MILLION VETERAN PROGRAM

Research Projects

VA researchers are using MVP data to learn about a range of health conditions affecting Veterans.

Research Topics Include:

- Cancer
- Cardiovascular Disease
- COVID-19
- Diabetes
- Gene Variation
- Gulf War Illness
- Informatics
- Kidney Disease
- Macular Degeneration
- Mental Health
- Osteoarthritis
- Parkinson's Disease
- Posttraumatic Stress Disorder
- Substance Use Disorders
- Suicide Prevention
- TBI
- Tinnitus

DISCOVERY ★ INNOVATION ★ ADVANCEMENT

VA | U.S. Department of Veterans Affairs

Cancer

Predicting the breast cancer risk for women Veterans

Shiuh-Wen Luoh, Sally Haskell, Cynthia Brandt
VA Portland Health Care System, VA Connecticut Healthcare System

Researchers are using MVP data to build a new screening strategy for breast cancer. The team is studying genetic and clinical markers to predict breast cancer risk. They will use this information to develop more personalized screening strategies for individual women, rather than relying, say, on age alone to plan screening. They are also looking at how military experience and race might affect breast cancer risk. Most current screening plans are based on studies of civilian, Caucasian women.

Immunogenetic determinates of HPV-related head and neck cancer in Veterans

Donna White
Michael E. Debakey VA Medical Center (Houston)

Researchers are looking at variations in immune-related genes that may control how susceptible a person is to cancers caused by the human papilloma virus. The incidence of oropharynx cancer—a type of throat cancer—has sharply increased in recent years, primarily because of increased HPV exposure. The project is using MVP data to look for the specific genes that affect oropharynx cancer risk, as well as nonoropharynx cancers of the head and neck, which are usually related to tobacco and alcohol use.

VA-DOE exemplar project on cancer

Amy Justice, Michael Gaziano, Francis Alexander
VA Connecticut Healthcare System, VA Boston Healthcare System, DOE Brookhaven National Laboratory

This project focuses on prostate cancer. It seeks new ways to tell which tumors are deadly and require treatment and which are slow-growing and not life-threatening. The project is part of an initiative called the MVP Computational Health Analytics for Medical Precision to Improve Outcomes Now (CHAMPION). This partnership with the Department of Energy will maximize the impact of research using MVP data.

Correlating clinical data and genomics in early/late stage presentation of lung cancer

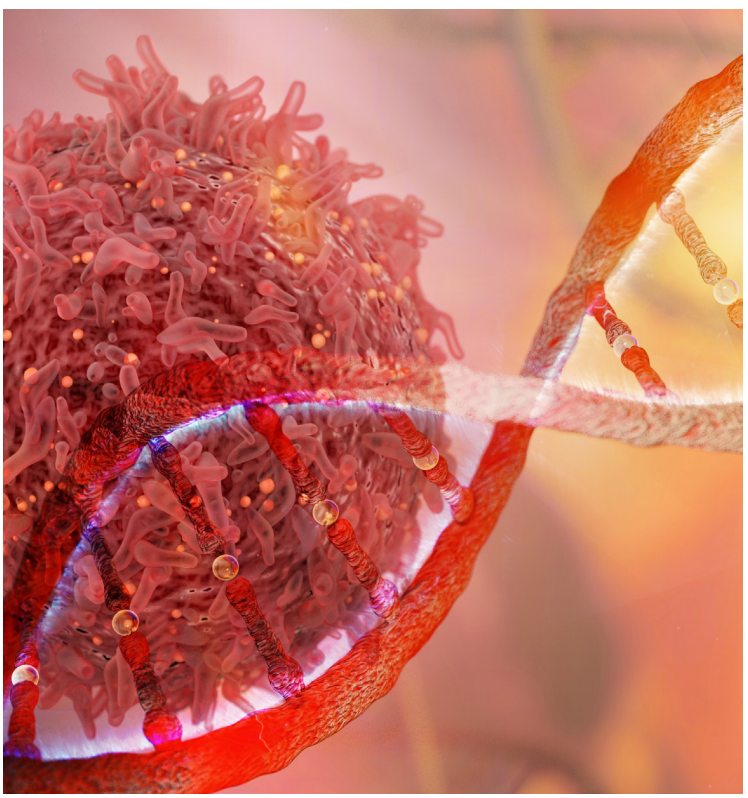
Brett Johnson, Saiju Pyarajan
VA Boston Healthcare System

Researchers are studying the gene variations connected with different tumor structures in patients with non-small cell lung cancer. They are also comparing treatments and outcomes of patients diagnosed with either early or late stage tumors. By combining this information with knowledge of mutations found in patients' blood and tumors, they hope to find patterns enabling earlier and more personalized treatments.

