Overview

- Who We are
- Core Research
- Research Capabilities
- Success Stories
- DHB Findings & Recommendations
- Leadership
- Directorate Overviews
- MilCo Brief
- MilCo Family Study Brief
Who We Are

BUMED

NAVY MEDICINE WEST
(San Diego, SD)

NAVAL HEALTH RESEARCH CENTER
(San Diego, CA)

NAMRU - DAYTON
(Dayton, OH)

NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY
(Groton, CT)

NAMRU - SAN ANTONIO
(San Antonio, TX)

NAVY MEDICINE RESEARCH AND DEVELOPMENT HQ
(Silver Spring, MD)

NAMRU - ASIA
(Singapore)

NAMRU - 3
(Istanbul, Turkey)

NAMRU - 6
(Lima, Peru)
Who We Are

Mission
To optimize operational readiness and warfighter health by informing DoD policy through research excellence.

Vision
To be the premier deployment health research center for the DoD.
Who We Are

NHRC Guiding Principles

Quality
Place the highest priority on meeting the mission—demonstrate meticulous accuracy, thoroughness, and effectiveness at every opportunity.

Teamwork
Enjoy the camaraderie at the command and take pride in your service to our country. People are the source of our strength. Partners enhance our capabilities.

Innovation
Be relevant by being on the cutting edge.
Who We Are

**DoD Deployment Health Research Center**
- Designated in 1999
- Re-designated in 2009

**Over 300 professionals**
- 17 Active duty
- 48 Civil service
- 264 Contractors
- 2 Military recruit training sites
- 7 Military treatment facilities in the United States and Naval Hospital Yokosuka

**Global Reach**
- Infectious disease surveillance along the U.S.-Mexico border and internationally
- Partnered with the Centers of Disease Control and Prevention (CDC) and the Global Emerging Infections Surveillance and Response System (GEIS) of the Armed Forces Health Surveillance Branch (AFHSB)
- International human performance partnerships
Who We Are

We are strategically located on Naval Base Point Loma

- Fleet concentration
  - Navy and Marine Corps
    - Air, land, sea, subsurface, and special warfare elements
- World-class universities
- Biotech and industry partners
- Navy Medicine West (NMW)
- Naval Medical Center San Diego (NMCSD)

Facilities

- Spanning 24 buildings
- Infectious diseases laboratories
- Warfighter performance laboratories
- On-site servers
  - In support of databases for epidemiological research
Research

Aligned with Navy Medicine, DHA, and DoD sponsor requirements, supporting medical readiness, health, and well-being for service members and families.
NAVAL HEALTH RESEARCH CENTER

MISSION:

The Premier DoD Deployment Health Research Center

VISION:

The Premier DoD Deployment Health Research Center

PRINCIPLES:

- Innovation
- Teamwork
- Quality

STRATEGIC GOALS:

- To conduct state-of-the-science research, development, testing, and evaluation that improves the operational readiness of our armed forces.
- To leverage scientific expertise and build partnerships that expand and enhance our research capacity to meet customer and sponsor requirements.
- To deliver high-quality, value-based research solutions that optimize troop and mission readiness for the battlespace of the future.

CORE COMPETENCIES:

- Physical Health and Wellness
- Psychological and Behavioral Health
- Injury, Injury Prevention, and Rehabilitation
- Physical and Cognitive Performance
- Medical Modeling and Decision Support
- Infectious Diseases Surveillance and Research

CORE RESEARCH AREAS:

- Operational Readiness & Health
- Military Population Health
- Operational Infectious Diseases

RESEARCH FOUNDATION:

- Laboratories
- Medical Informatics

READINESS THROUGH RESEARCH
Core Research
• Operational Readiness and Health
• Military Population Health
• Operational Infectious Diseases
Core Research Areas

Operational Readiness and Health
• We optimize health and performance

Military Population Health
• We protect and maintain health

Operational Infectious Diseases
• We contribute to force health protection by identifying critical pathogen threats

Our research aligns with Navy Medicine and fleet requirements, supporting medical readiness, health, and well-being for service members and families.
EXCELLENCE

COLLABORATION

INNOVATION

READINESS

Optimizing Human Performance and Recovery

Delivering Medical Planning, Logistics, and Decision Support

Sponsors/Customer:
- 21st Century Sailor
- NAVMED
- PHS
- USMC
- USN
- USAMC
- JPO
- NAV
- MTF
- USAMC
- JFSE
- DOD
- MOE
- JFSE
- USN
- MTF
- NAV
- DOD
- MOE
- JFSE
- USN
- MTF
- NAV
- DOD
- MOE
- JFSE
- USN
- MTF
- NAV
- DOD
- MOE
- JFSE

Warfighter Performance

Medical Modeling, Simulation, and Mission Support

- CAREN
- Environmental Chamber
- Expeditionary Medicine & Wounded Warrior Data Sets

Operational Readiness and Health
Optimize Health and Performance
Military Population Health
Protect and Maintain Health

EXCELLENCE

READINESS

SPONSORS/CUSTOMERS
- UCSD
- VRAB
- DOD
- NAVSO
- MCCLM
- VA
- MCRP
- UoU
- MDC
- VAF
- VAF
- VAF
- VAF
- VAF

COLLABORATION

DEPLOYMENT
HEALTH

- CHAMPS
- Military Population Health Data Sets
- Medical Registries

INNOVATION

HEALTH & BEHAVIORAL SCIENCES

- Reproductive Health
- Clinical Treatment Studies
- Epidemiological Studies
- Health Promotion Interventions

