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Proceedings of the
2010 AFMS Medical Research
Symposium
Volume 2. Operational & Medical Track
Abstracts and Presentations



Proceedings of the
2010 AFMS Medical Research
Symposium
Volume 2. Operational & Medical Track
Abstracts and Presentations

Edited by: Dr. Welford C. Roberts



Held
24-26 August 2010
at the
DoubleTree Hotel Washington DC – Crystal City
300 Army Navy Drive
Arlington, VA 22202



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Proceedings of the 2010 AFMS Medical Research Symposium Introduction

The U.S. Air Force Medical Service presented the fifth annual Air Force Medical Research Symposium coordinated by the Air Force Medical Support Agency's Research and Development Division (AFMSA/SGRS). The symposium was held on 24-26 August 2010 in the Washington D.C. area at the Doubletree Hotel Washington DC – Crystal City in Arlington, VA. The symposium featured two half-days of plenary sessions, one and a half days of scientific presentations, and a poster session.

The symposium was organized into several tracks to include Operational & Medical, En-route Care, Force Health Protection, and Nursing, as follows:

- The Operational & Medical Track focused on patient care and treatment in garrison, expeditionary care during contingency operations, and enhancing performance of airman in challenging environments.
- The En-route Care Track addressed science and technology targeted at the continuum of care during transport from point of injury to definitive care to include medivac, aeromedical evacuation, critical care air transport, patient staging, and patient safety.
- The Force Health Protection Track focused on prevention of injury and illness and the early recognition or detection of emerging threats for in-garrison or deployed operations. Topics of interest include research in bio-surveillance, infectious disease, emerging threats (pandemic response), protective countermeasures, disaster response/consequence management, toxicology/health risks (e.g., particulates nanomaterials, radiation, etc.), monitoring disease trends, other areas of preventive medicine, public and environmental health relevant to the military workforce.
- The Nursing Track focused specifically on evidence based practice.

These proceedings are organized into five volumes, as follows:

- Volume 1. This volume is a general overview of the entire 2010 Air Force Medical Research Symposium and includes abstracts of all the oral presentations and posters. First presented is the symposium's opening plenary session, followed by the abstracts from the four technical tracks, and then the closing plenary session. The abstracts associated with the poster session are in the last section of these proceedings. The agenda for the overall symposium is in Appendix A, attendees are listed in Appendix B, and continuing education information is in Appendix C of this volume. Appendices D-L are copies of presentation slides from the plenary sessions.
- Volume 2. This volume contains abstracts and presentation slides for the Operational & Medical Track.
- Volume 3. This volume contains abstracts and presentation slides for the En-route Care Track.
- Volume 4. This volume contains abstracts and presentation slides for the Force Health Protection Track.
- Volume 5. This volume contains abstracts and presentation slides for the Nursing Track.

Attenuation of Altitude De-acclimatization/Neocytolysis with Exercise Intervention

Human Performance Laboratory- United States Air Force Academy

Michael D. Brothers, Jeffery L. Nelson, James A. LaChapelle, Bryan S. Wynkoop, Cole R. Schindler, Elizabeth C. Grossmann, Tyner M. Apt, Erlyn R. Rudico, Laura Nelson, and Michael F. Zupan

INTRODUCTION: Astronauts and high-altitude (>4000m) residents experience neocytolysis—a rapid reduction in total hemoglobin mass (THM)—upon return to sea level (SL; <300m). Whether exercise intervention can mitigate this loss is unknown. **PURPOSE:** This study examined changes in THM among moderate altitude (MA; ~2210m) residents who completed various ‘exercise prescriptions’ during a three-week winter break spent at SL. Based on previous studies, we expected all subject’s THM to decrease significantly; however, we hypothesized cadets performing high-intensity exercise would minimize THM loss. **METHODS:** Fifty three cadet subjects (39 male, 14 female) age 20.5 ± 1.5 years participated in the study. Each subject was scheduled for THM assessment using the optimized CO re-breathing protocol twice the month prior to departing for SL, and twice upon their first week returning to MA. Subjects were classified into one of three groups: ‘control’ (moderate exercise), ‘interval’ (high intensity), or ‘endurance’ (high volume). Statistical analysis consisted of 1-tailed independent sample and paired T-tests with $p \leq 0.05$. **RESULTS:** All subjects had a significant ($p < 0.001$) loss in THM over winter break, losing 3.7% (-28.3 ± 29.3 g) on average. The ‘interval’ group lost only 2.9% (-23.0 ± 33.2 g), while the ‘control’ group lost 4.9% (-37.3 ± 27.0 g), which neared statistical significance ($p = 0.061$). The ‘endurance’ group lost 3.3% (-25.1 ± 26.7 g; $p < 0.1$, compared to the ‘control’ group). **CONCLUSIONS:** All subjects’ THM significantly decreased despite exercise intervention while at SL. However, exercise intervention attenuated THM loss, and the interval group’s decrease neared statistical significance.

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**Attenuation of Altitude
De-acclimatization /
Neocytolysis with
Exercise Intervention**

Michael D. Brothers, Jeffery L. Nelson, James A. LaChapelle,
Bryan S. Wynkoop, Cole R. Schindler, Elizabeth C. Grossmann,
Tyner M. Apt, Eriyn R. Rudico, Laura Nelson, & Michael F. Zupan

Lt Col Michael Brothers, Ph.D.



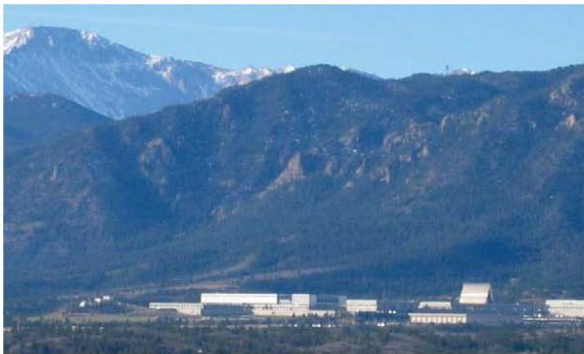
Outline

- Background
 - Previous USAFA altitude research and rationale for current study
- Methods
- Results
- Summary & implications
- Acknowledgements & questions

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**U.S. Air Force Academy & moderate
altitude (MA) adaptations**



**USAFA for analysis of
long-term MA adaptation**

- Elevation = 2210m (7,250 feet)
- Freshman students from **all** over the world (SL & MA) arrive w/in 24-hour period & in-process the same day each summer
- Unique, well-controlled military environment:
 - Stringent physiological requirements for appointment
 - Limited travel away from USAFA until Thanksgiving (4-6 days) **or Winter (2-3 week)** break (+5.5 month chronic MA exposure, and effect of 3 wk sojourn to SL)
 - Rigorous physical training/testing programs all 4 years
 - "Family style" dining (near-identical diet)

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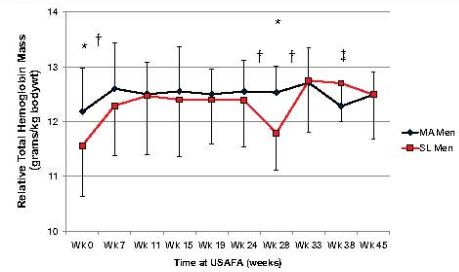
Support for current study

- > Longitudinal year-long study with double-blind, placebo-controlled iron supplementation (100mg ferrous sulfate daily)
- > Blood adaptations assessed x10 w/ THM via the optimized CO re-breathing protocol (Schmidt & Prommer EJAP 05)
- > Numerous Physical performance & physiological testing sessions (3x VO_{2max} , 5x RE at 3-5 velocities, 4x 1.5m AF fitness test run)
- > Subjects: 82 male and female freshman cadets
- > 13 MA, 69 SL (49 male, 20 female)
- > MA \geq 1500m, SL \leq 330m, for 3 yrs prior to USAFA

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Chronic THM data: Men

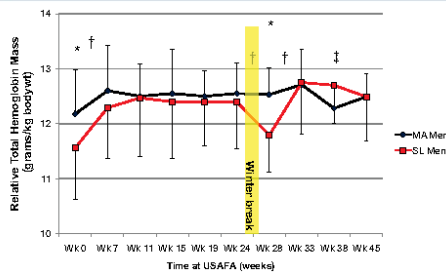


Significant main effect of time ($p < 0.001$), Time X Alt. ($p = 0.03$); *, sig. ($p < 0.05$) difference in altitude; SL only: †, sig. ($p < 0.01$) change in time from previous; ‡, sig. ($p < 0.01$) change in time from wk 7

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Chronic THM data: Men

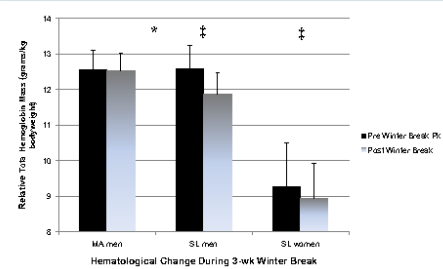


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Results: Relative THM Lost during 3-wk Winter Break



*, Significant ($P < 0.05$) differences between MA & SL males post-break; †, significant ($P < 0.005$) change over time.

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Current Study Rationale

- > Lengthy acclimatization time, but rapid de-acclimatization suggests neocytolysis (the selective destruction of immature red blood cells)
- > Can SL-induced de-acclimatization be attenuated with exercise?



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Methods: Subjects

- > Subjects: 53 USAFA Cadets (39 males, 14 females) spending winter break at SL (< 300m)
- > Provided Exercise Log for winter break exercise documentation and specific exercise intervention (moderate/control, endurance, or interval) instructions
- > Descriptive data:

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Descriptive data

	All n=53 (39 m, 14 f)	Control n=17 (12 m, 5 f)	Interval n=17 (13 m, 4 f)	Endurance n=19 (14 m, 5 f)
Age (yrs)	20.5 ± 1.5	20.67 ±1.32	20.79 ±1.72	20.01 ±1.21
Height (m)	1.74 ± .08	1.75 ±.10	1.73 ±.067	1.74 ±.08
Weight (kg)	71.5 ± 9.88	73.21 ±12.70	71.80 ±8.26	69.69 ±8.49
BMI (kg/m ²)	23.52 ± 1.98	23.77 ±2.60	23.81 ±1.65	22.99 ±1.56

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Methods: Cohorts

- > **Control** (n=17; 12 m, 5 f):
 - > Less than 6 completed workouts
 - > Intensity < RPE 6
 - > Total Time < 140 min
- > **Interval** (n=17; 13 m, 4 f):
 - > More than 7 completed workouts
 - > Intensity > RPE 6 at least 4 times
 - > Total Time > 190 min
- > **Endurance** (n=19; 14 m, 5 f):
 - > More than 5 completed workouts
 - > Intensity > RPE 6
 - > Total Time > 290 min

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Methods: THM Assessment

- Total Hemoglobin Mass (THM) assessed via Optimized CO Re-breathing Method (Schmidt & Prommer, EJAP 05)
- Scheduled tests:
 - 2x the mo prior to Winter Break
 - 2x within a wk of return from SL
- Statistical analysis: RMANOVA / Student T-test

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Optimized CO Re-breathing Method



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Optimized CO Re-breathing Method



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Optimized CO Re-breathing Method



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**Optimized CO
Re-breathing Method**



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**Optimized CO
Re-breathing Method**



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**Optimized CO
Re-breathing Method**



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**Optimized CO
Re-breathing Method**



