Parkinson’s Disease
Service Related Update

Caroline M. Tanner M.D., Ph.D.
Associate Director – Research,  PADRECC, SFVAHCS
Professor, Neurology, UCSF
San Francisco, CA
Parkinson’s Disease Service Related Update

• Scientific background
• Presumptions – Service connected
• VA services
What Causes PD?
Twins: Mother Nature's Controlled Study

• MZ twins share ~100% of genes
• DZ twins share ~50% of genes

**Hypothesis:** If Parkinson’s disease is primarily a genetic disorder, then concordance in MZ twins should be > than in DZ twins.

**Results:**

Twins aged 72-82:

- MZ & DZ concordance similar;
- *Except* in young onset MZ > DZ

Twenty year followup:

- 11 living, 97% valid NDI matches

*Tanner, et al, JAMA, 1999;
Goldman et al, Ann Neurol, 2019*
Concordance for Parkinson’s Disease in Twins: a 20-year Update

- U.S. National Death Index (NDI) through 12/31/2015
- ICD codes – underlying & all causes of death

<table>
<thead>
<tr>
<th>PD dx age in twin-1</th>
<th>Zygosity</th>
<th>Concordance</th>
<th>MZ:DZ Concordance Ratio (95% CI) &amp; Heritability ($h^2$)</th>
<th>MZ:DZ Hazard Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pairwise</td>
<td>Probandwise</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>MZ</td>
<td>0.17</td>
<td>0.20</td>
<td>1.5 (0.8-3.0) $h^2=0.13$</td>
</tr>
<tr>
<td></td>
<td>DZ</td>
<td>0.11</td>
<td>0.14</td>
<td>1.6 (0.9-3.0) $h^2=0.16$</td>
</tr>
<tr>
<td>≤ 50</td>
<td>MZ</td>
<td>0.67</td>
<td>0.75</td>
<td>3.3 (0.9-13.0) $h^2=0.61$</td>
</tr>
<tr>
<td></td>
<td>DZ</td>
<td>0.20</td>
<td>0.20</td>
<td>3.75 (1.02-13.8) $h^2=0.73$</td>
</tr>
<tr>
<td>&gt;50</td>
<td>MZ</td>
<td>0.14</td>
<td>0.16</td>
<td>1.4 (0.7-3.1) $h^2=0.11$</td>
</tr>
<tr>
<td></td>
<td>DZ</td>
<td>0.10</td>
<td>0.11</td>
<td>1.4 (0.7-2.8) $h^2=0.10$</td>
</tr>
</tbody>
</table>

Conclusion: Environment is an important contributor to the cause of PD

Tanner, et al, JAMA, 1999; Goldman et al, Ann Neurol, 2019
Parkinson’s Disease: A Complex Disorder

Genetics loads the gun

Environment pulls the trigger
Some Factors Associated with a Higher Risk of Parkinson’s Disease

- Pesticides
- Polychlorinated Biphenyls
- Head Injury
- Solvents
- Age
- Metals?
- Air Pollution
- Male Gender
The global burden of Parkinson’s disease is expected to increase with increasing life expectancy worldwide.

Change in number of people with Parkinson’s disease in the world’s most populous nations from 2005 to 2030*

*Among individuals over 50 in the world’s ten most and Western Europe’s five most populous nations

Source: Dorsey et al, Neurology 2007;68:384-6
The Economic Burden of PD in the U.S.A. 2017 - 2037

Excess Medical Costs Due to PD, 2017: $25,348 Billion

<table>
<thead>
<tr>
<th>Age</th>
<th>Total Excess Medical Cost due to PD</th>
<th>Percentage of the Total</th>
<th>Mean Excess Cost due to PD ($, Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤49</td>
<td>490</td>
<td>2%</td>
<td>29,346</td>
</tr>
<tr>
<td>50-64</td>
<td>4,153</td>
<td>16%</td>
<td>22,598</td>
</tr>
<tr>
<td>65-74</td>
<td>8,858</td>
<td>35%</td>
<td>23,011</td>
</tr>
<tr>
<td>≥75</td>
<td>11,847</td>
<td>47%</td>
<td>26,222</td>
</tr>
<tr>
<td>Overall</td>
<td>25,348</td>
<td>100%</td>
<td>24,439</td>
</tr>
</tbody>
</table>