- Millennium Cohort Program
- Family Cohort Program
- Recruit Assessment Program
Operational Infectious Diseases

Identify Critical Pathogen Threats

EXCELLENCE
IDENTIFY AND CHARACTERIZE CRITICAL PATHOGENS THAT THREATEN FORCE HEALTH
DEVELOP AND VALIDATE VACCINES AND NEW DIAGNOSTIC TECHNOLOGIES

COLLABORATION
Respiratory Surveillance
Acute Gastroenteritis Surveillance
Outbreak Support

INNOVATION
Advanced Diagnostics Lab
BSL2/3
Specimen Archives
Surveillance Networks

SPONSORS/CUSTOMERS

READINESS

BIOSURVEILLANCE

CLINICAL STUDIES

Diagnostic Studies
Epidemiology Studies
Clinical Trials

READINESS THROUGH RESEARCH
Research Capabilities

• Laboratories
• Medical Informatics
Laboratory Capabilities

**Warfighter Performance**
- Physical and Cognitive Operational Research Environment (PhyCORE) Lab
  - Create immersive virtual reality environments (CAREN)
- Environmental Physiology Lab
  - Replicate operational environmental conditions
    - Environmental Chamber
    - Swim Flume
- Sleep and Fatigue Lab
  - Sleep monitoring and disorder diagnostics using gold standard and innovative technologies
- Functional Fitness Lab
  - Biobehavioral monitoring

**Infectious Diseases**
- Microbiology Lab
  - Specializes in isolation and identification of respiratory and enteric pathogens
- Molecular Biology Lab
  - Ability to run Emergency Use Authorization Assays for Middle East respiratory syndrome coronavirus, Ebola, H7N9 influenza, enterovirus D68, and the Trioplex assay (Zika, Chikungunya, Dengue)
- Specimen Archive
  - Large capacity, state-of-the-art freezer archive with nearly 1 million specimens
Medical Informatics

NHRC Databases
• Expeditionary Medical Encounter Database (EMED)
• Wounded Warrior Recovery Project (WWRP)
• Birth and Infant Health Research (BIHR)
• Career History Archival Medical and Personnel System (CHAMPS)
• Recruit Assessment Program (RAP)
• Millennium Cohort Study
• Millennium Cohort Family Study

Data Collection and Analytical Tools
• Medical Planners’ Toolkit (MPTk) (Data Analysis and Interpretation)
• Joint Medical Planning Tool (JMPT)
• Joint Trauma Analysis and Prevention of Injury in Combat (JTAPIC)
• Infectious Diseases Detection and Surveillance Networks

Red = Operational Readiness and Health
Blue = Military Population Health
Green = Operational Infectious Diseases
Bench to Battlefield

Knowledge and Materiel Transitions

• Automated Heat Stress System
  – Incorporated into construction plans for new destroyers
  – On 60+ Navy ships and 50+ shore installations

• OPLANS | Wargaming
  – First time for medical

• Operational Infectious Diseases Surveillance Report
  – Weekly report delivered to clinicians

• Adenovirus Vaccine

• AMAL Standardization

• Highly Realistic Training for Independent Duty Corpsmen

• Rx App (In Production)

• Navy Corpsman Wellness Guide
Bench to Battlefield

**Policy Impact**

Millennium Cohort Study
- DoD Instruction 6495.02—Sexual Assault Response and Prevention Program updates
- DoD Instruction 5505.18—Investigation of Adult Sexual Assault in the Department of Defense
- Army Directive 2015-10—Sexual Assault Incident Response Oversight Report
- SECNAVINST 1752.4B—Sexual Assault Prevention and Response
- VHA Directive 2010-033—Military Sexual Trauma (MST) Programming

Environmental Physiology Research
- OPNAVINST 5100.19E—Navy Safety and Occupational Health (SOH) Program Manual for Forces Afloat
- Naval/Marine Corps Forces Ashore
  - NAVA MED P-5010—Manual of Naval Preventive Medicine
  - MCO 6200.1E—Marine Corps Heat Injury Prevention Program
  - MARADMIN 111/15—Marine Corps Heat and Cold Stress Injury Prevention Program
- Joint guidance contained in TB MED 507/NAVMED P-5052-5/AFP 160-1
Defense Health Board
Findings and Recommendations
Overarching Findings and Recommendations

Centers should establish rigorous metrics to measure outcomes, cost effectiveness, and return on investment.
Overarching Findings and Recommendations

The DoD should create viable, promotable career paths and ensure senior leaders value scientific leadership and careers to combat barriers to professional development in research.