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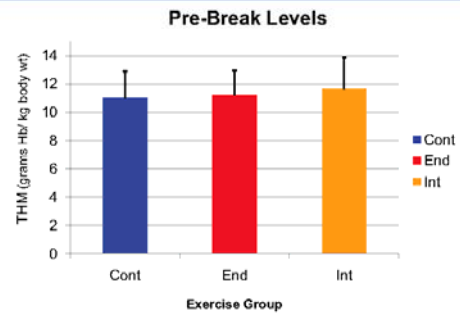
Results

- All subjects had significant ($p < 0.001$) THM loss as a result of Winter Break at SL
 - average 3.7% loss of THM
- Interval group only lost 2.9% ($p = 0.061$) compared to control group
- Endurance group lost 3.3% ($p < 0.1$) compared to control group
- Control group lost 4.9%

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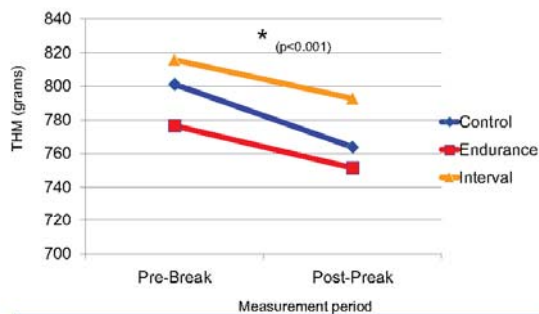
Normalized THM Between Groups



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Change in Absolute THM



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Study Limitations

- Exercise regimen
- Self-Reporting
- Scheduling



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Implications

- > MA Deployed troops
- > Exercise training
- > USAFA implications



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Acknowledgments / Questions

Disclaimer: Views expressed are those of the authors and do not reflect the official policy or position of the USAF, the DoD, or the US government

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Funding: [USAFA Life Sciences Research Center](#)

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Impact of Alternating Days of Intermittent Hypoxic Exposure (IHE) on Physical and Cognitive Performance

United States Air Force Academy- Alabama Department of Public Health (ADPH)

Michael F. Zupan, Monica S. Herrera, Lynette M. Lennemann, Julia N. McGregor and Thomas B. Walker

BACKGROUND: Unacclimatized military personnel rapidly deployed to moderate altitude (MA) (2750-3660m) environments are subject to physical and cognitive performance impairments. **PURPOSE:** The primary purpose of this study was to determine if alternating days of intermittent normobaric hypoxic exposures (IHE) for unacclimatized, sea-level residents works as a training strategy to minimize physical and cognitive impairments in battlefield airmen during MA deployments.

METHODS: We conducted a crossover style, randomized study to assess the efficacy of IHE on performance decrements. Baseline physical and cognitive tests were conducted at sea level (SL), normobaric hypoxic (NH), and hypobaric hypoxic (HH) environments. Subjects were randomly assigned to either five consecutive (C-IHE) or five alternating (A-IHE) days of IHE. All tests were repeated post-IHE exposure. Following a four-week washout interval, all subjects repeated the process again under the opposite IHE exposure schedule. Intra-subject differences between training regimens (C-IHE vs. A-IHE) and the three environments (SL vs. NH vs. HH) were analyzed. **RESULTS:** Seven well-conditioned ($\text{VO}_2 \text{ max} = 57 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) male subjects (30.4 ± 8.7 yrs) completed the study. Significant physiological differences ($p < 0.05$) between SL and NH or HH were observed. There were significant differences at HH environment for anaerobic endurance distance ($p = .01$), but not $\text{VO}_2 \text{ max}$ ($p = .27$), max HR ($p = .21$) between C-IHE and A-IHE training regimens. Analysis of cognitive and acute mountain sickness data is ongoing and will be reported at the Symposium. **CONCLUSIONS:** C-IHE may result in greater altitude adaptations than A-IHE allowing battlefield airmen to better prepare themselves for MA deployments.

This study was funded with a research grant provided by the Air Force Surgeon General Office and the Air Force Research Laboratory.

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Alternating Days of Intermittent Hypoxic Exposure on Physical and Cognitive Performance



Lt Col Michael Zupan, Ph.D.
 Director, USAFA Human Performance Lab

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Overview

- Background
- Intermittent Hypoxia
- Purpose
- Methods
- Results
- Discussion



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Background

- Physical and cognitive performance is greatly diminished during periods of high physical stress (such as altitude, heat, and fatigue)
- There is typically a 70% impairment in prolonged physical performance and a 20% decrement in cognitive performance within the first few days of exposure to moderate altitude for an unacclimatized individual (Muza 2007)
- Direct application for our newly deployed special tactics operators being deployed to altitude environments
 - ✓ Some CCT's are prepositioned and can acclimatize throughout deployment
 - ✓ Others are based low and fight at moderate altitudes (6-9K)
 - ✓ Limited reports of AMS
 - ✓ Greater need in Afghanistan than Iraq for preexposure



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Intermittent Hypoxic Training for Performance Enhancement

Live Low - Train Low
 Live Low - Train High
 Live High - Train High
 Live High - Train Low
 Live High - Train Low, Train High
 Live Very High - Train High

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 **Possible Structural and Hematological Adaptations with IHE**

- ↑ Capillary density
- ↑ Mitochondrial density
- ↑ Myoglobin stores
- ↑ Oxidative enzymes
- ↑ EPO
- ↑ Hemoglobin concentration [Hb]
- ↑ Hematocrit [Hct]
- ↑ Oxygen saturation (SaO₂)
- ↑ 2,3 DPG
- ↓ AMS occurrence
- Ventilatory acclimatization



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 **Background**



- Altitude Training with a normobaric hypoxic environment is currently being utilized to help pre-acclimatize some battlefield airmen before strenuous deployments to moderate/high altitude (above 7,000 ft)
- The current recommended altitude preparation guidelines for using IHE are 5 consecutive days at 4,000 m (13,200 ft) for 1.5 hours during the week prior to high altitude deployments
- Difficult schedule to accomplish with all the other tasks required that week
- Alternating exposure days would lessen the time demands during a high ops tempo on our deploying airmen while still providing the necessary high altitude adaptations

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 **The Colorado Altitude Training (CAT) Room**

- Altitude simulator
- Creates a hypoxic condition by decreasing the oxygen partial pressures within the enclosed room
- No change in barometric pressure
- Decreased pO₂ to 12.5% to simulate 14,300 ft (~4300 m)



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 **Purpose**

The primary purpose of this study was to determine if alternating days of intermittent normobaric hypoxic exposures (IHE) for a previously unacclimatized, sea-level resident (SLR) will work as a training strategy to minimize physical and cognitive impairments and possibly reduce acute mountain sickness (AMS) incidence in battlefield airmen during deployment.



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Data Collection

- > **Baseline testing under 3 conditions:**
 - ✓ Ground-level
 - ✓ Altitude chamber (hypobaric hypoxic exposure)
 - ✓ CAT (normobaric hypoxic exposure)
- > **Normobaric intermittent altitude exposures (1.5 hours/day at 14,300 ft)**
 - ✓ Consecutive day schedule: Mon-Fri
 - ✓ Alternating day schedule: Tues, Thurs, Sat, Mon, Wed
- > **Post-testing identical to baseline testing for a within-subjects design**
 - ✓ All subjects repeated testing under both exposure schedules
 - ✓ One month washout between trials



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Training/Testing Overview (~74 hours/subject)

Initial Screening
Aerospace Physiology Chamber Training
Preliminary Training for Test Familiarization
Baseline Testing #1 – 3 environments (hypobaric chamber, sea level, hypoxia tent)
1 week wash-out period at sea level
Intermittent Hypoxic Exposure #1 (either 5 consecutive days or alternating days)
Post-testing #1 – 3 environments (hypobaric chamber, sea level, hypoxia tent)
40 week wash-out period at sea level
Baseline Testing #2 – 3 environments (hypobaric chamber, sea level, hypoxia tent)
1 week wash-out period at sea level
Intermittent Hypoxic Exposure #2 (opposite of initial exposure treatment)
Post-testing #2 – 3 environments (hypobaric chamber, sea level, hypoxia tent)



Testing Protocol

- > **DEXA Scan**
- > **Maximal Oxygen Uptake**
- > **Battlefield Airman Anaerobic Endurance Test**
- > **Whole Body Reaction Time**
 - ✓ Proactive
 - ✓ Reactive
- > **Stroop Colored Word Test (SCWT)**
- > **Blood Lactates**
- > **Acute Mountain Sickness (AMS)**
 - ✓ Environmental Symptoms Questionnaire (ESQ)
 - ✓ Lake Louise AMS Scoring System (LLS)
- > **Oxygen Saturation (SaO₂ level)**



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Maximal Oxygen Uptake (followed by Stoop, SaO₂, lactates & AMS)



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 **Battlefield Airman Anaerobic Endurance Test**
 (Followed by Stoop, SaO₂, lactates & AMS)



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 **Makoto Eye-Hand Speed**
 (followed by Stoop, SaO₂, lactates and AMS)



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 **Stroop Colored Word Test**

BLUE	GREEN	BLUE	YELLOW	GREEN	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
YELLOW	BLUE	RED	GREEN	RED	00000	00000	00000	00000	00000	YELLOW	BLUE	RED	GREEN	RED
FPNC	RED	GREEN	RED	YELLOW	00000	00000	00000	00000	00000	FPNC	RED	GREEN	RED	YELLOW
FPNC	GREEN	FPNC	YELLOW	RED	00000	00000	00000	00000	00000	FPNC	GREEN	FPNC	YELLOW	RED
GREEN	BLUE	FPNC	BLUE	YELLOW	00000	00000	00000	00000	00000	GREEN	BLUE	FPNC	BLUE	YELLOW
FPNC	RED	BLUE	RED	GREEN	00000	00000	00000	00000	00000	FPNC	RED	BLUE	RED	GREEN
BLUE	YELLOW	FPNC	YELLOW	FPNC	00000	00000	00000	00000	00000	BLUE	YELLOW	FPNC	YELLOW	FPNC
YELLOW	RED	BLUE	FPNC	GREEN	00000	00000	00000	00000	00000	YELLOW	RED	BLUE	FPNC	GREEN

- Administered 5 times during every test session
- Yields a color-word score based on time taken (sec)
- Tests mental vitality and flexibility
- Provides insight into cognitive effects that are experienced as a result of attentional fatigue

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 **Research Results – Demographics**

- 7 Male Subjects
- Age: 30.4 ± 8.7 yrs (22-44)
- Weight: 78.2 ± 4.5 kgs (70.5-83.8)
- Height: 178 ± 6.2 cm (168-187)
- % Bodyfat: 6.4 ± 6.8% (6.0-26.7%)



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Oxygen Saturation (SaO₂)

	Pre Alternating	Post Alternating	Pre Consecutive	Post Consecutive
Chamber	75.7 ± 5.6%	76.8 ± 3.7%	77.9 ± 5.1%	79.6 ± 3.5%*
Ground	96.4 ± 0.7%*	96.8 ± 0.4%*	96.8 ± 0.6%*	96.4 ± 0.8%*
Tent	81.6 ± 4.0%	83.1 ± 3.6%*	81.8 ± 3.8%	83.0 ± 3.5%*

* = p<0.05 (pre vs post); * = p<0.01 (ground vs tent/Chamber)

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Battlefield Airman Anaerobic Endurance Test Results

	Pre Alternating	Post Alternating	Pre Consecutive	Post Consecutive
Chamber	173 ± 61	189 ± 50	178 ± 65	200 ± 76
Ground	235 ± 87	241 ± 61 <small>(p=.07)</small>	259 ± 75	267 ± 74
Tent	214 ± 58	206 ± 60	215 ± 54	204 ± 66

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Reactive Eye-Hand Results (seconds)