Indirect Costs Due to PD, 2017: $26,509 Billion

<table>
<thead>
<tr>
<th></th>
<th>PWP Loss</th>
<th>Care Partner Loss</th>
<th>PWP &amp; Care Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributable Death</td>
<td>2,508</td>
<td>NA</td>
<td>2,508</td>
</tr>
<tr>
<td>Reduced Employment</td>
<td>1,873</td>
<td>802</td>
<td>2,675</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>1,395</td>
<td>3,655</td>
<td>5,050</td>
</tr>
<tr>
<td>Presenteeism</td>
<td>1,263</td>
<td>1,684</td>
<td>2,946</td>
</tr>
<tr>
<td>Social Productivity Loss</td>
<td>623</td>
<td>410</td>
<td>1,034</td>
</tr>
<tr>
<td>Disability Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplemental security income (SSI)</td>
<td>561</td>
<td>NA</td>
<td>561</td>
</tr>
<tr>
<td>Social security disability insurance (SSDI)</td>
<td>1,677</td>
<td>NA</td>
<td>1,677</td>
</tr>
<tr>
<td>Other disability income</td>
<td>2,521</td>
<td>NA</td>
<td>2,521</td>
</tr>
</tbody>
</table>

Projected Increase in Total Economic Burden 2017-2037

Projected Economic Burden Of PD, 2037: $79.18 Billion

Yang et al, 2020
Parkinson’s Disease at VA

• Estimated number receiving care with Parkinson’s Disease: 80,000* ~ 110,000 in 2017 & at least 130,000 Veterans or surviving spouses

Estimates do not include veterans receiving care outside of VAHCS.

*http://www.va.gov
Veterans with Parkinsonism
Taking an Exposure History

• Service history
  − Years/ages, branch, rank, occupation, locations,
  − Combat? POW?

• Exposure assessment
  − Jobs, tasks? Known exposures? Where? When?
    Duration? Route(s) of exposure? Precautions?
  − Symptoms? Treatments?

• Traumatic Brain Injury
  − How many? When? Where? Loss of consciousness?
    How long? Hospitalized? Signs/symptoms?

• Documentation? Witnessed? Others exposed?
Parkinson’s Disease – Presumptive Relationship to Qualifying Military Service

Presumptive diseases: Certain diseases assumed by VA to be related to a Veteran’s qualifying military service.

Parkinson’s disease:
- Agent Orange (qualifying service in Vietnam, Korea, other) + *Parkinsonism 2021*
- Camp Lejeune residence (Cl solvents in $\text{H}_2\text{O}$)
- Traumatic brain injury (2ary)
# Exposure Related Health Concerns

Veterans may be exposed to a wide variety of hazards and potentially harmful substances during military service that may cause health problems.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent Orange Related Diseases</td>
<td>Certain cancers and other diseases linked to Agent Orange</td>
</tr>
<tr>
<td>Gulf War Veterans' Illnesses</td>
<td>Medical conditions linked to service during the Gulf War Era (Aug. 2, 1990 to present)</td>
</tr>
<tr>
<td>Radiation Related Diseases</td>
<td>Certain cancers linked to ionizing radiation exposure during military service</td>
</tr>
<tr>
<td>Toxic Embedded Fragments</td>
<td>Shrapnel and other metals that remain in the body after injury</td>
</tr>
<tr>
<td>Traumatic Brain Injury</td>
<td>Often caused by explosions among Veterans who served in Iraq and Afghanistan</td>
</tr>
<tr>
<td>Cold Injuries</td>
<td>Health problems associated with extremely cold temperatures</td>
</tr>
<tr>
<td>Birth Defects</td>
<td>Certain birth defects in Veterans' biological children associated with military service in Vietnam or Korea</td>
</tr>
<tr>
<td>Infectious Diseases</td>
<td>Nine infectious diseases associated with Southwest Asia and Afghanistan military service</td>
</tr>
<tr>
<td>Vaccinations &amp; Medications During Service</td>
<td>Possible health effects of certain military vaccinations and medications</td>
</tr>
<tr>
<td>Rabies</td>
<td>Disease transmitted by bite or saliva from an infected warm-blooded animal</td>
</tr>
<tr>
<td>Heat Injuries</td>
<td>Health problems that could be caused by extremely hot temperatures</td>
</tr>
<tr>
<td>Occupational Hazards</td>
<td>Exposures from working with chemicals, paints, and machinery during service</td>
</tr>
</tbody>
</table>
Operation Ranch Hand: 1962-1971
20 x 10^6 gallons Agent Orange