**FY19 Commander Promotion Statistics**

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<thead>
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<tr>
<td>HCA</td>
<td>20/42</td>
<td>47.62%*</td>
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<tr>
<td>HCC</td>
<td>13/42</td>
<td>30.95%**</td>
</tr>
<tr>
<td>HCS</td>
<td>9/412</td>
<td>21.43%</td>
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<table>
<thead>
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</thead>
<tbody>
<tr>
<td>HCA</td>
<td>20/60</td>
<td>33.33%</td>
</tr>
<tr>
<td>HCC</td>
<td>13/67</td>
<td>19.40%</td>
</tr>
<tr>
<td>HCS</td>
<td>9/49</td>
<td>18.37%</td>
</tr>
</tbody>
</table>

MSC promotion opportunity: 63.64% (42/66)
*2.2 and **1.5 times more promoted than HCS

Navy Health Care Scientists are under-promoted compared with their administrative counterparts.
Overarching Findings and Recommendations

Transition contractor positions into government staff positions to reduce challenges created by heavy reliance on contract personnel and address barriers to the timely hiring of civilians.

Navy specific 51% rule
- \( \leq 49\% \) of sponsor funding may be spent on contractor staffing
- NHRC staff mostly contractor support
- Diminished ability to meet mission

Mandated to an STRL Demo Project
- Streamlines HR process and provides flexibilities
Overarching Findings and Recommendations

NHRC-Developed eProcesses

↑ Standardization, transparency, and efficiency
↓ Review time
- Developed with SharePoint for authored works and agreements
- Transitionable to NMR&D Enterprise

Processed 575+ authored works; decreased processing time by 68%
NHRC Findings and Recommendations

The Navy should encourage the recruitment of experienced researchers as leaders to maintain its quality leadership and significant research accomplishments at NHRC.

NHRC MILCON project will combine all administrative, research, and support functions currently occupying 24 historic WWII-era military barracks into one state-of-the-art facility.
NHRC Findings and Recommendations

The DoD should provide sufficient core funding through Program Objective Memorandum (POM) to reduce multiple sponsor funding and increase stability of research projects.

- Lack of core research funding threatens NHRC’s ability to meet strategic objectives and puts research at risk
- BUMED M8 submitted a funding model for POM-20 that could provide 6.6 RDT&E core funding for GS positions
Operational Readiness and Health Directorate
DoD Center for Deployment Health Research
Defense Health Board
27 Aug 2018
MS NREMT, Director
Operational Readiness Directorate

Warfighter Performance

Conducts Human Performance R&D

- Measurement
- Maintenance
- Reset, Recovery
- Enhancement
- Human Modeling
- Stress Mitigation, Inoculation
- Accelerated Rehabilitation
- Primarily Human Subject Oriented Studies
- Performed Both Laboratory and In-field
- Materiel Solution T&E (personal protective equipment [PPE], wearables, sensors)
Optimize warfighter performance or rehabilitation and reset using physical and cognitive studies to enhance readiness, prevent injury, and build resilience

Supported Operational Forces:
- Navy Special Warfare, BUD/S candidates, SOCOM
- Navy EOD; Navy Surface Fleet
- Marine Corps 1st Marine Expeditionary Force
- Marine Corps Recruit Depot, San Diego
- Marine Corps School of Infantry West

Military Relevance/Operational Impact:
- Preventing injury and increasing physical and psychological resilience
- Frontline warfighter recovery (PTSD, TBI)
- Shaping operational ground mobility professional development
- Testing impacts of new PPE on operational human performance
- Optimizing operational performance with virtual environment correlates
- Heat tolerance testing
- Objective Close-Quarters Combat skills evaluation
- Mindfulness training
- Fatigue countermeasures

Capabilities:
- Mobile Neural and Physiological Monitoring
- Computerized Dynamic Posturography
- Gait and Balance Analysis Systems
- PhyCORE
- Environmental Chambers
- Dual-energy X-Ray Absorptiometry
- Functional Magnetic Resonance Imaging (access)
- Driving Simulators
- Eye-tracking Devices
- Automatic Heat Stress Systems (AHSS)
- Gunfighter Gym (Conflict Kinetics) Shooting Platform
- Equipment T&E (e.g., PPE, Sleep Assessment)
- Exercise Test (VO2Max, Strength, Power, Torque)

Products and Successes:
- Peer-reviewed manuscripts and technical reports
- Briefs to leadership
- Prototype testing of helmets, plate carrier, modular armor, full body armor
- Performance strategies
- New rehab programs for amputees, vestibular patients
- EEG recordings for diagnosis, treatment of PTSD, TBI
- Research linking biobehavioral constructs to health and performance
- Physical Readiness Test evaluation/anthropomorphic standards
- Input for Return to Duty vs. MEB dismissal decisions
Operational Readiness Directorate

Warfighter Performance

Conducts Informatics-Oriented R&D

- Operational Medical Decision Support Forecasting and Planning
- Table-top Course of Analysis Tools
- Data Capture, Verification, Integration (non-medical, non-protected health information [PHI])
- Data Created In-house when Non-existent Elsewhere (e.g., SinkEx)
- Data Warehousing (EMedKW) (non-medical, non-PHI)
- Injury/Disease Epi Research (DHA DSAs)
Operational Readiness Directorate
Medical Modeling and Simulation

Supported Operational Forces:
- Joint Staff/COCOM medical decision support (funding sponsor)
- DHA/services medical decision support (funding sponsor)
- Continuous Naval Air/Surface/Sub AMAL modernization
- Continuous Marine Corps AMAL modernization
- Continuous Air Force UTC (AMAL) modernization
- Joint/service-specific wargaming support
- Continuous OPLAN development assistance
- Injury epidemiology