	Pre Alternating	Post Alternating	Pre Consecutive	Post Consecutive
Chamber	.54	.55	.53	.55
Ground	.54	.55	.55	.55
Tent	.59	.55	.57	.55

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Proactive Eye-Hand Results

	Pre Alternating	Post Alternating	Pre Consecutive	Post Consecutive
Chamber	86%	78%	63%	70%
Ground	71%	68%	68%	61%
Tent	53%**	56%**	55%*	56%*

* = p<0.05 (chamber vs tent); * = p<0.05 (ground vs tent)

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Other Results

- > **Acute Mountain Sickness**
 - ✓ No occurrences during testing or during IHE exposures
 - ✓ Exposure time
- > **Stroop Colored Test**
 - ✓ Data analysis not complete at this time



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Summary

- > 5 days of intermittent normobaric hypoxic exposures (IHE) for a previously unacclimatized, sea-level resident (SLR) results in minor adaptations
- > Few differences between consecutive or alternating exposure schedules
- > Not sure on optimal # of days and minimum daily dose
- > IHE High intensity exercise
- > Additional research is needed



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Recommendations

- > Increase IHE exposure time
- > Smaller units that can be taken home and used up to 90 days prior to deployment
- > Units can be transferred to next group for pre-exposure to moderate altitude



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Acknowledgments

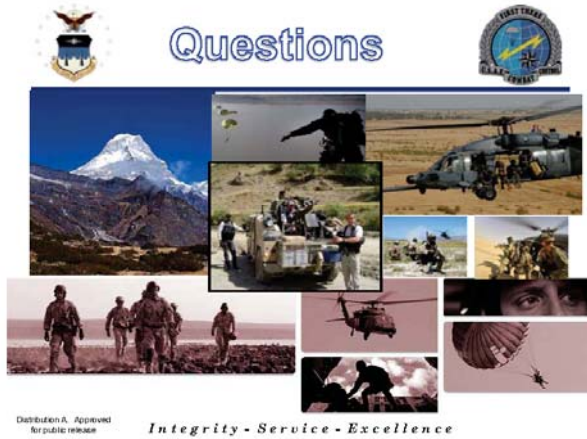
- > Dr. (Maj) Thomas Walker
- > Dr. (Maj) Chris Vojta
- > 1Lt Monica Herrera
- > Capt Jules McGregor
- > 1Lt Lynette Lennemann

Study funded by:
 Air Force Research Laboratory
 Biobehavioral Performance Branch
 Biosciences and Protection Division
 Human Effectiveness Directorate
 Brooks City Base, TX 78235



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Altitude-related Differences in Running Economy among Sea Level Residents during 46 Weeks at Moderate Altitude

United States Air Force Academy- Alabama Department of Public Health (ADPH) Human Performance Laboratory, United States Air Force Academy, 2169 Field House Drive/Ste. 111, USAF Academy, CO 80840

Jeffrey L. Nelson, James A. LaChapelle, Elizabeth C. Grossmann, Michael F. Zupan, Brandon K. Doan, Michael D. Brothers

INTRODUCTION: Although improvement in sea level (SL) running economy (RE) following short-term altitude exposure has been demonstrated, changes in RE among SL residents following chronic moderate altitude (MA; 2210m) residence have not been examined. **PURPOSE:** To assess differences in RE between SL and MA subjects during 46 wks of chronic residence at the U.S. Air Force Academy. It was hypothesized that SL subjects would have significantly worse RE initially, but RE would improve following MA acclimatization.

METHODS: 55 male subjects (18.7 +/- 0.7 yrs) from SL (n = 44) and MA (n = 11) had their RE assessed (6-9 mph) on 5 separate occasions over 46 wks. Correlations between total hemoglobin mass (THM) and RE data were assessed. Subjects were supplemented with either iron or placebo.

RESULTS: SL subjects had significantly ($p < 0.05$) worse RE compared to their MA peers after 8-10 wks at MA at all velocities examined (46.0 +/- 4.3 vs. 42.7 +/- 3.4 ml/kg/min; SL vs. MA, respectively). All subjects' RE changed significantly ($p < 0.05$) over time. The altitude-related difference became non-significant after +16-18 wks. There was no difference in RE due to iron supplementation. Despite changes in RE and THM among SL subjects residing at MA, there were no significant correlations between THM and RE. **CONCLUSIONS:** Significant altitude-related differences existed in RE and THM for 15+ wks at USAFA, but did not correlate significantly. These data suggest chronic MA acclimatization results in changes to both RE and THM, but unique adaptations may underlie each.

This research funded by a HQ AF/SGRS grant.

HQ U.S. Air Force Academy

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Altitude-related Differences in Running Economy Among Sea Level Residents During 46 Wks at Moderate Altitude



LaChapelle JA, Grossmann EC, Zupan MF, Doan BK, and Brothers MD

Jeff Nelson, Ph.D.
 USAFA Human Performance Laboratory



SGR-funded USAFA Altitude Study

- Double-blind, placebo-controlled Fe supplementation w/ physiological assessments
 - Early recruitment & IP testing approved by senior AFA staff
 - Baseline testing 24-28 June 08 (w/in 2-4 days of in-processing)—determination of THM via CO re-breathing
 - Follow-up THM assessments every 4-6 wks to monitor blood adaptations
 - Additional performance assessment conducted:
 - AFT/PFT: day 1, wk 5, 11, and 28
 - 5 running economy assessments with 3 VO_{2peak} tests

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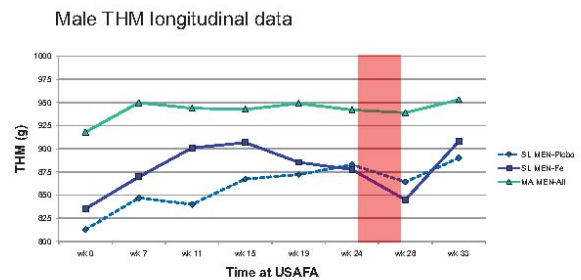
THM Assessment



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Chronic hematological data: THM



Significant main effect of time ($p < 0.001$), All. ($p < 0.04$), no effect of Fe ($p = 0.173$), no interaction ($p > 0.38$)

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THM Peak

Group	Week	THM	% Increase
Fe ²⁺	15	+73.7±39.4 g	+10.4%
Placebo	28	+68.6±9.4 g	+9.4%

❖ Clearly, the iron group had a shorter acclimatization time

❖ Hematological acclimatization is longer in duration than previously thought.

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Running Economy



- Energy demand for a given velocity of submaximal running
- Determined by measuring steady-state consumption of oxygen (VO₂, RER)
- Runners with good RE use less energy (less O₂) than those with poor RE

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Running Economy

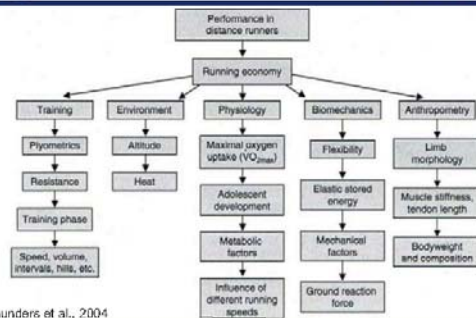


Analogy: mpg

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Factors Affecting Running Economy

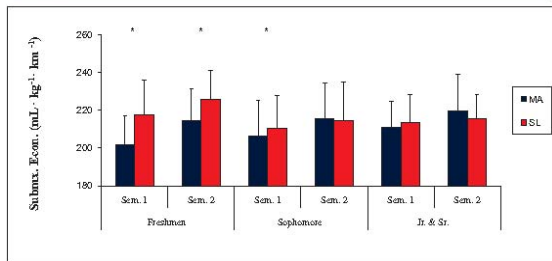


Saunders et al., 2004

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Previous USAFA RE Results



Legend: Sig. ($p < 0.03$) main effects of altitude & time, and sig. ($p < 0.05$) alt. x class & alt. x time interactions occurred in sub-maximal running economy. *, Sig. ($p < 0.05$) differences between MA & SL.

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Purpose & Demographics

- Purpose: Assess the differences in RE between former SL & MA cadets during 46 wks of residence at USAFA
- Examine correlation between THM and VO_{2peak}

Demographics:

	n	Age	Ht (cm)	Wt (kg)
SL	44	18.6±0.5	177.1±7.8	70.9±9.0
MA	11	19.0±1.0	179.5±7.0	75.5±10.8

No sig. difference between MA and SL

SL defined as <330m, and MA >1500m, 3 yrs prior to arrival

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Methodology

Assessed RE 5x

- Alternating Protocols:
 - Based on AFT Time
 - 3 Stages + VO_{2peak}
 - 7, 8, & 9mph + VO_{2peak}
 - 5 submax Stages
 - 7, 7.5, 8, 8.5, & 9mph
- 5 min submax stages
- ↑ 2% /min for VO_{2peak}



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Jack's Valley




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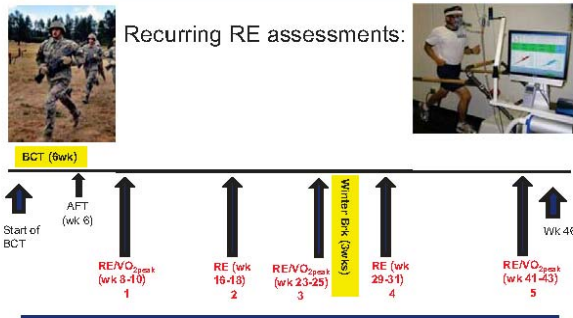
 **Jack's Valley**