2,4-D

2,4,5-T

2,3,7,8 tetrachlorodibenzodioxin

• 2009: Agent Orange Linked to Parkinson's Disease established service-connection:

• Certain Vietnam Veterans may be eligible for: disability compensation and health care benefits.
Agent Orange Exposure: Qualifying Military Service

Exposure to Agent Orange by Location

- **Exposure to Agent Orange in Vietnam**
  Presumed exposure on land in Vietnam, on a vessel operating on the inland waterways of Vietnam, or on a vessel operating not more than 12 nautical miles seaward from the demarcation line of the waters of Vietnam and Cambodia as defined in Public Law 116-23 (Blue Water Navy Vietnam Veterans Act 2019) between January 9, 1962 and May 7, 1975

- **C-123 Airplanes and Agent Orange Residue**
  Possible exposure of C-123 flight, ground maintenance, and aeromedical crew members to herbicide residue in C-123 planes flown during and after after the Vietnam War

- **Korean Demilitarized Zone**
  Presumed exposure for units determined by VA and DoD to have operated along the demilitarized zone in Korea between Sept. 1, 1967, and August 31, 1971.

- **Thailand Military Bases**
  VA considers disability benefits claims based on exposure to herbicides on a U.S. military base in Thailand or Royal Thai Air Force base between January 9, 1962, and May 7, 1975, on a case-by-case basis.

- **Herbicide Tests and Storage Outside Vietnam**
  Possible exposure due to Department of Defense herbicide tests and storage at military installations in the United States and at locations in other countries.
SEC. 9109. ADDITIONAL DISEASES ASSOCIATED WITH EXPOSURE TO CERTAIN HERBICIDE AGENTS FOR WHICH THERE IS A PRESUMPTION OF SERVICE CONNECTION FOR VETERANS WHO SERVED IN THE REPUBLIC OF VIETNAM.

Section 1116(a)(2) of title 38, United States Code, is amended by adding at the end the following new subparagraphs:

“(I) Parkinsonism. “(J) Bladder cancer. “(K) Hypothyroidism.”.

- Passed House and Senate with veto-proof majorities 12\1\2020.
- President Trump vetoed on 12\23\20..
- House & Senate voted to override veto 12\28 & 1\1\21, respectively.
- First and only veto override of Trump's presidency.

History: IOM 2016 report included the term “Parkinson’s-like symptoms” under PD as presumptive disease associated with Agent Orange. OMB objected & VA leadership changed - did not go forward.
Exposure Related Health Concerns

Veterans may be exposed to a wide variety of hazards and potentially harmful substances during military service that may cause health problems.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agent Orange Related Diseases</td>
<td>Certain cancers and other diseases linked to Agent Orange</td>
</tr>
<tr>
<td>Gulf War Veterans' Illnesses</td>
<td>Medical conditions linked to service during the Gulf War Era (Aug. 2, 1990 to present)</td>
</tr>
<tr>
<td>Radiation Related Diseases</td>
<td>Certain cancers linked to ionizing radiation exposure during military service</td>
</tr>
<tr>
<td>Toxic Embedded Fragments</td>
<td>Shrapnel and other metals that remain in the body after injury</td>
</tr>
<tr>
<td>Traumatic Brain Injury</td>
<td>Often caused by explosions among Veterans who served in Iraq and Afghanistan</td>
</tr>
<tr>
<td>Cold Injuries</td>
<td>Health problems associated with extremely cold temperatures</td>
</tr>
<tr>
<td>Birth Defects</td>
<td>Certain birth defects in Veterans' biological children associated with military service in Vietnam or Korea</td>
</tr>
<tr>
<td>Infectious Diseases</td>
<td>Nine infectious diseases associated with Southwest Asia and Afghanistan military service</td>
</tr>
<tr>
<td>Vaccinations &amp; Medications During Service</td>
<td>Possible health effects of certain military vaccinations and medications</td>
</tr>
<tr>
<td>Rabies</td>
<td>Disease transmitted by bite or saliva from an infected warm-blooded animal</td>
</tr>
<tr>
<td>Heat Injuries</td>
<td>Health problems that could be caused by extremely hot temperatures</td>
</tr>
<tr>
<td>Occupational Hazards</td>
<td>Exposures from working with chemicals, paints, and machinery during service</td>
</tr>
</tbody>
</table>
December, 2013: 38 CFR 3.310(d) was amended to establish an association between TBI and certain illnesses:

In the absence of clear evidence to the contrary, Parkinsonism, including Parkinson’s disease, following moderate or severe TBI is held to be a secondary result of TBI.
Subjects: 93 discordant pairs with complete information → 26 pairs with at least one head injury

Results: 14.7% with head injury; 7.8% hospitalized

Head injury 37.4 yrs (mean) *before* PD onset

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>3.0</td>
<td>1.14-9.2</td>
<td>0.023</td>
</tr>
<tr>
<td>MZ</td>
<td>3.3</td>
<td>0.86-19</td>
<td>0.092</td>
</tr>
<tr>
<td>DZ</td>
<td>2.7</td>
<td>0.64-16</td>
<td>0.23</td>
</tr>
</tbody>
</table>

→ PD risk further increased with > 1 head injury:
  1 injury: OR 2.6 (1.07,6.5; p = 0.035)
  2 injuries: OR 5.1 (0.54, 48; p = 0.16)

Test for trend 0.042
### VA & DOD Definitions of TBI Severity

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Imaging</td>
<td>NL</td>
<td>NL or ABNL</td>
<td>NL or ABNL</td>
</tr>
<tr>
<td>Loss of consciousness</td>
<td>0 to 30 min</td>
<td>30 min – 24 hrs</td>
<td>&gt; 24 hrs</td>
</tr>
<tr>
<td>Alteration of consciousness</td>
<td>1 min – 24 hrs</td>
<td>&gt; 24 hrs</td>
<td>&gt; 24 Hrs</td>
</tr>
<tr>
<td>Posttraumatic amnesia</td>
<td>&lt; 24 hrs</td>
<td>24 hrs – 1 week</td>
<td>&gt; 1 week</td>
</tr>
<tr>
<td>GCS*</td>
<td>13 to 15</td>
<td>9 to 12</td>
<td>&lt; 9</td>
</tr>
</tbody>
</table>

Glasgow Coma Scale (GCS):

- Eye opening: NL = 4…No response = 1
- Best verbal response: Oriented = 5…No response = 1
- Best motor response: Obeys commands for movement = 6… No response = 1
Clinically defined head injury “severity” is poorly correlated with metabolic derangement

[¹⁸F]deoxyglucose PET Scan in Mild & Severe Head Injury

- Est. 90% of military head injuries are mild.
- Interval between mild head injury and PD can be decades.

Is there more to understand?
Chemicals

Veterans' exposure to the chemicals listed below potentially could be linked to certain health problems, depending on a number of other factors.

**Agent Orange or Other Herbicides**
Herbicides used during the Vietnam era to destroy foliage and crops

**Pesticides (Gulf War)**
Substances used to repel or destroy pests such as insects and pathogens

**Burn Pits**
Open-air pit waste disposal at military sites

**Depleted Uranium**
Uranium used in military tank armor and some bullets

**Sulfur Fire** (Al Mishraq, Iraq)
Sulfur plant burned almost a month in June 2003; large amounts of sulfur dioxide released into the air

**Chromium** (Qarmat Ali)
Hexavalent chromium in sodium dichromate dust; water treatment plant in 2003

**Camp Lejeune Water Supplies**
Tap water contaminated by industrial chemicals at Marine Corps Base Camp in the 1950s to 1980s

**PCBs**
Polychlorinated biphenyl used as coolant and insulating fluid

**Industrial Solvents**
Usually liquid, used to dissolve, degrease, clean, strip paint, etc.

**PFAS**
Perfluoroalkyl and polyfluoroalkyl substances (PFAS) found in products, including fire-fighting foams
Camp Lejeune N.C.