Military Relevance/Operational Impact:
- Provide operational planning for each service from POI through Role 3
- Provide operational planning across the ROMO
- Medical sets across services remain efficient and up-to-date
- Real-time casualty data feedback to theater
- Wargaming T&E of OPLANs

Capabilities:
- DoD’s sole medical planning M&S development program
  - JMPT – Accredited
  - MPTk – Accredited
- JTAPIC
- Research quality EMED
- Longitudinal WWRP
- Injury and disease epidemiological research tracks
  - Extremity injury (EACE)
  - Rehabilitation outcomes
  - PTSD/mental health
  - Head, face, neck injury

Products and Successes:
- Multiple annual peer-reviewed manuscripts and technical reports
- Wargaming scenario development and execution
- Joint Staff/DHA mandate use of NHRC M&S tools in all medical OPLANs
- Provide near real-time casualty data to intelligence community
- Desktop test and evaluation of emerging technologies and mission scenarios
- DoD’s only long-term casualty quality of life tracking program (WWRP)
Operational Infectious Diseases

We Contribute to Force Health Protection by Identifying Critical Pathogen Threats
OID Surveillance Populations

U.S. Recruits
- 8 sites (6 staffed)
- ≈ 2,000 samples/yr

Shipboard/Special Forces
- 17 ships in 3rd, 7th, and USFF Fleets
- ≈ 200 samples/yr

DoD Dependents
- 9 staffed sites + Yuma (outside funding)
- ≈ 800 samples/yr

U.S.-Mexico Border
- Collaboration with CDC-BIDS and local health departments
- 4 outpatient and 4 hospital (SARI) sites
- ≈ 1,200 samples/yr
OID Surveillance Populations

Surveillance Sites:
- Recruit Febrile Respiratory Illness (FRI) Surveillance
- Recruit Acute Gastroenteritis (AGE) Surveillance
- Beneficiaries Febrile Respiratory Illness (FRI) Surveillance
- FRI Surveillance at the U.S.-Mexico Border
- Shipboard FRI Surveillance

Influenza Diagnostic Collaborators:
- Centers for Disease Control and Prevention (CDC)
- U.S. Air Force School of Aerospace Medicine (USAFSAM)
FY18–19 Results

- Recruits
- US-Mexico Border
- DoD Beneficiaries

- Number Positive
- % Influenza Positive

- RSV
- Rhinovirus
- Mycoplasma pneumoniae
- Chlamydia pneumoniae
- Adenovirus
- Flu B/Untyped
- Flu B/Yamagata
- Flu B/Victoria
- Flu A unsubtyped
- H3N2
- pH1N1
- % Flu Positive
Influenza Sequencing

Evolutionary Relationships Among Influenza (H1N1)pdm09 Hemagglutinin (HA) Genes 2017-2018 Influenza Season

Vaccine Strain
Reference Strain
2016-2017 Consensus (1 strain)
Nov 2017 (1 strain)
Dec 2017 (7 strains)
Jan 2018 (7 strains)
February 2018 (8 strains)
March 2018 (5 strains)

LOSS GLY: predicted loss of glycosylation
ADD GLY: predicted addition of glycosylation
NHRC: Naval Health Research Center
BRD: US/Mexico Border outpatient
SAR: US/Mexico Border inpatient
FDX: DoD beneficiaries
JX or no prefix: US recruit
SEA: US Special Forces

Amino Acid Substitution per 100 residues

A/California/NHRC_QV4183/2018 [A48T]
A/California/NHRC_BRD41984N/2018
A/California/NHRC_QV4192/2018 (2 strains)
A/California/NHRC_BRD41866N/2018 (4 strains)
A/California/NHRC_MAP4223A/2018
A/California/NHRC_SAR41981N/2018
A/Missouri/NHRC_37113/2018
A/California/NHRC_BRD41808N/2018 (2 strains)
A/South Carolina/NHRC_75754/2018
A/Arizona/NHRC_MAP6094A/2018
A/California/NHRC_28352/2017

A/California/NHRC_QV653/2018 [H273Y]
A/California/NHRC_QV4381/2018 [N451T]

A/California/NHRC_BRD41800N/2018
A/California/NHRC_BRD41771N/2018
A/California/NHRC_SAR41891N/2018
A/California/NHRC_28351/2017
A/California/NHRC_QV10858/2017
A/California/NHRC_BRD41929N/2018
A/California/NHRC_BRD80970N/2018
A/North Dakota/03/2016 [R205K]