Progression and prognosis of multiple myeloma in U.S. Veterans

Nathanael Fillmore, Nikhil Munshi, Saiju Pyarajan
VA Boston Healthcare System

This project is looking at genomic markers linked to disease progression and prognosis on multiple myeloma. Multiple myeloma is a cancer of the plasma cells in the bone marrow. It is preceded by two non-malignant stages of disease: monoclonal gammapathy of undetermined significance and smoldering multiple myeloma. Multiple myeloma is particularly common among Veterans. Understanding the genomic basis of progression could help researchers build models to more effectively monitor Veterans at high risk of developing the cancer, and to treat Veterans who are already diagnosed.



Acting on MVP prostate cancer findings study

Bruce Montgomery
VA Puget Sound Health Care System

The aim of this study is to test how communicating with Veterans about MVP prostate cancer results will affect their care. Veterans with prostate cancer will be screened to determine genetic contributions to their cancers. Those who are found to have a gene-based cancer diagnosis will be offered genetic counseling. Their immediate family will also be offered screening to test for inherited prostate cancer risk.

Cardiovascular Disease

Genetics of cardio-metabolic diseases in the VA population

Philip Tsao, Kyong-Mi Chang
VA Palo Alto Health Care System, Corporal Michael J. Crescenz VA Medical Center (Philadelphia)

This research project explores the role of genetics in obesity, diabetes, and abnormal lipid levels as drivers of heart disease. The knowledge gained through this research may lead to new therapies that are safe, effective, and personalized. Heart disease is the number one cause of death among Veterans.

Cardiovascular disease risk factors, prevalent cardiovascular disease, and genetics in the Million Veteran Program

Peter Wilson, Kelly Cho
Atlanta VA Health Care System, VA Boston Healthcare System

Researchers are studying the genes that influence how obesity and lipid levels affect heart disease risk. Using MVP data, this project looks at whether these genetic factors differ among African Americans and Hispanics. Most previous research has looked mainly at Caucasians. The findings could help guide treatment and prevention efforts.

Phenotypic and genomic architecture of cardiovascular disease subtypes

Scott Damrauer, Philip Tsao, Christopher O'Donnell, Ravi Madduri
Corporal Michael J. Crescenz VA Medical Center (Philadelphia), VA Palo Alto Health Care System, VA Boston Healthcare System, DOE Argonne National Laboratory

This project will explore which sets of risk factors are the best predictors of certain forms of heart disease. It will help providers tailor treatment based on patients' individual genetic profiles. The project will leverage the Department of Energy's expertise and technologies in big data, artificial intelligence, and high-performance computing to identify trends related to cardiovascular disease subtype in VA patients.

Actionable results for patients with high cholesterol

Jason L. Vassy
VA Boston Healthcare System

This study will explore how to best return medically actionable genetic results to MVP participants with high cholesterol. It will also more generally develop processes to use the results of genetic studies to directly benefit study participants. Familial hypercholesterolemia (high cholesterol) is a disease affected by a single gene. The study aims to use genetic data gained about the disease to improve medical management and quality of life for Veterans affected by it.

COVID-19

Biological basis of COVID-19

J. Michael Gaziano, Christopher J. O'Donnell, Phillip S. Tsao
Boston VA Healthcare System, VA Palo Alto Health Care System

Researchers will use MVP data to investigate multiple aspects of COVID-19. They will develop and validate a diagnostic algorithm for COVID-19 using antibody testing, surveys, and electronic health records. They will seek to describe the natural history of the virus, and identify who is at high risk of acquiring COVID-19 basted on genomics. Studies will also research drug targets for treatment of the disease and identify the genomic determinants of how well patients respond to medications. Finally, research will investigate the impact of social distancing in MVP Veterans on virus spread.