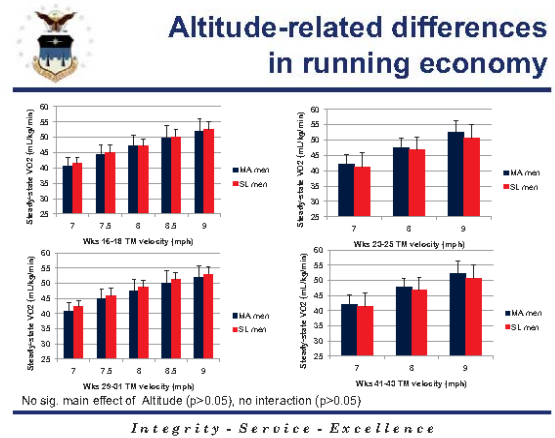
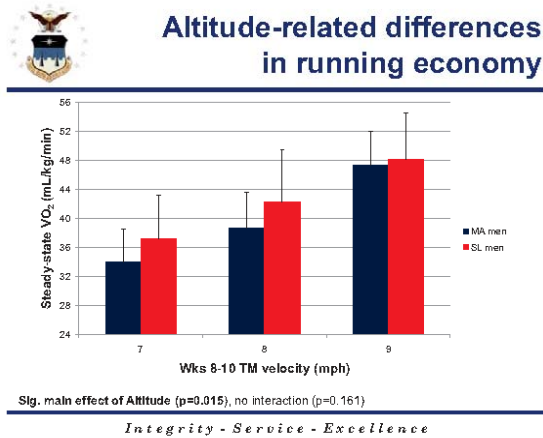
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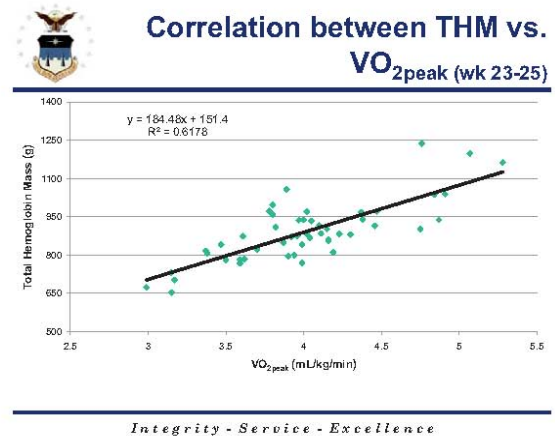
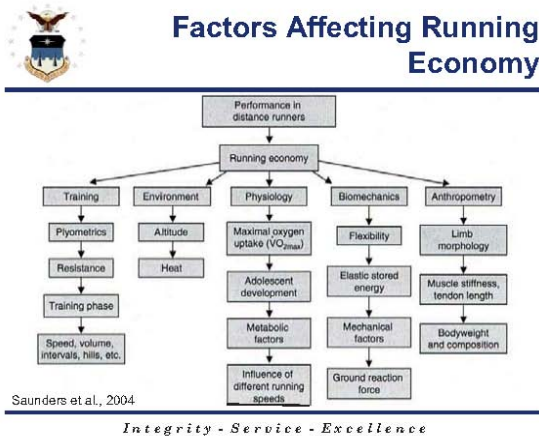
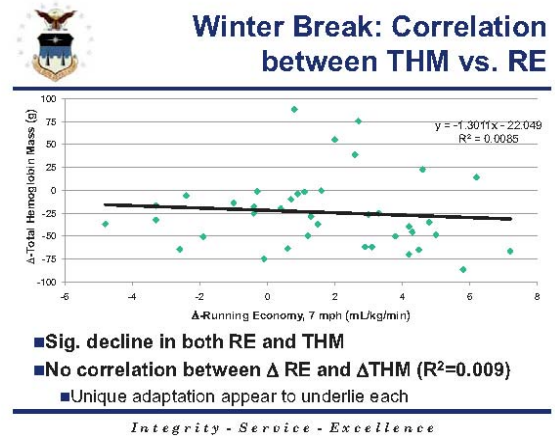
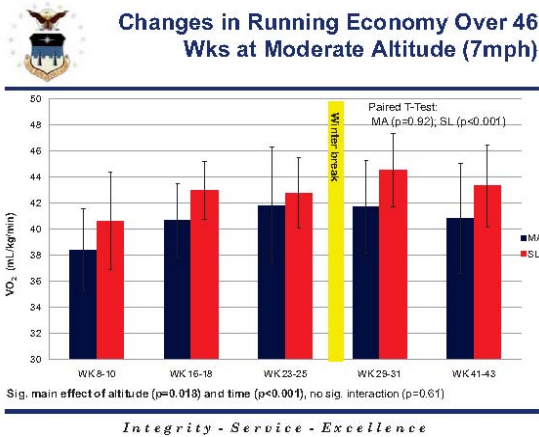
 **Experimental Design**

Recurring RE assessments:



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Conclusions

- SL cadets' RE was sig. worse at 8-10 wks at all velocities examined
- Alt. related difference was not apparent at/beyond +16-18 wks when all velocities examined with ANOVA
 - However, sig. altitude-related differences still evident below LT (7 mph) for the entire yr
- Sig. decline in RE and THM after winter break
 - No sig. correlation between Δ THM and Δ RE ($R^2 = 0.009$)
- Correlation existed between THM and VO_{2peak} ($R^2 = 0.62$)

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Implications

- Lower RE could lead to earlier onset of fatigue compared to acclimatized individuals
 - Using more energy (CHO, Fat, PRO) for given exercise intensity
- Interventions
 - Altitude acclimatization (requires time)
 - Pre-acclimatization prior to altitude deployment?



Depending on mission elements, Pre-acclimatization may be an option if troops deployed at altitude are compromised in their duties.



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Questions

Disclaimer: Views expressed are those of the authors and do not reflect the official policy or position of the USAF, the DoD, or the US government

Thanks to: Mr. Al Wile (M.S.); Dr. Bill Byrnes & Dr. Randy Wilber; Capt. Jules Macgregor, 2d Lt Andrea Pinchak, TSgt Chris Ruth, Ms. Christina Minares; Cadets Courtney Hemmert, Zach Garrett, Russell Smith, Jane Hwang, Robert Edmonds, Andrew Groberg, Chloe Angello, and Tyner Apt (former USAFA 499 researchers), Ms. Liz Terry, Mr. Ben Ryan, Ms. Darci Thurston, (HPL Interns), plus all the USAFA cadet subjects!

Research funded by: HQ USAF/SGSR, AFRL and USAFA HERC

USAFA Human Performance Laboratory

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AFRRI's history, mission, and current research and education programs

Armed Forces Radiobiology Research Institute (AFRRI), Bethesda, MD

Maj Michael Dempsey

The concern of a major radiological or nuclear attack has been reduced since the end of cold war. However, the threat of nuclear or radiological terrorism has become a subject of increased interest, especially after the events of September 11, 2001. The Armed Forces Radiobiology Research Institute (AFRRI) is the only DoD facility dedicated to research on the assessment and treatment of radiation injuries. The research focus areas include biodosimetry; countermeasure development; elucidation of molecular basis of radiation injury, alone or with wound, burn, and/or infection polytraumas, as well as effective treatments; potential uses of radiation to defeat biowarfare and bioterrorism agents; and methods for treatment of internal contamination of military-relevant heavy metals. This presentation will provide an overview of AFRRI's history, mission, and current research and education programs.

**Research and Education
Opportunities at AFRRRI**

**Michael P. Dempsey, PhD, MT(ASCP)
Lt Col(sel), USAF, BSC**

**Ileana Hauge, MS, MT(ASCP)
Maj, USAF, BSC**

AFMS Research Symposium 2010
Arlington, VA
24 August 2010

 **UNIFORMED SERVICES UNIVERSITY**
of the Health Sciences
Armed Forces Radiobiology Research Institute

Presentation Objectives

- Present overview of AFRRRI's history and mission
- Provide description of AFRRRI's scientific R&D infrastructure
- Describe AFRRRI's key research focus areas and opportunities
- Provide brief description of AFRRRI education and training opportunities



Background

- AFRRRI is the only medical nuclear/radiological defense Research and Development institute in DoD.
- Located on National Naval Medical Center campus and a key part of the Uniformed Services University of Health Sciences, Bethesda, MD.



Established 1960



The Threat

- Accidents
- Radiological dispersal devices
- Radiation-emitting devices
- Nuclear weapons

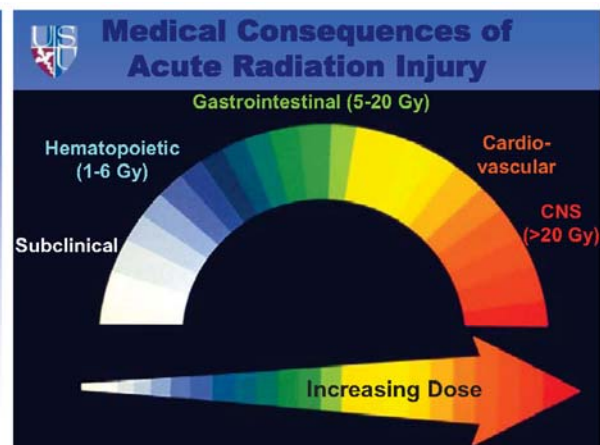


Photo from the book, *And the Sun of the Star is Chernobyl*, published by "Chernobylcenter" Agency, Ukraine. Used with permission.

AFRRI Mission

- Medical R&D**
 - Conduct radiobiology research and develop medical countermeasures for DoD.
- Medical Education**
 - Train medical personnel in ionizing radiation countermeasures.
- Medical Emergency Response Team**
 - Advise JCS (J-4 Medical), Combatant Commands, and others on radiological matters.
- Consultation**
 - Answer questions from federal agencies and participate with them as subject matter experts.

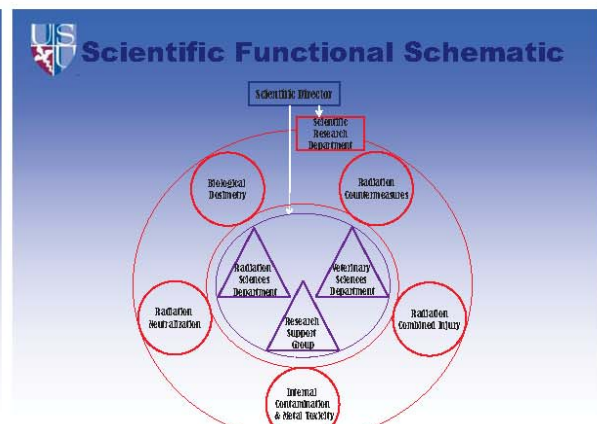
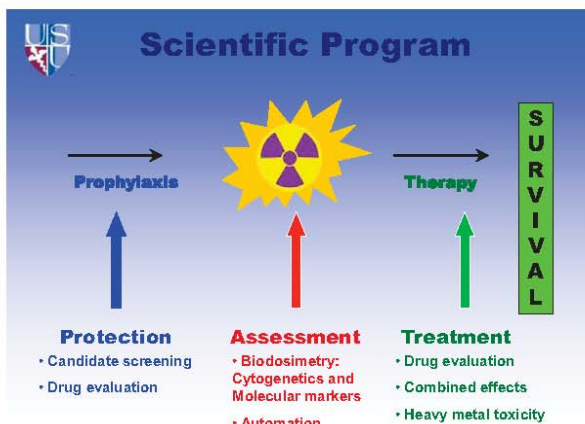
AFRRI Research in Radiation Biology



Detonation Casualties

	1 KT	10 KT
Prompt fatalities:	>7k	>13k
Expectant (>830 cSv):	~18k	~114k
Intensive care (IC) ward (530-830):	~19k	~90k
IC/minimum care ward (300-530):	~33k	~141k
Minimum care ward (150-300):	~66k	~150k
Outpatient (70-150):	~83k	~159k
Health monitoring (25-70):	~106k	~128k
Worried well (<25):	>150k	>212k

- ### Research Gaps in Medical Preparedness
- **Countermeasures**
 - The only FDA-approved radioprotectant, amifostine, has toxicity that makes military use not feasible
 - **Biodosimetry**
 - Biodosimetric tools for triage are limited in speed and physiologic predictive power
 - **Mitigation/Therapy**
 - No drug has an FDA-approved indication for radiation-induced hematopoietic or GI injury



Unique Radiation Sources

- 1 Megawatt TRIGA Mark F Reactor
- Phillips Industrial X-Ray Facility
- 100 Curie Casium Calibration Facility
- Chronic Irradiation Facility
- 450,000 Curie Co-60 Panoramic Irradiator

Veterinary Resources

- Animal facility designed to support radiation & surgery studies (32K ft²)
- State-of-the-art environmental controls & monitoring
- Histopathology, Microbiology, and Clinical Pathology Labs
- AAALAC-accredited animal care and use program
- Supports AFRRRI, SOM, WRAMC, and Navy studies
- All protocols IACUC approved

Research Portfolio

AFRRRI FY10 Research Funding

AFRRRI's Extramural Sponsors Include:

- National Institutes of Health (NIH)
- National Institute of Allergy and Infectious Diseases (NIAID)
- Defense Threat Reduction Agency (DTRA)
- National Aeronautics and Space Administration (NASA)
- Defense Advanced Research Projects Agency (DARPA)
- Biomedical Advanced Research and Development Authority (BARDA)
- Defense Medical Research and Development Program (DMRDP)

Funding Type	Amount (M)	Percentage
FY10 Extramural	\$19,546 M	92%
FY10 Intra-mural	\$1,658 M	8%