2016-2017 Group 6B.1 (1 whole genome strain)
A/Michigan/45/2015 [Q233R]
<table>
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<tr>
<th>Year</th>
<th>Title</th>
<th>Sponsor</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>2008</td>
<td>Meso Scale Diagnostics</td>
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<td>CDC disc.</td>
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<td>2008</td>
<td>Nanogen</td>
<td>CDC/BARDA/HHS</td>
<td>CDC disc.</td>
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<td>2009</td>
<td>AVC H5</td>
<td>Arbor Vita Corp</td>
<td>510K approval</td>
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<td>2009</td>
<td>PlexID pH1N1</td>
<td>Ibis Pharmaceuticals</td>
<td>EUA approval</td>
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<tr>
<td>2009</td>
<td>JBAIDS H5</td>
<td>MCS (JPO-MCBS)</td>
<td>EUA approval</td>
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<tr>
<td>2010</td>
<td>JBAIDS pH1N1</td>
<td>MCS</td>
<td>EUA approval</td>
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<td>2011</td>
<td>RPS Influenza</td>
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<td>2011</td>
<td>JBAIDS “Big Flu”</td>
<td>MCS</td>
<td>FDA approval</td>
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<td>2013</td>
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<td>MCS</td>
<td>FDA approval</td>
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<td>2013</td>
<td>H7N9 JBAIDS</td>
<td>MCS</td>
<td>FDA approval</td>
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<td>2013</td>
<td>JBAIDS: PPEK-PAT</td>
<td>MCS</td>
<td>Equiv. approval</td>
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<tr>
<td>2014</td>
<td>AVC H7N9</td>
<td>AVC</td>
<td>EUA Approval</td>
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<tr>
<td>2016-2018</td>
<td>InDevR</td>
<td>BARDA</td>
<td>Just completed</td>
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<tr>
<td>2017-2021</td>
<td>RAMP</td>
<td>DARPA</td>
<td>Fall 2018 start</td>
</tr>
<tr>
<td>2018</td>
<td>Biofire Global Fever</td>
<td>JSTO-MCS</td>
<td>Fall 2018</td>
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## Clinical Trials

<table>
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<th>Year</th>
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<tr>
<td>2006–2011</td>
<td>Adenovirus 4 &amp; 7 vaccine</td>
<td>DoD, Barr Pharma.</td>
<td>FDA-cleared</td>
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<tr>
<td>2009–2014</td>
<td>ACAM smallpox study</td>
<td>CDC</td>
<td>Safety data with FDA</td>
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<tr>
<td>2014–2018</td>
<td>Norovirus GI &amp; GII vaccine trial</td>
<td>Takeda Pharma.</td>
<td>Enrollment complete</td>
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<tr>
<td>2008–2012</td>
<td>Japanese encephalitis vaccine</td>
<td>IHB</td>
<td>Completed</td>
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<tr>
<td>2012–2018</td>
<td>IRC 003/IRC 004 TCAD studies</td>
<td>NIH/NIAD</td>
<td>Final data analysis</td>
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Health and Behavioral Sciences Department

Enhancing Psychological and Behavioral Health and Readiness

• Improving Universal Suicide Screening in Primary Care
  − A multi-service effort to empirically develop a more accurate suicide screening instrument for use in military primary care settings

• Improving Sleep to Enhance Health
  − Develop and test an intervention that provides service members with strategies for maximizing their sleep quality in operational settings
  − Evaluate a program that teaches leaders specific techniques for supporting sleep health among their subordinates

• Optimizing Resilience and Performance
  − Adapt and evaluate an evidence-based intervention designed to improve resilience and performance under stress

• Understanding Consequences of Chronic Occupational Overpressure Exposure
  − Investigate occupational overpressure exposure as a risk factor for mTBI/concussion and other medical outcomes
Health and Behavioral Sciences Department
Clinical Treatment Interventions

• Behavioral Activation [BA] + Cognitive Processing Therapy [CPT]
  – Integrate 2 evidence-based psychotherapies (BA + CPT) to treat comorbid PTSD and major depressive disorder (MDD)

• Surf Therapy
  – Evaluate whether a surf therapy program for wounded warriors reduces mental health symptoms
  – Compare the effectiveness of surf vs. hike therapy for service members with MDD

• Improving Military Mental Health Care Providers’ Suicide Assessment and Response Practices
  – Develop and assess the effectiveness of a brief training to improve the skill and comfort of providers in assessing and responding to suicidal patients

• Improving Pain Management Materials
  – Adapt a DoD pain management workbook into an interactive mobile app in order to increase accessibility and engagement among clinic patients
Deployment Health Research Department
Recruitment Assessment Program

• RAP is the only ongoing baseline health study in military recruits. With over 220,000 Marine recruits surveyed since June 2001, RAP boasts a 91% participation rate. 15,000 Marine recruits are surveyed each year.

• Major Findings
  − Deployment alone in support of the wars in Afghanistan and Iraq was not associated with an elevated risk for suicide, and most suicides occurred among non-deployed active duty Marines.
  − Service members from a military family had more issues dealing with authority prior to service, but higher AFQT scores and better military outcomes (less desertions and higher re-enlistment rates.
**Deployment Health Research Department**

**DoD Birth and Infant Health Research Program**

- Established in 1998, by the Assistant Secretary of Defense for Health Affairs, the DoD BIHR program is a retrospective assessment of birth defects and other adverse infant health outcomes.
- BIHR captures approximately 100,000 live births per year, in the United States and overseas. It also captures pregnancy and maternal outcomes among military beneficiaries.