Diabetes

Diabetic complications and genetic variants in the Million Veteran Program

Lawrence Phillips
Atlanta VA Health Care System

This project is identifying the genes that underlie the differences in risk for diabetic patients by combining gene information with the clinical experience of MVP participants. The team is studying eye disease, kidney disease, heart failure, and hypoglycemia in diabetic patients. They are also looking at how gene variants, glucose levels, and different diabetes drugs affect diabetes risk. The work may lead to a better understanding of diabetes and improve individualized care.

Studying the association of glycemic dysregulation with pancreatic and liver cancers in the Million Veteran Program

Andrew Chang, Jennifer Lee
VA Palo Alto Health Care System

This project focuses on the relationship of diabetes with pancreas and liver cancer. Diabetes is one of the most prevalent chronic diseases in the United States. The majority of pancreatic cancer patients have diabetes, and diabetes is one of the largest potential risk factors for liver cancer. Researchers will use data from the VA's electronic health records and MVP to try to figure out how diabetes and cancer are linked. The results of the research may be used to better understand the causes of cancer.

Gene Variation

Large-scale transcriptome and epigenome association analysis across multiple traits

Panagiotis Roussos
James J. Peters VA Medical Center (Bronx, New York)

This project is examining how differences in people's genes affect gene expression (how the information in DNA is translated into actual physiological changes within the body). Studying changes in gene expression will help researchers understand the genetic risk factors of different diseases. The researchers are looking at numerous health conditions, such as PTSD, depression, diabetes, and heart disease. They will use the results to improve treatments and develop precision medicine—treatment customized to individual patients.

Using MVP data to assess genotype-guided warfarin dosing algorithms

Steven Zeliadt, Hannah Gelman
VA Puget Sound Health Care System

Researchers are using MVP data to better understand how variations in patients' genes affect how they respond to a common anticoagulant, Warfarin. Past studies suggest that knowing a patient's genetic variation can help find the right Warfarin dose more quickly, leading to better control of blood clots. The large and diverse MVP patient population will allow researchers to conduct the largest research project ever on the accuracy of dosing methods that use genetic information, and to better understand the strengths and weaknesses of those methods.

Gulf War Illness

Gulf War Illness (GWI) risk factors

Drew Helmer, Dawn Provenzale
VA New Jersey Health Care System, Durham VA Medical Center

Researchers are studying how genes relate to Gulf War illness (GWI) in Gulf War-era Veterans. GWI is a chronic illness affecting many Veterans from that era. It can include fatigue, headaches, joint pain, indigestion, insomnia, dizziness, respiratory disorders, skin problems, and memory problems. The researchers are comparing men and women with GWI to those without the condition. They are also looking at how different genes and self-reported Gulf War environmental exposures relate to GWI rates. The findings could lead to better treatments to help these Veterans.

Informatics

Efficient electronic phenotyping using APHRODITE in the Million Veteran Program

Jennifer Lee, Themistocles Assimes
VA Palo Alto Health Care System

Researchers are testing how efficiently a new computer algorithm can automatically find data on people with specific diseases within the MVP database. The algorithm, called APHRODITE, will be used to link diseases to inherited DNA changes within participants. If the algorithm proves successful, it will allow researchers to quickly match data on diseases with related DNA characteristics. APHRODITE should be able to identify individuals with a condition in a fraction of the time it takes to search the database using current methods.

Kidney Disease

Pharmacogenomics of risk factors and therapies outcomes for kidney disease

Adriana Hung
VA Tennessee Valley Healthcare System

This project focuses on on how genes affect the risk and progression of kidney disease, a condition common in people with diabetes. It is examining differences in how people with diabetes respond to the drug metformin (the most common treatment for diabetes) and what role genes play in these differences. The project is also looking at people with high blood pressure, a major risk factor for kidney disease, to determine whether genes play a role. The work may help doctors personalize kidney disease treatment.

Advancing the phenotyping of acute kidney injury for the Million Veteran Program

Edward Siew, Michael Matheny
VA Tennessee Valley Healthcare System

This project is looking at the genetic basis for susceptibility to intrinsic acute kidney injury. This condition results in tissue damage and persistent loss of kidney function. Intrinsic acute kidney injury can have a number of different causes, so the researchers must first classify the most common and severe forms of the condition. They can then identify the genetic variants associated with different forms of intrinsic acute kidney injury.