Scientific Program Areas

Biological Dosimetry Program

William F. Blakely, PhD
 Program Advisor

Mission: To develop diagnostic tools for triaging DoD and civilian personnel exposed to radiation addressing:

- High precision
- Rapid throughput
- Automation
- Field Deployability

Website for research program:
<http://www.afmri.usuhs.mil/research/biodos.htm>
 Website for biosimetry tools:
<http://www.afmri.usuhs.mil/outreach/biodostools.htm>

Radiation Countermeasures Program

Mark H Whitnall, PhD
 Program Advisor

Mission: To develop pharmacological countermeasures to radiation injury that can be used by:

- Military personnel and
- Emergency responders

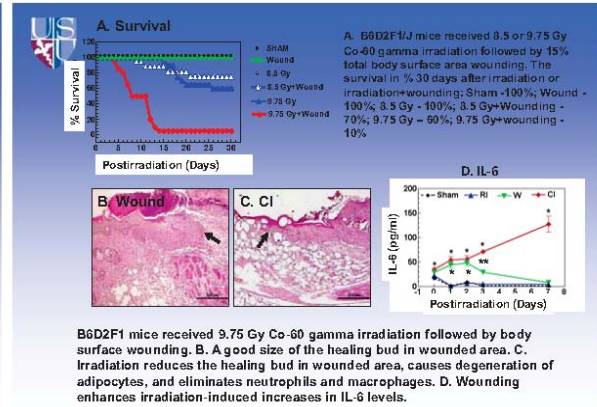
A: 30 day mouse survival after whole-body gamma-irradiation; Effect of a thrombopoietin (TPO) mimetic (sc, 24 h before irradiation). B: Intracellular signaling pathways modulated by Delta-Tocotrienol (DT3). C: Mouse bone marrow, 8 days after whole-body gamma irradiation (7 Gy). D: As in C, but mouse treated with Alpha-Tocopherol Succinate (sc, 24 h before irradiation).

Radiation Combined Injury Program

Juliann G. Kiang, PhD
 Program Advisor

Mission: To develop medical treatments for irradiated personnel with exposures compounded by polytrauma, with emphases on:

- Understanding mechanisms associated with Radiation Combined Injury (RCI)
- Development of preventive and therapeutic strategies for RCI-affected personnel

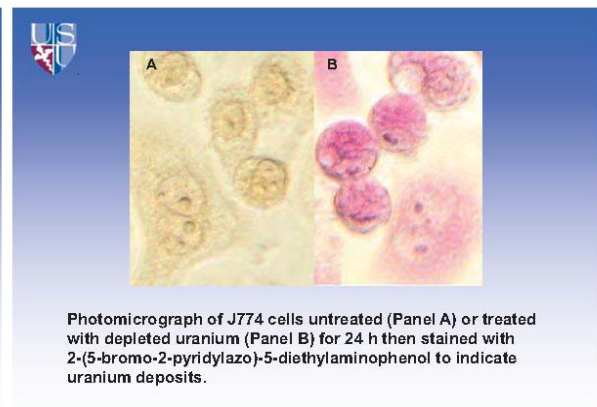


Internal Contamination and Metal Toxicity Program

John F. Kalinich, Ph.D.
 Program Advisor

Mission: To assess radiological and toxicological risks of exposure to military-relevant metals including Depleted Uranium (DU). Assessment used to provide:

- Guidance for patient treatment strategy
- Input to DoD policy for associated metal decorporation




Radiobiology Education and Training Opportunities

- **Graduate Education in Radiobiology**
 - PhD established within USU Molecular and Cellular Biology Program: Radiation Biology track
 - Now building faculty and curriculum
 - Inquiries welcome: USU web site (<http://www.usuhs.mil>)
- **Operational Support Training: MEIR**

Operational Support Training

Medical Effects of Ionizing Radiation Course

- CME / CNE / CHE credit
- Required training for contingency personnel
- Target Audience
 - Physicians
 - Nurses
 - Medical Response Personnel
- 30 - 40 courses presented worldwide annually with approximately 1000 individuals trained
- Courses are customizable (1-day focused courses)



Acknowledgements

Disclaimer: The views expressed in this presentation are those of the authors and do not reflect the official views of the USAF, DoD, or US Government.

COL Mark Melanson	Director
Col Andy Huff	Deputy Director
Dr. Christopher Lissner	Scientific Director
CDR John Gilstad	Head, Scientific Research Dept.
LTC Steven Tobias	Head, Veterinary Science Dept.
Mr. Steve Miller	Head, Radiation Science Dept.
LT Matthew Deshazo	Head, Admin Support Dept.

AFMS Symposium Presentation Team:
 Maj Michael Dempsey
 Maj Ileana Hauge

For more information go to: www.afri.usuhs.mil

AFRI STAFF



Armed Forces Radiobiology Research Institute
 13 August 2009

**A Model Graduate Medical Education Military Unique Training Program
59th Medical Wing (MDW)/59 MCCS, Lackland AFB, TX**

LtCol Vinod Gidvani-Diaz

The San Antonio Uniformed Services Health Education Consortium Pediatric Residency ongoing program in Honduras is designed to give military pediatric residents a unique experience in International Health and Stability Operations. The training, which combines didactic learning stateside with hands on experience in Honduras, focuses on health conditions that cause morbidity in post-war/disaster scenarios.

During the two week preparatory phase, residents are exposed to a curriculum that is geared toward understanding goals of Stability Security Transition and Reconstruction Operations (SSTRO), command structure used the military in joint operations, and planning and executing a Humanitarian Civic Assistance mission. Trainees also complete the Military Medical Humanitarian Assistance Course, a 2-day program designed to teach providers from varying backgrounds the unique and practical aspects of pediatric medicine in austere, resource-limited environments.

In the in-country phase of the program, participants conduct a two-week Medical Readiness Training Exercise in rural Honduras. Residents plan all mission aspects including intelligence briefs, creating an operational plan and coordinating it with chief stakeholders, and preparing logistical support. During execution of the mission, trainees learn and demonstrate competence with practical military field skills, gain understanding of health care systems and delivery of care in a developing country and practice empiricism-based medicine while being exposed to unique medical conditions not encountered in stateside training.



Post-residency surveys have shown that the skills learned during this GME training experience have been invaluable as most graduates have deployed to wartime and peacetime missions and encountered similar circumstances. This program serves as a model for in-residency military unique training.



Training of Pediatric Residents for Humanitarian Deployments, Research, and Interventions in the Developing World: A Ten Year Experience




Vinod K. Gidvani-Díaz, LtCol, USAF, MC
Program Director, SAUSHEC Pediatric Residency





Overview

- Program Background
- Mission Objectives
- Pre-Deployment Curriculum and Training
- Deployment Phase
- Summary of Research and Results
- Lessons Learned / Graduate Surveys



SAUSHEC Residency

- Largest Pediatric Residency in DoD
 - 14 Residents Yearly
 - 8 Air Force & 6 Army (varies per year)
- 5 Hospitals
 - Brooke Army Medical Center (SAMMC – north)
 - Wilford Hall Medical Center (SAMMC – south)
 - Darnall Army Medical Center, Ft. Hood, TX
 - Santa Rosa Children’s Hospital, San Antonio, TX
 - University Hospital, San Antonio, TX



Military Unique Curriculum

- Need for military medical unique training in residency identified over a decade ago
- Most residency programs, before 2000, did not incorporate residents into formal readiness training
- 2001 - SAUSHEC Pediatric Residency develops an informal rotation with deployment to Honduras
- 2006 – Honduras rotation officially integrated in residency curriculum

Training for SSTR

- “The military organizes, trains, and equips its forces for conventional combat; **it must prepare similarly for security, transition, and reconstruction operations**”

Joint Operating Concept, version 1.10 and 1.06, JFCOM, 8 June 2004

- Audit Report, Office of the Inspector General: DOD Graduate Medical Education Programs and Medical Readiness Training: 90-168, June 1996

DoD Joint Directive NUMBER 3000.05 November 28, 2005

It is DoD policy that:

- 4.1. Stability operations are a core U.S. military mission that the Department of Defense shall be prepared to conduct and support. They shall be given priority comparable to combat operations and be explicitly addressed and integrated across all DoD activities including doctrine, organizations, training, education, exercises, materiel, leadership, personnel, facilities, and planning.



Mission Goals

- 1) Provide a realistic field experience by exposing military medics to conditions that are prevalent in underdeveloped countries and in post-war/natural disaster scenarios,
- 2) Improve the health of Honduran children by collecting critical nutritional information and carrying out research that can modify nationwide nutritional policy, and,
- 3) Support US regional foreign policy through positive interaction with Honduran military and civilians in the areas of pediatric medicine and disaster preparedness.




San Antonio Military Pediatric Center Honduras MEDRETE Program



Honduras MUC Rotation

3 months prior to mission start:

- Team members are identified (up to 6 residents PGY-2,3, Army and AF Staff (3-4), Dieticians, Linguists (Total Team 15-20)
- Apply for passports
- Obtain Rabies/Typhoid vaccines
- Schedule weapons training – AF Training requirement
- Schedule MURT
- Complete team data sheet
- Dental and Medical clearance
- Start SOUTHCOM CBT requirements



**San Antonio Military Pediatric Center
Honduras MEDRETE Program**


Honduras MUC Rotation – Didactic Portion (2 Weeks)
 (Afternoons for continuity/post-call/catch up on readiness requirements)

Week 1

Monday
 AM – Travel Medicine
 OSI
 Life Skills
 ISOPREP
 PM – Anti-Terrorism/Red/CITL/Weapons/Dental/Medical

Tuesday
 AM – Mission Overview
 Staff Functions
 SSTRO Spectrum
 PM – Anti-Terrorism/Red/CITL/Weapons/Dental/Medical

Wednesday – Friday –MURT (AF) or Army specific training/ Training/Travel Medicine



**San Antonio Military Pediatric Center
Honduras MEDRETE Program**


Honduras MUC Rotation – Didactic Portion (2 Weeks)
 (Afternoons for continuity/post-call/catch up on readiness requirements)

Week 2

Monday
 AM – S1 Personnel Briefing
 S2 Intel Briefing
 S3 Operations Briefing
 S4 Logistics Briefing
 PM – Anti-Terrorism/Red/CITL/Weapons/Dental/Medical

Tuesday
 AM – MMHAC Modules Part 1
 PM – Anti-Terrorism/Red/CITL/Weapons/Dental/Medical

Wednesday
 AM – MMHAC Modules Part 2
 PM – Anti-Terrorism/Red/CITL/Weapons/Dental/Medical




**San Antonio Military Pediatric Center
Honduras MEDRETE Program**

Honduras MUC Rotation – Didactic Portion (2 Weeks)
 (Afternoons for continuity/post-call/catch up on readiness requirements)

Week 2

Thursday
 AM – MMHAC Exercises
 PM – Anti-Terrorism/Red/CITL/Weapons/Dental/Medical

Friday
 AM – Intro to Nutritional Surveillance Program
 Sprinkles Study
 Infectious Disease/ Integrated Management of Childhood Illness
 De-worming Guidelines
 Structure of Health Care Systems in Developing Countries
 PM – Anti-Terrorism/Red/CITL/Weapons/Dental/Medical



**San Antonio Military Pediatric Center
Honduras MEDRETE Program**

Unique Features of Training and Mission:

- Residents are assigned staff positions and oversee all aspects of training and mission execution
 - S1 – ensures all pre-deployment training is completed on time
 - S2 – presents medical intel brief to team
 - S3 – runs day-to-day operation during the mission
 - S4 – orders formulary and manages all medications and supplies through mission execution
- Funding
 - Staff funded from by the Pediatric Department (Army) and SOUTHAF (AF)
 - Linguists funded by SOUTHAF
 - Residents funded by GME
 - Class VIII funds from SOUTHAF – ~10K/mission
- Three (2) week didactic sessions and three (2) week missions to Honduras

**San Antonio Military Pediatric Center
Honduras MEDRETE Program**

Unique Features of Training and Mission:

- Residents participate in the Military Medical Humanitarian Assistance Course

Combat paradigm:
 acute care (primarily trauma) to a population of young healthy adults.
 Rapid triage to higher echelons of care.