**Active Registries**
- National Smallpox Vaccine in Pregnancy Registry
- BioThrax® (Anthrax) Vaccine in Pregnancy Registry
- ACAM2000® Myopericarditis Registry
Major Findings

− No increased risk of adverse pregnancy or infant outcomes associated with prenatal:
  • Anthrax vaccination (*Vaccine*, 2017)
  • Pandemic H1N1 vaccine vs. seasonal influenza vaccine (*Vaccine*, 2018)

− Military wives whose husbands were deployed at time of delivery were more likely to develop postpartum depression than wives whose husbands were not deployed (*Arch Gynecol Obstet*, 2015).
The Millennium Cohort Study

Principal Investigator
Study Origin

• 1998: DoD, Armed Forces Epidemiological Board, Institute of Medicine recommended a coordinated prospective longitudinal cohort study of service members
  – Newly available DoD surveillance and electronic health care data

• 1999 Strom Thurmond National Defense Authorization Act
  – Sect. 743: Establish “a longitudinal study to evaluate data on the health conditions of members of the armed forces upon their return from deployment”
Millennium Cohort Study

• Largest and longest running cohort study in military history
  – Initiated July 2001 (pre-9/11)
  – Includes all services, active duty, Reserve, and National Guard

• Participants complete surveys every 3 years (planned through 2068)
  – Standardized instruments assess physical and mental health outcomes and health behaviors (e.g., smoking)
Multiple-Panel Design

Panel 1
- Wave 1
- Wave 2
- Wave 3
- Wave 4
- Wave 5
- Wave 6

Panel 2
- Wave 1
- Wave 2
- Wave 3
- Wave 4
- Wave 5

Panel 3
- Wave 1
- Wave 2
- Wave 3
- Wave 4

Panel 4
- Wave 1
- Wave 2
- Wave 3

Panel 5
- Wave 1
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<th>Panel (Group)</th>
<th>Enrollment Dates</th>
<th>Years of Service at Enrollment</th>
<th>Oversampled Groups</th>
<th>Roster Size (Date)</th>
<th>Total Contacted</th>
<th>Total Enrolled (%)</th>
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<tbody>
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<td>1</td>
<td>Jul 2001–Jun 2003</td>
<td>Unrestricted</td>
<td>Females Reserves/Guard Prior deployers*</td>
<td>256,400 (Oct 2000)</td>
<td>214,388</td>
<td>77,019 (36%)</td>
</tr>
<tr>
<td>2</td>
<td>Jun 2004–Feb 2006</td>
<td>1–2</td>
<td>Females Marine Corps</td>
<td>150,000 (Oct 2003)</td>
<td>123,001</td>
<td>31,110 (25%)</td>
</tr>
<tr>
<td>3</td>
<td>Jun 2007–Dec 2008</td>
<td>1–3</td>
<td>Females Marine Corps</td>
<td>200,000 (Oct 2006)</td>
<td>154,270</td>
<td>43,439 (28%)</td>
</tr>
<tr>
<td>4</td>
<td>Apr 2011–Apr 2013</td>
<td>2–5</td>
<td>Females Married</td>
<td>250,000 (Oct 2010)</td>
<td>247,266</td>
<td>50,052 (20%)</td>
</tr>
<tr>
<td>5</td>
<td>Nov 2018–Dec 2019</td>
<td>1–4</td>
<td>Females Married</td>
<td>500,000 (Jul 2018)</td>
<td>TBD</td>
<td>100,000 (expected)</td>
</tr>
</tbody>
</table>

*Deployment to Southwest Asia, Bosnia, and/or Kosovo after August 1997.
Cohort Profile
(N = 201,620)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>31</td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>70</td>
</tr>
<tr>
<td>Enlisted</td>
<td>83</td>
</tr>
<tr>
<td>Active component</td>
<td>67</td>
</tr>
<tr>
<td>Current status</td>
<td></td>
</tr>
<tr>
<td>Ever deployed</td>
<td>62</td>
</tr>
<tr>
<td>Separated</td>
<td>70</td>
</tr>
</tbody>
</table>

Service branch (%)

- Navy/Coast Guard
- Marine Corps
- Army
- Air Force
Study Participants (2017)
Study Productivity

Active Projects: 40

Publications: 101 (3 in press)

Citations by Year
Study Leadership

Principal Investigator:
Dr. Rudy Rull replaced CAPT Dennis Faix (October 2017)
Psychological Health: Research Priorities

• Impact of service-related experiences, such as combat, on psychological health and well-being
  – Focus on specific occupations: veterinarians and Special Forces

• Long-term patterns and trends of disorders, such as PTSD
  – Co-morbidity of disorders, such as PTSD and depression
  – Specific biomarkers associated with mental disorders (e.g., serum miRNA profiles and PTSD)

• Aspects of military service and/or transitions that increase risk for suicide and suicidal behavior
  – Progression of suicidal behaviors
Behavioral Health: Research Priorities

- Sexual trauma
- Sexual health and gender roles
- Sleep issues
- Modifiable behaviors including substance use
Chronic Disease: Research Priorities

- Cardiometabolic outcomes
  - Obesity
  - Diabetes mellitus
  - Hypertension
  - Cardiovascular disease
- Autoimmune disorders
- Cancer morbidity and mortality
- Chronic disease burden in vulnerable populations, including women, racial/ethnic minorities, and sexual and gender minorities

Who Is At Risk?

While current Service members are less likely to be obese compared with civilians, this rapidly changes around the time of their separation from the military.