Macular Degeneration

Genetic risk for AMD in diverse Veteran populations

Neal Peachey
Louis Stokes Cleveland VA Medical Center

Past studies have shown that macular degeneration (an eye condition that causes vision loss) is related to specific genes. However, these studies have included mostly Caucasian volunteers. VA researchers are now looking at whether similar genes are carried by African Americans. This will help to develop better treatments to slow or stop vision loss.

Mental Health

Functional disability in schizophrenia and bipolar illness

Philip Harvey
Miami VA Healthcare System

This research project is studying what genes make it more likely for people to have schizophrenia or bipolar disorder. It is also looking at the problems with thinking and day-to-day function that come with these conditions. Researchers are comparing participants with the two conditions to those who do not have the condition in the MVP database. The findings could help Veterans and others with serious mental illnesses.

Clinical manipulation of testosterone and its impact on dementia and health

Richard Hauger
VA San Diego Healthcare System

Researchers are studying the impact of low testosterone, androgen deprivation therapy, and testosterone replacement therapy on the risk of mild cognitive impairment and Alzheimer's disease. They are also looking at how pre-existing genetic risk for Alzheimer's changes the impact of testosterone treatments on cognitive function. They hypothesize that higher genetic androgen sensitivity is connected to higher risk of Alzheimer's disease.

Osteoarthritis

Genetics of osteoarthritis and joint replacement recovery: Key to precision rehabilitation

Marcas Bamman
Birmingham VA Medical Center

Researchers are exploring how genetics affect the prevalence and progression of osteoarthritis. They are looking for genetic predictors of the disease. The researchers believe that understanding how gene variance is related to knee and hip arthritis could lead to new treatments both before and after surgery. The project is also looking at how genetics affect the success of hip or knee joint replacement.

Parkinson's Disease

Single nucleotide and copy number variants associated with Parkinson disease

James Ashe
Minneapolis VA Health Care System

Researchers are using MVP data to identify genetic risk factors for Parkinson's disease. Gene-by-gene comparison will let researchers identify which gene variants are associated with the disease. They are also looking at whether genetic risks factors for Parkinson's identified in those with European ancestry also occur in Hispanic and African American patients. The researchers hope that this project will reveal new information on the biology of Parkinson's disease, possibly leading to targets for new treatments.

Posttraumatic Stress Disorder

Posttraumatic stress disorder (PTSD) risk factors

Murray Stein, Joel Gelernter
VA San Diego Healthcare System, VA Connecticut Healthcare System

Researchers are using MVP data to learn about the genes that may affect whether combat Veterans develop PTSD. The team hopes to gain new insight into the effects of PTSD on the brain so that new and improved treatments can be explored. This will be one of the largest genomic research projects on PTSD ever done.

Early cognitive impairment as a function of Alzheimer's disease genes and trauma

Mark Logue
VA Boston Healthcare System

This project looks at the link between Alzheimer's disease genetic risks and PTSD symptoms. Researchers are looking at how gene variants already shown to increase Alzheimer's may also affect the risk of PTSD, and also how these risk factors interact with environmental factors such as traumatic brain injury and combat stress. They hypothesize that those at higher genetic risk for Alzheimer's may also have a higher risk of developing PTSD when exposed to trauma.

Substance Use Disorders

Genetic vulnerability of sustained multi-substance use in MVP

Amy Justice, Henry Kranzler
VA Connecticut Healthcare System, Corporal Michael J. Crescenz VA Medical Center (Philadelphia)

Researchers are studying genetic risk factors for chronic alcohol, tobacco, and opioid use. Past research suggests that genes play a role in these unhealthy habits. The team hopes to use the findings to advance screening, diagnosis, and treatment of alcohol, tobacco, and opioid abuse.

Pharmacogenetic study of opioid agonist treatments in MVP

Kyle Kampman
Corporal Michael J. Crescenz VA Medical Center (Philadelphia)

This project aims to identify genetic predictors of opioid sensitivity. This will allow researchers to better predict the effectiveness of the opioid drug buprenorphine for maintenance treatment of opioid addiction, and better determine effective opioid dosing for pain treatment. They are running separate analyses for different classes of opioids. The findings could help prescribers avoid over – or under-prescribing of opioids, as well as maximize the effectiveness of buprenorphine as a replacement for more dangerous opioids.

