different conditions on brain activity which can, in the future, help lead to different ways of diagnosing and treating brain conditions. The overall results of this testing will be examined after several people have taken part in the study as it will be necessary to compare several people in order to see if there are any differences. The group results will be shared with you, but this will take several months and potentially could take years.

EDUCATIONAL INFORMATION

Future Results

You will receive individualized information about the following assessments. The Navigation Nurse will phone you when these results become available and they will be provided to you in a post-visit report approximately 4 weeks after your completion of the study. If there are any results that require immediate attention, we will contact you as soon as we have those results to share them with you. If needed, we will assist you with contacting your doctor in order to better understand what the results may mean for you. A brief description of each of these assessments is provided below to give you an idea of the type of information you will receive in the report.

Sensory Testing

You underwent a series of tests to measure your sensory response. For example, pressure was applied to different parts of your body to assess at what point this was uncomfortable for you. You will receive information about your individual response to this testing as compared to the general population.

Liver MRI

You underwent an MRI scan of your liver. The purpose of this scan was to measure the level of fat in your liver. You will receive the percent fat noted in your liver from this scan with an indication if the level is in the healthy or unhealthy range.

Physical Function Assessments

On the second day of the study you had a series of assessments to determine your muscle strength, power, endurance, and overall physical function. You may remember performing various exercises in the physiology lab. You will receive your test results that will be compared with values expected from healthy, although not necessarily athletic men of your age.

Electroencephalogram (EEG)

You had an electroencephalogram (EEG) during the TMS assessment on the second day of the study. An EEG is a test used to evaluate the electrical activity in the brain. Brain cells communicate with each other through electrical impulses, and this electrical activity can show how the brain is functioning. An EEG can help diagnose certain brain disorders,

such as head injury, seizure disorders (such as epilepsy), memory problems, dementia, or sleep disorders. You will receive a brief report about the results of your EEG.

Sleep Assessment

During your stay, you completed an overnight sleep study which included monitoring of your oxygen saturation, breathing pattern, heart rate, and sleep stage. It is common for adults to have a few dips in their oxygen levels as a result of pauses in breathing or shallow breaths during sleep. Whether you have a condition known as “sleep apnea” is based on the number of these breathing events (known as apneas or hypopneas) each hour of sleep. This is called the Apnea/Hypopnea Index or AHI. You will receive a report of your AHI.

Cardiac Testing

On the final day, you completed cardiac testing to assess your metabolic rate, exercise capacity (level of fitness), and heart structure and function. Using measurements of the amount of oxygen you breathe while resting, you will receive information about how many calories your body consumes on a daily basis (metabolic rate). Using the same measurements of oxygen consumption, this time during exercise, we will provide information about your level of fitness. Lastly, you had an echocardiogram, an ultrasound test that examines the heart valves, heart muscle, and pumping function of your heart. You will receive information about your heart’s ability to pump blood – your ejection fraction.

X-ray Assessment

You had an x-ray that scanned several joints (e.g. knee, hip, shoulder). This scan will be evaluated for the presence of arthritis in these joints and this information will be shared with you.

General Recommendations

For Promoting Brain Health and Cognitive Health

1. **Exercise and physical endurance.** Under the guidance and supervision of your physician, most people benefit from a regular exercise program. Exercise has been shown in several studies to have a positive impact on psychological health, and there is emerging evidence that exercise is good for cognitive health. Maintaining or building physical endurance is generally good for overall psychological health and usually helps people function better in daily life.
2. **Maintaining a healthy weight.** Obesity is a risk factor for diabetes, heart disease, and other health problems that can affect the brain. Maintaining a healthy weight, in consultation with your physician, is therefore important for maintaining brain health.
3. **Managing Stress.** Stress management and stress-reduction practices are important for brain health. Stress reduction does not need to be complicated; the goal is to embed stress reduction activities as part of your daily routine. Depending on your situation and preferences, stress reduction might involve activities such as deep-breathing exercises, meditation, yoga, engaging in relaxing activities such as reading, or spending time in quiet and calming environments such as a leisurely walk or listening to music. If you are having difficulty controlling your stress levels, your health practitioner can work with you to find the best stress reduction program for you.
4. **Practice good sleep hygiene.** Good quality sleep is important for optimal functioning. Sleep difficulties can contribute to mental health problems, reduced ability to tolerate and manage stress, and cognitive difficulty. Healthy sleep hygiene involves maintaining regular bedtimes and wake times, and aiming for 6.5 to 8 hours of sleep per night. If you are not having restful and restorative sleep, a consultation with your health care practitioner may be beneficial. There are also good resources on the internet relating to promoting good sleep hygiene.
5. **Substance use in moderation.** Minimal to light use of alcohol is best for overall mental and cognitive health.
6. **Cognitive stimulation and mental endurance.** Engaging in cognitively demanding activities (e.g., reading or mentally-stimulating hobbies) might help promote mental endurance and be good for overall cognitive health.