Civilian medical care:
 acute care (primarily NOT trauma) to large populations of chronically ill
 and malnourished women and children.
 Disease prevention, limited triage, limited resources.

**The Military Medical Humanitarian
Assistance Course**

Goal:
Provide training in preparing for and executing appropriate medical care to civilian populations in the austere humanitarian emergency environment in the developing world

Audience:
military primary care providers

Format:
didactic lectures, interactive exercises and case management skill stations


**San Antonio Military Pediatric Center
Honduras MEDRETE Program**

Unique Features of Training and Mission:


- In-country direct collaboration with the Honduran MoH
- Support from JTF-Bravo
 - Vehicles
 - Lodging
 - Liason Officers, OIC, NCOIC
 - Coordination for all activities including:
 - Reconnaissance of roads
 - Acquisition of security through Honduran Military
 - Immunization records for randomization of households to be surveyed
 - Arrange rounds at regional hospital and tertiary care center

**San Antonio Military Pediatric Center
Honduras MEDRETE Program**

The Mission



Fly MILAIR when available...



Mission in SW Honduras



The first two days of the mission the ADVON team does follow-up clinics for patients referred for anemia or malnutrition from the previous mission



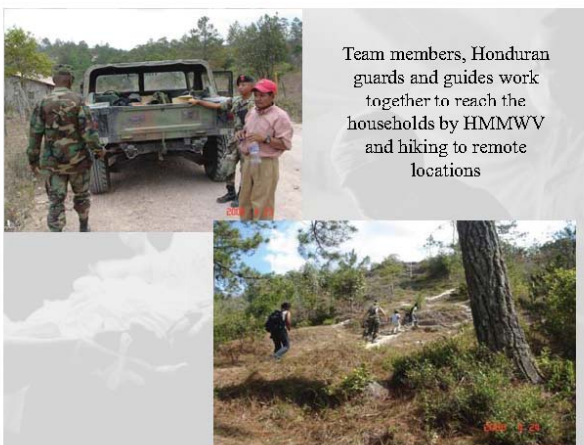
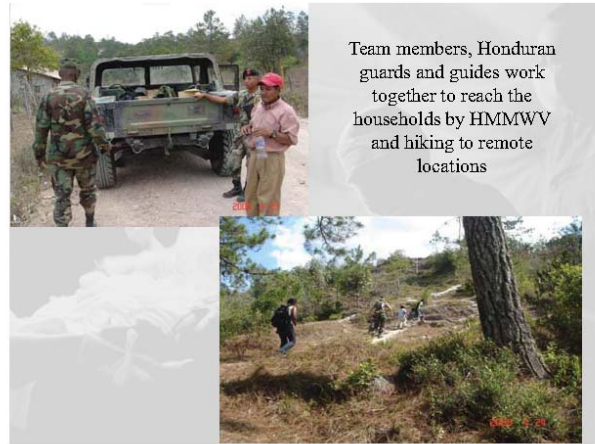
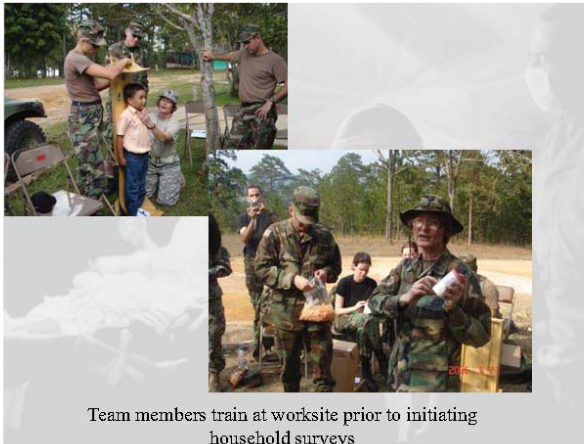
Every mission we meet with the Ministry of Health to update them on our previous findings and new projects



The day the main body arrives we inventory our supplies and medications and prepare to depart to the worksite the next day



Early the next day we convoy out from JTF-B to the worksite





MEDRETE Pediatric Clinic Day
Includes Preventive Medicine, Nutrition Station and Medical Consultations

This block contains two photographs. The top photo shows a large group of people, including children and adults, sitting on the floor in a room with windows. The bottom photo shows a medical professional in a white coat examining a young child held by a woman.

Capacity Building & Nutrition Assessments



This block features a collage of five photographs. The top-left photo shows a woman examining a child's mouth. The top-right photo shows a person in a white coat examining a child. The middle-left photo shows a group of people sitting on the floor in a circle. The middle-right photo shows a group of people sitting at a table. The bottom photo shows a group of people sitting at a table.



The last two days of the mission we round at a community hospital and at Hospital Escuela to learn about malnutrition management and discuss interesting cases – a great learning opportunity for all team members

This block contains two photographs. The top photo shows a group of people gathered around a table, possibly in a meeting or classroom setting. The bottom photo shows a young child lying in a hospital bed.

Malnutrition



This block features a collage of five photographs. The top-left photo shows two large, colorful cylindrical containers. The top-middle photo shows a young child with a very thin body. The top-right photo shows a young child with a very thin body. The bottom-left photo shows a young child with a very thin body. The bottom-right photo shows a young child with a very thin body.

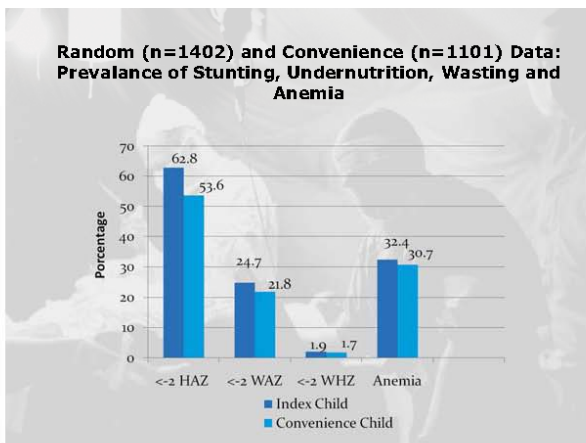
**San Antonio Military Pediatric Center
Honduras MEDRETE Program**

Summary of In-Country Mission Activities:

- Research focus to obtain representative data.
- Random sample using immunization records.
- Date collection at the household level.
- Assessment of:
 - Growth (Z-scores utilizing WHO anthropometric standards)
 - Micronutrient deficiencies (anemia, iron, vitamin A)
 - Protein energy malnutrition (marasmus, kwashiorkor)
 - Fortification of foodstuffs (sugar, salt and wheat flour): availability at the household and quality control

**San Antonio Military Pediatric Center
Honduras MEDRETE Program**

- Activities since mission inception:
 - Acceptability and efficacy of micronutrient “Sprinkles” supplements.
 - Evaluate use of micronutrient “Sprinkle” supplement to determine impact on anemia, iron deficiency and vitamin A deficiency.
 - Micronutrient distribution methods.
 - Design and develop new handheld software technologies to enhance data collection, evaluation, and rapid reporting.
 - Test telemedicine technologies at the household, clinic, and hospital levels.
 - Test new field friendly blood analysis methods.



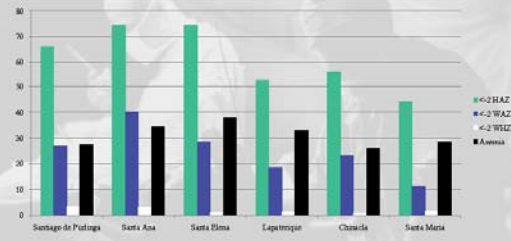
General Data by Municipality (Index Children)

Region	Sex (m/f)	Mean Age in Months
Santa Ana (n=77)	53.2/46.8	31.6
Santa Elena (n=106)	50/50	31.7
Santiago Puringla (n=298)	48.7/51.3	33.4
Lepaterique (n=197)	54.0/46.0	31.0
Chinacla (n=145)	49.7/50.3	29.58
Santa Maria (n=63)	52.4/47.6	33.4

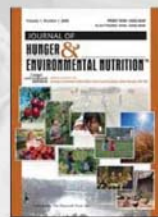
Number of Individuals living in a Household by Municipality

Municipality	Number of Cases	Average number in household
Santiago Puringla	298	6.55
Santa Ana	77	7.65
Santa Elena	101	6.56
Lepaterique	197	6.17
Chinacla	145	7.12
Santa Maria	63	7.02

Prevalance of Malnutrition and Anemia by Municipality



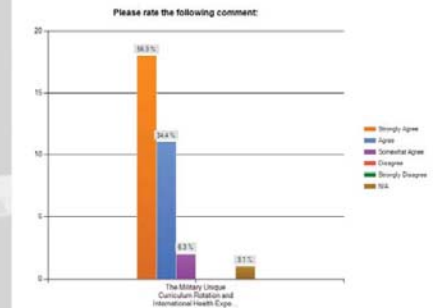
Publications



Identifying Children at Risk for Nutritional Crisis in Rural Honduras
 Daniel J. Tolson ; Teresa M. Kemmer ; Julia Lynch; Douglas Lougee ; Ricardo Aviles ; Wilmer E. Amador Carlos Alberto Durón ; Ramón Oswaldo Guifarré Pino

San Antonio Military Pediatric Center Honduras MEDRETE Program

Graduate Survey Results





**San Antonio Military Pediatric Center
Honduras MEDRETE Program**



Lessons Learned

- **Staff commitment and participation; Command Support**
- **Funding Sources**
- **Collaboration with Ministry of Health**
- **Coordination of In-Country Logistics and Operations**

**Coordinators Since Program Initiation
in 2001**

- Dr. Julia Lynch
- Dr. Douglas Lougee
- Dr. Teri Kemmer
- Dr. Aviles, JTFB Medical Liaison Officer
- Dr. Coello, JTFB Medical Liaison Officer
- Dr. Amador, JTFB Medical Liaison Officer

Collaborators

- Honduran Ministry of Health (MOH), Food Security Office, to ensure project reflection and support of National Policy Level Priorities.
- San Antonio Military Pediatric Center.
- South Dakota State University.
- Honduran Micronutrient Initiative Group (CONCOM).
- Facilitated by Joint Task Force Bravo (JTFB) Medical Element (MEDEL) Medical Liaison Officers and logistically supported by JTFB MEDEL.
- Routine presentations on research results are presented to the Director, Food Security Office, MOH, governmental and non-governmental organizations (NGOs) facilitating maternal and child health initiatives.

39




The END

An Overview of Combat Wound Initiative Program and Biosurveillance Efforts at Armed Forces Institute of Pathology
Armed Forces Institute of Pathology

Mina Izadjoo, Ph.D., Mohammad Alavi, Ph.D., Maj Thomas Shaak, COL Peter Weina and COL Alexander Stojadinovic

Combat Wound Initiative Program (CWIP) is a collaborative, multi-disciplinary, inter-service Program providing state-of-the-art; complex wound care through targeted clinical and translational research incorporating advanced technology and treatment, tissue banking, and bioinformatics. This program provides a centralized leadership in establishing a strategic cooperation in studying wounds and candidate therapeutics. The goal is to deliver the highest quality advanced complex wound care to our wounded service members; to conduct first-rate integrated basic, clinical and translational research; and to advance personalized or individualized medicine.