Suicide Prevention

Using 'big data' and precision medicine to assess and manage suicide risk in U.S. Veterans

Jean Beckham, Nathan Kimbrel, David Oslin, Philip Harvey, Benjamin McMahon
VA Connecticut Healthcare System, Corporal Michael J. Crescenz VA Medical Center (Philadelphia), Miami VA Medical Center, DOE Los Alamos National Laboratory

This project is a collaboration between VA and the Department of Energy. It will combine VA's electronic health records and MVP data with DoE's big-data expertise and high-performance computing capacity to develop a computer algorithm to predict the risk of suicide in patients. Researchers will look at whether common genetic variants are related to suicide risk. By combining data on gene-based risk factors with non-genetic risk factors—such as demographics, medical conditions, and stressful life events —the researchers hope to better understand and predict suicidal behavior.

Genome-wide association study of suicidal behavior in the Million Veteran Program

Jean Beckham, Nathan Kimbrel
Durham VA Health Care System

As part of the larger "big data" project mentioned above, this research is studying genetic variants that increase Veterans' risk for both suicide attempts and suicidal thoughts. Past studies have suggested that some people are at higher risk of suicidal behavior because of their genes. Suicide ideation and suicidal acts may have different genetic risks. The researchers hope that this project will lead to improved approaches to suicide prevention by finding new ways to identify Veterans at high risk for suicide.

Identifying bio-signatures of suicidal subtypes in Veterans

Fatemeh Haghighi
James J. Peters VA Medical Center (Bronx, New York)

Past research has identified genetic biomarkers related to suicidal behavior. This project is using statistical and machine-learning methods to classify subtypes of suicidal behavior, ranging from low-lethality, low-intent impulsive acts to high-lethality, high-intent suicidal acts. The researchers will then do a genomic analysis of these subtypes in order to develop a diagnostic tool to assess the risk of suicidal behavior.

TBI

Examination of Biological Markers Associated with Neurobehavioral and Neuropsychological Outcomes in Military Veterans with a History of Traumatic Brain Injury

Victoria Merritt
VA San Diego Healthcare System

A challenge of studying traumatic brain injury (TBI) is understanding the many complicated factors that impact outcome and recovery. The purpose of this research is to examine the influence of genetic factors and neuroendocrine abnormalities on cognitive and psychiatric outcomes in Veterans with TBI histories. The goal is to increase understanding of the extent to which neurobiological factors influence these important clinical outcomes following TBI. Findings from this project have the potential to better determine which factors influence clinical outcomes following TBI, and they may impact treatments that are being developed with a precision medicine approach to target those most at risk for poor outcome.

Tinnitus

Genome-wide association study of tinnitus in the Million Veteran Program with emphasis on traumatic brain injury

Allen Ryan
VA San Diego Healthcare System

Researchers are studying how genes relate to tinnitus. Tinnitus is ringing in the ears with no external source. It has been the No. 1 disability for Veterans for more than a decade, being reported in more than 30 percent of VA population. The project aims to identify genes associated with tinnitus from different causes, such as noise, blast, traumatic brain injury, and age. Identifying these genes will direct research into ways to measure tinnitus and new drug treatments.

About the Biobank

Blood samples provided to the Million Veteran Program are processed and stored in a core laboratory facility at the VA Boston Healthcare System. The laboratory is a fully equipped, state-of-the-art biological specimen collection and processing center. The lab provides both local and national VA researchers a convenient, high-quality, low-cost mechanism for biological specimen handling, storage, and analysis in clinical studies and research projects such as MVP. Additional capabilities of the laboratory include preparation and storage of serum, plasma, buffy coats; extraction of DNA from blood, tissue, or serum buffy coat; extraction of RNA and genotyping; shipping of samples for DNA analysis, genotyping, whole exome sequencing, whole genome sequencing, and methylation.

The lab is capable of processing 3,000 – 4,000 samples per week with advanced robotics including three blood processors, three DNA extractors, two DNA Quality Control readers, and three DNA normalizers. Laboratory staff also use four laminar flow hood stations for manual processing of samples when necessary. The lab houses 30 mechanical freezers at -80°C (~2 million samples), 17 liquid nitrogen tanks at -180°C (~ 1 million samples), a robotic freezer (pictured above) with 16 Ultra Low Temperature Units each at -80°C (> 4 million samples), and a smaller robotic freezer at -80°C for temporary storage and sorting of samples.

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