Over a 6 year period (~2001-2007), men and women who left the military gained significantly more weight (an average of 12.6 and 13.9 pounds, respectively) compared with continuing Service members (7.7 and 8.8 pounds, respectively).¹

Environmental Health: Research Priorities

- Airborne hazards and respiratory health (asthma and COPD)
  - Burn pits
    - Deployment proximity to burn pits
    - Serum biomarkers of exposure (DHP JPC-5 funded, collaboration with USACEHR)
  - Fuels and fumes exposures

2018 publication:
Elevated risk of new-onset asthma among deployed personnel who experienced combat vs. deployers without combat experience and non-deployed personnel

Injury and Recovery: Research Priorities

- Musculoskeletal injury
- TBI
- Sensory impairments (vision, hearing)
- Metabolic responses to injuries
- Prescriptions (sedatives, opioids)
Family and Social Relationships: Research Priorities

- Relationship formation and stability
- Sexual health, fertility, and pregnancy
- Family violence risk
- Household economic resilience
Veterans Health: Research Priorities

• Identification of factors that predict successful or unsuccessful transitions from the military
  – Post-service economic well-being
  – Homelessness
  – Health care access and utilization

• Diseases with long latency periods (cancer, dementia)

• Post-deployment health concerns
  – Gulf War illness/Chronic multisymptom illness

New capability:
Linkage of VA data with Millennium Cohort Study data
• Data Use Agreement signed August 2018
Millennium Cohort: VA MVP Collaboration

- DoD-VA partnership to facilitate expansion of VA Million Veteran Program (MVP) by co-enrolling Millennium Cohort participants
  - DoD-VA Memorandum of Agreement signed March 2017
  - Current: 6,200 MilCo veterans enrolled in MVP
    - MVP survey
    - Whole blood collected for whole genome sequencing

- Cohort panel presentation at Military Operational Readiness: Precision Medicine Research conference (May 2017)
2017-2018 Launch Timeline

- **Suggestions**: Mar-Jun 2015
- **Draft**: Jun 2015
- **Finalize**: Aug 2015
- **OMB/RCS**: Aug 2015
- **IRB**: Oct 2018
- **Launch**: Nov 2018

- **Duration**:
  - 38 months
  - 1 month
FY19 Funding Realignment

• Study core funding will be transferred from MOMRP Army Core to DHA as a directed requirement (DHP RDT&E)
Stakeholder Research Requests

• USSOCOM/Preservation of the Force and Family (POTFF)
  – Mental and physical health of Special Operations Forces

• Army Office of the Surgeon General
  – Mental and behavioral health of Army veterinarians and veterinarian technicians
  – Study results included in briefing to Chief of Army Veterinary Corps (August 2018)

• Department of Veterans Affairs
  – Health of Gulf War veterans
Stakeholder Research Requests

• Assistant Secretary of Defense for Health Affairs
  – Burn-pit exposure and respiratory health

• Deputy Assistant Secretary of Defense Office of Personnel and Readiness, Health Services Policy and Oversight
  – Obesity and deployment
    • Analyses requested by Dr. Donald Shell to inform Medical and Personnel Executive Steering Committee (MEDPERS) on revising body composition standards
  – Close Combat Lethality Task Force (CCLTF)
    • Millennium Cohort Program and previous studies featured as a population health resource to inform performance and readiness optimization
Knowledge Transitions

- Knowledge Transition Agreement (KTA) signed
  - POTFF/SOCOM
  - SAPR: Sexual trauma manuscripts

- KTA approval pending
  - DSPO: Suicide progression, risk factors, and high-risk groups
  - MC&FP: Family-related knowledge products

- KTA in development
  - USU Center for Deployment Psychology: Results relevant to educational programming for military service providers
  - Deputy Assistant Secretary of Defense Office of Personnel and Readiness, Health Services Policy and Oversight: Requested obesity and deployment analyses
  - Humana Military (contractor for TRICARE East)
Future Directions

• Veteran-focused module in future surveys

• Linkage with cancer registries
  – DoD Consolidated Cancer Registry
  – VA Central Cancer Registry
  – States (Virtual Pooled Registry)

• Potential for biospecimen collection in future surveys
Questions?
The Millennium Cohort Family Study

Principal Investigator
Family Study Background

- DoD recommended conducting research on post-deployment adjustment for family members
- Abt Associates submitted “Family Impact Study” proposal to the MOMRP. MOMRP partnered Abt with NHRC to benefit from existing survey implementation infrastructure
- A multidisciplinary team of investigators from NHRC, Abt Associates, Duke University, and New York University formed to co-lead the Family Study

“Our ultimate goal is...to ensure that the health and well-being of our military personnel and their families is at the top of our list of priorities. Apart from the war itself, we have no higher priority!”
Family Study Methodology

- Recruit participants using a common baseline sampling frame in coordination with the Millennium Cohort Study
- Develop a comprehensive database including self-report and archival data from service members and spouses (i.e., dyadic)
- Conduct follow-up surveys approximately every 3 years in tandem with the Millennium Cohort survey cycles
- Promote internet-based electronic survey response, with paper mail survey options only offered to late responders
# Family Study Enrollment

<table>
<thead>
<tr>
<th>Panel</th>
<th>Enrollment Dates</th>
<th>Oversampled Groups</th>
<th>Total Eligible</th>
<th>Total Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apr 2011–Apr 2013</td>
<td>Females, married</td>
<td>28,603</td>
<td>9,872 (35%)</td>
</tr>
<tr>
<td>2</td>
<td>Sep 2017–Sep 2019</td>
<td>Females, married special forces</td>
<td>175,000</td>
<td>~50,000 (33% projected)</td>
</tr>
</tbody>
</table>
Family Study Panel 1 Progress

- At baseline, the Millennium Cohort Program enrolled 9,872 married dyads.
- At wave 2, a total of 4,872 dyads responded to a follow-up survey.