**History:**
- 1953-1985 - Water contaminated with TCE & PCE (i.e., PERC)
- 1980 – Contaminants discovered
- 1987- Wells closed
- 1989 - EPA Superfund

**500,000 – 1 million exposed**
- **Military:** Marines, National Guard, reservists
- **Civilian:** Family members, employees

**Sources of exposure:** Drinking water, bathing, inhalation, swimming, recreation

**Exposure levels:**
- Est. monthly median (max. mean) ug/L:
  - PCE: 85 (158); TCE: 366 (783)
  - vs. US max. contaminant level: 5 ug/l

**Dept. of Veterans Affairs 2017**
- 30 or more days of service
  - 8/1/1953 to 12/31/1987
- Entitled to benefits
Other Hazards Associated with PD but No VA Presumption

Chemicals

Veterans’ exposure to the chemicals listed below potentially could be linked to certain health problems, depending on a number of other factors.

Agent Orange or Other Herbicides
Herbicides used during the Vietnam era to destroy foliage and crops

Pesticides (Gulf War)
Substances used to repel or destroy pests such as insects and pathogens

Burn Pits
Open-air pit waste disposal at military sites

Depleted Uranium
Uranium used in military tank armor and some bullets

Sulfur Fire (Al Mishraq, Iraq)
Sulfur plant burned almost a month in June 2003; large amounts of sulfur dioxide released into the air

Chromium (Qarmat Ali)
Hexavalent chromium in sodium dichromate dust; water treatment plant in 2003

Camp Lejeune Water Supplies
Tap water contaminated by industrial chemicals at Marine Corps Base Camp in the 1950s to 1980s

PCBs
Polychlorinated biphenyl used as coolant and insulating fluid

Industrial Solvents
Usually liquid, used to dissolve, degrease, clean, strip paint, etc.

PFAS
Perfluoroalkyl and polyfluoroalkyl substances (PFAS) found in products, including fire-fighting foams
3 PD patients, small industry, all exposed to TCE
65/134 coworkers responded to questionnaire
21 endorsed symptoms
14 with clinical signs of parkinsonism on exam
PD & Occupational Solvent Exposure in 99 Discordant Twin Pairs
Goldman, Tanner, Quinlan, et al, Ann Neurol 2012

- NAS/NRC WWI Veteran Twins
- Male twins discordant for PD
- NIH criteria by consensus of 2 movement disorder neurologists (CMT, GWR)
- Lifelong job task specific occupational history
- Exposure assigned by industrial hygienist unaware of case status

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Odds Ratio Ever/Never</th>
<th>95% Confidence Interval</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCE</td>
<td>6.1</td>
<td>1.2-33</td>
<td>0.034</td>
</tr>
<tr>
<td>PERC</td>
<td>10.5</td>
<td>0.97-113</td>
<td>0.053</td>
</tr>
</tbody>
</table>
Pesticides used in the Gulf War

Pesticides used in the Gulf War fall into several major categories:

- Methyl carbamate organochlorine pesticides (lindane), used to treat uniforms
- DEET, used on the skin as an insect repellent
- Organophosphorus (OP) pesticides
- Pyrethroid pesticides (primarily permethrin)

Lindane and DEET were used as personal insect repellents, lindane to treat uniforms and DEET on the skin. All other pesticides shipped to the Gulf region were to be used only by specially trained individuals or for specific applications.

Visit the Deployment Health and Family Readiness Library to learn how DEET and permethrin-impregnated clothing are used during service.
83 PD and 328 controls with complete data in FAME

- Head injury in 19%
- Paraquat used by 17%, all men

<table>
<thead>
<tr>
<th>Head injury</th>
<th>Paraquat Use</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>1.0 (ref)</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>1.2</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td><strong>Yes</strong></td>
<td><strong>4.2</strong></td>
</tr>
</tbody>
</table>

Head injury and paraquat use were synergistically associated with increased PD risk

Both cause oxidative stress

Joint effects are synergistic in animal model (Hutson, 2011).
Is Preventing PD Possible?

Preliminary Results

Primary Prevention:
- Remove causative factors
- Disease process never initiated

Increased Risk of PD Was Not Observed in Farmers Using Gloves During Pesticide Application

Furlong, Tanner, Goldman, et al, 2015
Can we identify Veterans at risk & intervene?