A critical strategic partnership was recently established between the CWIP and the AFIP for the establishment and hosting of the CWIP Biospecimen Network program. This joint effort is aimed at wound bioburden analysis, molecular diagnostics and therapeutics using cutting edge instrumentation and techniques. In support of this effort, we have established a "Combat Wound Microbial Culture Collection" and "Antibiotic Resistance Plasmid Library". These collections will provide significant resource for DOD in conducting research in biosurveillance of combat related infections. This collaborative, multidisciplinary, inter-service program will clearly lead to the much needed improved treatment and fast recovery of our combat wounded soldiers. We will provide an overview of the ongoing efforts in support of an unprecedented initiative in biosurveillance of infectious agents using cutting edge instrumentation and bioinformatics. Our efforts may lead to developing much needed methodologies for differentiation between natural or intentional exposures to current and emerging infectious disease agents.



Mina Izadjoo, PhD
Chief, Division of Wound Biology and
Translational Research
Armed Forces Institute of Pathology
Washington, DC

Disclaimer

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the US Department of the Army, The Department of Defense, or the Department of Veterans Affairs.

Division Mission

To Conduct Basic and Applied Research to Better Protect our Military and Civilian Populations Against Natural or Intentional Exposure to Infectious Agents



Overview



- Introduce our Team/Capability
- Combat Wound Initiative Program
- Problems/Challenges in Biosurveillance
- Our Efforts in Strain Typing
- Proposed Solutions/Next Steps


Personnel



30 personnel with expertise in

- Molecular Genomics
- Bacteriology
- Virology
- Immunology
- Therapeutics
- Drug Discovery
- Sequencing
- Bioinformatics

Capability



- Vaccine, drug discovery and therapeutics
- Diagnostic assay development and validation
- Basic and applied research
- Genetic characterization of infectious agents
- Collaboration with industry and academia on state-of-the-art diagnostics and therapeutics for potential DOD applications

Space



- Office, BSL-2 and BSL-3 laboratory and biobanking.
- Controlled access; secure electronic communication (SIPRNET).

Main Entrance – Controlled Access PCR Set-up Rooms




Key Card Entry – Camera monitored

Bacteriology

Automated Bacterial ID Systems





BD Phoenix



Biolog Micro-station



Omnilog

Molecular Genomics

- Develop/Validate assays for detection of agents.
- USAF proficiency test program for select agents.



AFPT Program

- 55 Air Force Sites
- Biological and Toxin testing Platforms
- JBAIDS proficiency testing
- M1M proficiency testing
- AFIP support

BioRobot WorkStations



Mass Array compact system



FilmArray



Qiagen EZ1



M48 Workstation

Immunology

- Immunoassays (manual and automated)
- Production of Polyclonal and Monoclonal antibodies.
- State-of-the-art instruments



SECTOR® Imager 6000



PR2 from MSD



Bioveris M1M Detector

Virology

- Culture/maintain stocks
- Design/validate PCR viral assays
- Efficacy testing of novel anti-viral drugs




Influenza
Source: Wikipedia


Swine Flu

- Swine Flu Culture Collection
- Diagnostics
- Antiviral drug Discovery








7900 Fast Real Time PCR
ABI 7500 Fast DX


Animal Testing


Armed Forces Institute of Pathology
 Washington, DC


Animal Preclinical Efficacy Testing of Candidate Therapeutics/Devices

Effects of Extracorporeal Shock Wave Therapy (ESWT) on Open Complex Femur Fractures



Pollinator



GGTTAGGGTTAG
 ||| ||| ||| ||| |||
 CCAATCCCAATC

An inexpensive but highly accurate multiplex sequencing. This technique was first developed by Dr. George Church group in Harvard Medical School.

Combat Wound Initiative Program

*Translation of fundamental research into individualized treatments for patients through:
 Advanced therapies, Bioinformatics, Tissue Banking, and Personalized Medicine*

Combat Wound Initiative Program A Bench-to-Bedside Strategy for Research of Wounded Warriors

- **Proving ground** for emerging wound care technologies and treatments in support of healthcare beneficiaries with wounds
- **Biobanking**: Collection and storage of blood, wound tissue/fluid, bone, heterotopic ossification, removed fragments for translational research
- **Personalized medicine**: Development of predictive models to advance individualized wound therapy decisions
- **State-of-the-art care**: Complex Wound and Limb Salvage Center
- **Strategic private-public partnerships** to enhance the quality of care for wounded personnel

Complex Wound Biospecimen Network

- Military-based biorepository for the CWI Program
- Partnership with Wound Biology and Translational Research Division of the AFIP
- Collection, storage and tracking of specimens to provide DoD researchers high quality material for translational research
- Development of predictive clinical models
 - personalized wound care
 - Decisions support for necessity and timing of retained fragment and foreign body removal and wound closure

Defense Acquisition Challenge Shockwave Therapy for Traumatic Wounds of the Extremity

Purpose: To evaluate shockwave therapy to determine if it meets combat casualty care requirements for complex wound treatment

Challenge: Conduct definitive field testing to determine if shockwave therapy significantly improves wound healing over current standards of care

ESWT Phase II Completed Clinical Field Testing

Design: Prospective feasibility trial, in complex acute and chronic soft tissue wounds

Response: Complete healing in 156 of 208 (75%).

Adverse events: No treatment-related toxicity, infection or wound deterioration

Schaden W, Thiele R, Kolpi C, Pusch M, Nissan A, Attinger C, Maniscalco M, Peoples GE, Elster EA, Stojadinovic A. J Surg Res 2007 Nov; 143(1): 1-12

Feasibility Trial: Wound ESWT Results: Wound dehiscence



43 year old male patient 10 days after clavicular fracture plating. Dehiscence & exposed hardware.

ESWT sessions: 2
 ESWT impulses: 1400
 ESWT time: 4 min., 40 seconds

10 days post-op



124 post-ESWT

Healed at 3wks post-ESWT; 4 months post-op photo

Defense Acquisition Challenge Shockwave Therapy for Traumatic Wounds of the Extremity

Potential benefits to the war fighter:

- ✓ Accelerate tissue repair in wounds
- ✓ Reduce infection-related amputation, deformity
- ✓ Minimize number of surgical interventions
- ✓ Reduce hospital time and cost
- ✓ Facilitate early rehabilitation

Key Benefit: Non-invasive, painless treatment method to reduce bacterial load in wounds, and facilitate blood vessel in-growth and soft tissue healing

Biomarkers to Predict Outcome in High Energy Penetrating War Injuries

Timing of War Wound Closure

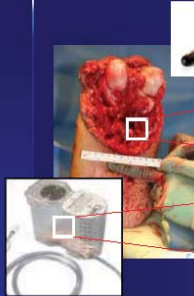
This wound healed



This wound dehisced



Biomarkers in War Wound Healing



Serum:

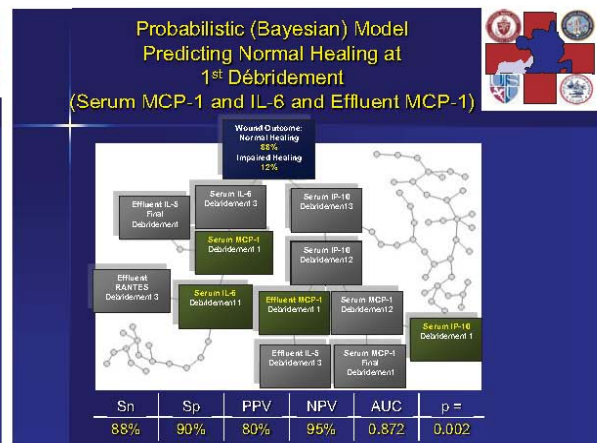
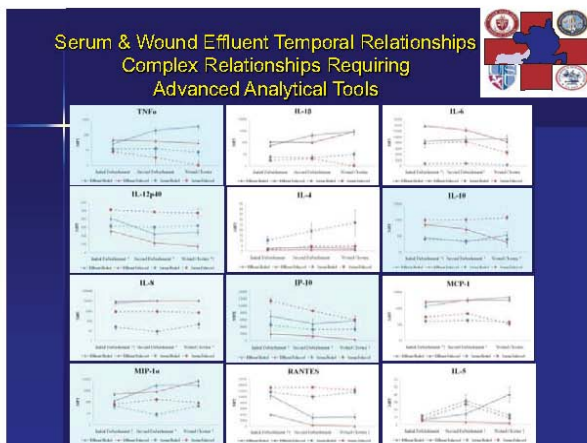
- Cytokines
- Chemokines

Tissue biopsy:

- Wound healing associated genes
- Quantitative bacteriology

Wound effluent:


- Cytokines
- Chemokines
- Quantitative bacteriology

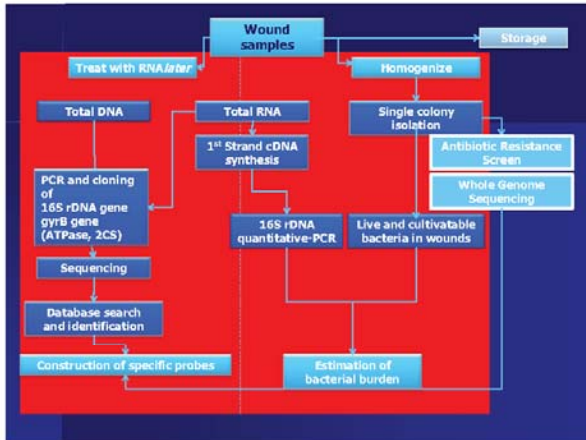




- ### Complex Wound and Limb Salvage Center Strategic Connection
- **Readiness** – reduced time to rehabilitation, return to duty
 - **Research** – Inter-service (Army-Navy) translational research program: Combat Wound Initiative Program (Private-Public partnership)
 - **Quality care**: multi-disciplinary team, evidence-based best practice protocols
 - **Cost-effective care**: Reduced ER visits and re-admissions, focused management
 - **Graduate Medical Education**: resident and staff education; recapture of patients lost to network and multi-service consultation supports GME mission

- ### Combat Wound Initiative Program Complex Wound and Limb Salvage Center
- Advanced multi-disciplinary care center
 - State-of-the-art assessment, testing, and evidence-based treatment for complex wounds
 - Integrated targeted clinical and translational research incorporating advanced technology and treatment, informatics, tissue banking and research in the National Capitol Area

- ### AFIP's Role in CWIP
- 
- Complex Wound Biospecimen Network: Biorepository for clinical samples from wounded service members
 - Establishment of a Combat Wound Microbial Culture Collection (CWMCC)
 - Combat Wound Genomic Repository (CWGR)
 - Providing space, state-of-the-art instruments, expertise, testing and assessment capability for translational research in the National Capitol Area.



Combat Wound Genomic Repository (CWGR)

DNA Production Overview

This slide features the CWGR logo in the top right corner. Below the title, there are two images: a stylized DNA double helix on the left and a photograph of soldiers in a field on the right.

CWGR Purpose

Developing a Combat Wound Genomic Repository (CWGR) for organisms isolated from combat related clinical samples.

The diagram shows a 'Combat Wound' leading to 'Isolated Bacteria', which then leads to a detailed diagram of the DNA extraction and analysis process. The DNA diagram includes the following steps:

1. DNA is in the nucleus of the cell.
2. Cell membrane is disrupted with a detergent.
3. Alcohol is added to the tube to precipitate DNA from other cell components. DNA remains in the alcohol layer.
4. DNA is spooled onto a glass pipette.