6,625/9,872 (67.1%) Family Study Spouse

4,872 (49.4%) Dyads

6,447/9,872 (65.3%) Millennium Cohort Service Member
Family Study Panel 2 Progress

- Maximize response rates by encouraging early responders to engage their married partners.
- Dual-enroll single parent service members in the Family Study to complete a brief parenting and child well-being module.
Millennium Cohort Family Study Aims

- Methodological and Foundational Research
- Individual and Dyadic Mental Health
- Marital and Family Relationship Adjustment
- Career and Economic Well Being
- Physical Health and Health Behaviors
- Child Well Being and Parental Adjustment
Featured Program Area: Child Well-Being

- **Child Domain Mission**
  - To examine the impact of military and nonmilitary stress on family functioning and an array of child processes (i.e., vulnerability to resilience) using a developmental framework (i.e., from infancy through adolescence)

- **Research Priorities**
  - Child well-being
  - Parenting
  - Fertility and birth
  - Adverse events
Child Well-Being: Collaborative Work

MILLENNIUM COHORT FAMILY STUDY

-10,000 participants
At the time of the 1st survey
>60% have kids, most ages 1-5.

Family Study participants are married to service members who have 2-5 years of service and are part of the Millennium Cohort Study. This allows a complete picture of these families’ unique experiences.

DEPLOYMENT AND MENTAL HEALTH OF MILITARY KIDS

Most children appear to be doing well.
But, during or after deployment, children may have a greater likelihood of ADHD or depression.
What can spouses do to reduce risk?
Odds are lower when spouses at home can remain engaged in normal social activities.
Child Well-Being: Collaborative Work

- **Parental Stress and Infant Health**
  - Large sample (range of 6,000–20,000 infants by model) of military parents with linked data from Millennium Cohort and NHRC BIHR program
  - Complimentary maternal and paternal analyses
  - Multiple birth outcomes: birth defects in the first year, growth problems in utero, growth problems in infancy, preterm birth, alterations in sex ratio (indicating fertility problems)
Child Well-Being: Research Directions

- Expanding resources on adverse childhood events (ACE)
  
  • Family Study and Millennium Cohort Studies have been linked to Family Advocacy Central Registry met criteria reports of child abuse and neglect.

  • At the request of the DoD Office of Military Community and Family Policy (MC&FP), a measure has been added to obtain parental reports of child ACE exposure.

  • A new measure has been added assessing parental engagement as a proximal protective factor for neglect.

  • Under the guidance of the DoD Family Advocacy Program, a screening tool has been added for possible intimate partner violence in the home.
Child Well-Being:
Adverse Events

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did [SAMPLE CHILD] ever live with a parent or guardian who got divorced or separated after [SAMPLE CHILD] was born?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Did [SAMPLE CHILD] ever live with a parent or guardian who died?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Did [SAMPLE CHILD] ever live with a parent or guardian who served time in jail or prison after [SAMPLE CHILD] was born?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Did [SAMPLE CHILD] ever see or hear any parents, guardians, or any other adults in [his/her] home slap, hit, kick, punch, or beat each other up?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Was [CHILD] ever the victim of violence or witnessed any violence in [his/her] neighborhood?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Did [SAMPLE CHILD] ever live with anyone who was mentally ill or suicidal, or severely depressed for more than a couple of weeks?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Did [SAMPLE CHILD] ever live with anyone who had a problem with alcohol or drugs?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Since [SAMPLE CHILD] was born, how often has it been very hard to get by on your family’s income, for example, it was hard to cover the basics like food or housing?</td>
<td>1: Very Often 2: Somewhat Often 3: Not Very Often 4: Never</td>
</tr>
</tbody>
</table>
Future Directions: Research

- Expand portfolios and programmatic planning process
- Enroll Family Study Panel 2
- Evolve study content to match an evolving participant base
- Encompass full range of relevant DoD/VA archival data
- Extend research collaborations
- Engage key stakeholders (MC&FP and their chain of command, SOCOM, VA, TVPO, SAPRO, Humana Military)
- Explore ways to disseminate a range of research deliverables
  - Educational information such as public health messaging and infographics (support personnel, military families, general public)
  - Answers to direct questions from stakeholders
  - Recommendations for programs and policies
  - Directions for future research
Future Directions: Networking

- Family Study and Millennium Cohort have public facing websites providing information on study progress, guidelines for collaboration, and searchable research publications
- Millennium Cohort Program keeps a list serve of researchers, providers, and stakeholders interesting in regularly receiving study products
- Family Study maintains a list of researchers interested in collaborating and strives to include an external subject matter expert (SME) on every project
- Family Study accepts external proposals for projects within our research objectives; proposals are reviewed and approved by a committee of SMEs
- Family Study has limited ability to provide analytic support for external projects, and does not provide monetary support
Questions?

www.familycohort.org
www.millenniumcohort.org