At diagnosis of Motor PD:
- 50% neuron loss in the substantia nigra
- 80% striatal dopamine deficit

PD Progression:
- **PRECLINICAL**
- **PRODROMAL**
- **PARKINSON’S DISEASE**
VA Services
Military Exposures

Veterans may have been exposed to a range of chemical, physical, and environmental hazards during military service.

MILITARY EXPOSURES & YOUR HEALTH NEWSLETTER

Read the latest issue of Military Exposures & Your Health, a biannual newsletter for Veterans with service from 1990 to the present. This issue covers news on environmental exposures and health, environmental health registries, research, and more.

4 Ways to Find Exposures

Registry Evaluation
A free medical assessment for possible health problems related to specific environmental hazards

Health Care
Health care services for eligible Veterans, how to qualify and apply

Research Studies
Find out about military exposure-related research studies

Publications & Reports
Use these resources and media materials on military exposures and Veterans

Provider Resources
Exposure Ed App
Health Registry Programs
Exposure Assessment
Agent Orange for Providers
Gulf War Veterans' Illnesses for Providers
Diagnosis and Treatment of Exposure Health Effects

Good resource for patients & providers: PublicHealth.va.gov
Discuss VA services with the Veteran

VA offers specialized programs to address health issues related to deployment. Providers should encourage their patients to enroll in VA health care in order to take advantage of these services as part of their overall health care plan.

- **VA Environmental Health Clinics**
  Environmental Health Clinicians provide specialized knowledge about potential environmental exposures and conduct exams for registry programs: Ionizing Radiation, Agent Orange, Gulf War (includes Operations Iraqi Freedom and New Dawn), and Depleted Uranium. Find local VA Environmental Health Coordinator.

- **War Related Illness and Injury Study Center (WRIISC)**
  Three locations nationwide provide telephone or inter-facility consultations: Washington, DC; East Orange, NJ; and Palo Alto, CA. WRIISC provides medical evaluations and treatment plans for chronic, difficult-to-diagnose conditions related to deployment.
Public Health

Benefits Overview for Agent Orange Exposure

VA offers health registry exams, health care, disability compensation and other benefits to eligible Veterans. Their dependents and survivors also may be eligible for benefits.

Health care for Veterans

Veterans who were exposed to Agent Orange or other herbicides during military service may be eligible for:

- **Agent Orange Registry health exam**, a free exam for possible long-term health problems related to herbicide exposure. Veterans who served in Vietnam, the Korean demilitarized zone or other areas where Agent Orange was sprayed may be eligible.
- **Health care benefits**, a full range of medical benefits. There are many ways a Veteran may qualify.

Disability compensation for Veterans
Benefits for Camp Lejeune Exposure

Disability compensation

VA has established a presumptive service connection for Veterans, Reservists, and National Guard members exposed to contaminants in the water supply at Camp Lejeune from August 1, 1953 through December 31, 1987 who later developed one of the following eight diseases:

- Adult leukemia
- Aplastic anemia and other myelodysplastic syndromes
- Bladder cancer
- Kidney cancer
- Liver cancer
- Multiple myeloma
- Non-Hodgkin's lymphoma
- Parkinson's disease

Presently, these conditions are the only ones for which there is sufficient scientific and medical evidence to support the creation of presumptions; however, VA will continue to review relevant information as it becomes available.
The registry data helps VA understand and respond to these health problems more effectively.

You may be eligible to participate in one or more of these health registries:

- Agent Orange Registry
- Airborne Hazards and Open Burn Pit Registry
- Gulf War Registry (includes Operations Iraqi Freedom and New Dawn)
- Ionizing Radiation Registry
- Depleted Uranium Follow-Up Program
- Toxic Embedded Fragment Surveillance Center

Use the chart below to help determine your eligibility.

<table>
<thead>
<tr>
<th>Period of Military Service</th>
<th>Agent Orange</th>
<th>Airborne Hazards and Open Burn Pit</th>
<th>Depleted Uranium Follow-up</th>
<th>Gulf War</th>
<th>Ionizing Radiation</th>
<th>Toxic Embedded Fragments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940s–1950s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1970s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000s–Present</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Contact your local VA Environmental Health Coordinator about getting a registry evaluation. You do not need to enroll in VA’s health care system to take part.
Thank You