 The diagram also shows 'Alcohol' and 'Protein and RNA' being removed, leaving 'DNA'.

Identification of Bacteria

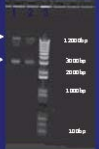
This slide displays three different bacterial identification systems:

- Phoenix Identification System:** A large, white, upright machine.
- Biolog Identification System:** A desktop computer setup with a monitor, keyboard, and a Biolog card reader.
- Omnilog Identification System:** A smaller, white, upright machine.

Isolation of an Antibiotic Resistance Carrying Plasmid from an *Enterobacter* Sp from a Wound Sample


Agarose Gel Electrophoresis of the Plasmid(s)
 The plasmid isolated from the *Enterobacterium* sp. was run on a 1.2% E-gel (Invitrogen)

Lanes 1 and 2: Plasmid prep
 Lane 3: 1 Kb ladder




Normal human microbial flora could be a potential reservoir for antibiotic resistance genes.
 Journal of Wound Care 19(7): 396 - 310 (Jul 2010)


Ongoing Biofilm Studies



Bioflux 200



Oxidative adhesion at 2 hours and 4 hours under shear flow



ROTATING DISC REACTOR

Efficacy of novel antibacterial agents for treating polymicrobial wound infections

Bioburden and Wound Healing

Role of bacteria in wound healing process is less understood. Bacteria are commensal inhabitants of human epithelium and in normal conditions interact with the host in mutually beneficial or harmless interactions.

Wounds could enable commensal as well as opportunistic and antibiotic resistant bacteria to gain access to the underlying tissue and interact with cellular and molecular components of wound repair.

Characterization of bacteria associated with wounds could help understand in more details the wound healing process carried out by the host immune system.

Summary of Accomplishments



- Complex Wound Biorepository
- Laboratory testing for bacterial bioburden and antibiotic resistance profiling in wounds
- Animal modeling for testing new therapeutics and devices in wound healing

Global Surveillance


 Armed Forces Institute of Pathology
 Washington, DC

After half a century of fighting infectious diseases, emerging and reemerging epidemics present a new threat to human health.


Infectious Disease Diagnosis is "the cornerstone" of effective disease control and prevention efforts including surveillance.













Microbial World: A Challenging Frontier


 Armed Forces Institute of Pathology
 Washington, DC

The physical diversity of microorganism is a reflection of underlying genetic differences.

Bacteria could have traveled through space on comets. If even one microbe survived space travel to Earth, it would be enough to start a colony on our planet.
 Courtesy of NASA

<http://textbookofbacteriology.net>

Challenges to Global Surveillance and Response

Health Infrastructure

- Inadequate capabilities outside US.
- Inadequate Integration/Coordination between surveillance systems.

Methodology

- No consensus on methodologies or outcome measures.
- No clear measures of effectiveness of surveillance systems. Difficult to assess contributions of the surveillance systems.
- It is not clear if infections that spread rapidly or silently can be detected before they are widely disseminated.

<http://www.uprn-biosecurity.org>

Challenges continued.....

Technical Resources

- Diagnostic tests do not exist for all infectious diseases or too expensive or technical for use in resource-limited health infrastructure.
- Global Communication for disease surveillance.
- Verification of reports (quality of methods and data generated varies in different labs).
- Time to results. What is our goal. Is it practical?

Resources

- Financial
- Manpower
- Technical: Integrated Diagnostic assays/instruments
- Standardization

Strain Typing

Used to determine relatedness of isolates

- Epidemiology (pathogens)
- Industrial microbiology (e.g. monitoring production strains)
- Food Microbiology


"Types" are defined by the technology

- PFGE (CDC "Gold Standard")
- 16s Sequencing
- Multi-locus sequence typing (MLST)
- Ribotyping, Rep-PCR ("bacteria barcodes")

Nucleic Acid Signatures

- The objective of a nucleic acid-based pathogen assay is to detect specific genetic features that serve as signatures.
- Genetic variation can be detected by direct or indirect means.
 - **Indirect Analysis:** Reveals genetic variations without direct sequencing usually by methods involving analysis of DNA fragment patterns (ex. RFLP). Fingerprints are platform specific.
 - **Direct Analysis:** Requires sequence information. Involves screening of samples from a large number of related and unrelated organisms (ex. MLST).

MassArray Compact System



Biochemistry
 Proprietary Spectrochips
 Mass Spec optimized for Genomic analysis
 Data Analysis Software

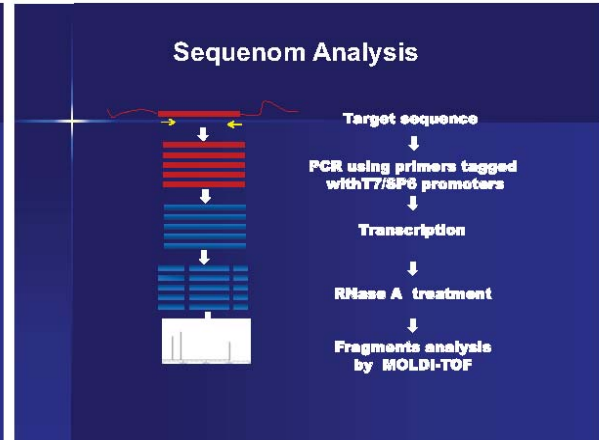
SNP Genotyping with IPLEX® Gold



Isolate/genomic DNA		Treat, grow, & isolate as necessary
SNP Assay Design Run PCR		Design PCR & Extend oligos for each target; perform PCR
SAP & Mass Extend		Perform extension reaction with IPLEX® chemistry
SpectroCHIP® & Nanodispenser		Conditioning & automated dispensing
MassARRAY® MALDI-TOF		Data acquisition, automated genotype calling and cluster analysis in Typer Software

iSEQ™ Comparative Sequence Analysis

- Automated comparative sequence analysis of targets of interest.
- Integrated software for rapid experimental design and automated results.
- Data portability of 384 reactions in less than 1 hr.
- Discriminatory power down to a single nucleotide.
- Detect sequence variations, new sequence types and clustering.



Targets for Sequenom Analysis

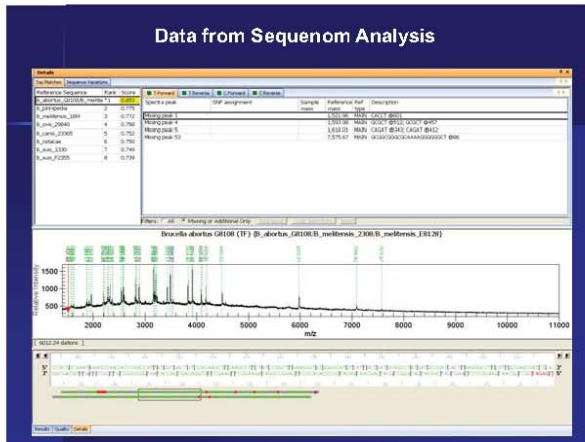
- Between 700 – 800 bps
- High Density of Single Nucleotide Polymorphism.

Approach

- Identify Target Regions Using Computational Analysis.
- Use Computer Simulation to Identify Regions with Highest Resolution.

Analysis of the Brucella Strains

1. Sequence amplicons generated by PCR using specific primers to the HYP25 and HYP36 of the "Test Strains"
2. Use the same primers for Sequenom analysis of the "Test Strains"
3. Compare the results from the two methods
 1. Accuracy of **Identification**
 2. Accuracy of **Differentiation**



Identification


Locus: hyper-variable region 25

Sequencing ID	Sequenom ID
<i>Brucella canis</i> ATCC 23365	<i>Brucella canis</i> ATCC 23365
<i>Brucella suis</i> F2355	<i>Brucella suis</i> F2355
<i>Brucella ovis</i> 29840	<i>Brucella ovis</i> 29840
<i>Brucella suis</i> 1330	<i>Brucella suis</i> 1330
<i>Brucella cetacea</i>	<i>Brucella cetacea</i>
<i>Brucella pinnipedia</i>	<i>Brucella pinnipedia</i>
<i>Brucella melitensis</i> 16M	<i>Brucella melitensis</i> 16M
<i>Brucella abortus</i> GS108	<i>Brucella abortus</i> GS108
<i>Brucella melitensis</i> E8128	<i>Brucella melitensis</i> E8128
<i>Brucella melitensis</i> biovar Abortus 2308	<i>Brucella melitensis</i> biovar Abortus 2308

Locus: hyper-variable region 36

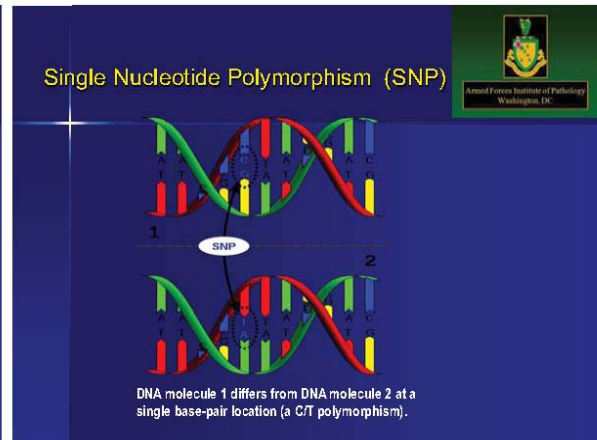
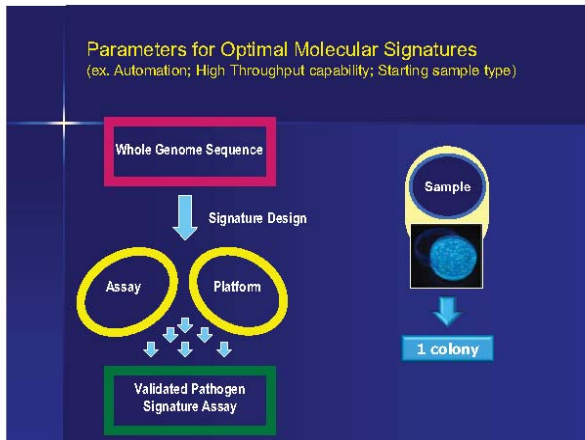
Sequencing ID	Sequenom ID
<i>Brucella canis</i> ATCC 23365	<i>Brucella canis</i> ATCC 23365
<i>Brucella suis</i> F2355	<i>Brucella suis</i> F2355
<i>Brucella suis</i> 1330	<i>Brucella suis</i> 1330
<i>Brucella pinnipedia</i>	<i>Brucella pinnipedia</i>
<i>Brucella cetacea</i>	<i>Brucella cetacea</i>
<i>Brucella ovis</i> 29840	<i>Brucella ovis</i> 29840
<i>Brucella melitensis</i> 16M	<i>Brucella melitensis</i> 16M
<i>Brucella melitensis</i> E8128	<i>Brucella melitensis</i> E8128
<i>Brucella abortus</i> GS108	<i>Brucella abortus</i> GS108
<i>Brucella melitensis</i> biovar Abortus 2308	<i>Brucella melitensis</i> biovar Abortus 2308

Molecular Targets



Agents	Target Genes
<i>Brucella melitensis</i>	<i>virB11</i> , <i>vjbR</i>
<i>Bacillus anthracis</i>	<i>atxA</i>
<i>Francisella tularensis</i>	<i>mgIA/B</i> , <i>igIC</i>
<i>Yersinia pestis</i>	<i>ycsS</i> , <i>ycsT</i> , <i>yopJ</i>

VirB11: Essential for intracellular survival (Type IV secretion system)
vjbR: A quorum sensing regulator of the LuxR family.
atxA: A pX01 gene required for transcription of the three toxin genes
mgIA/B, *igIC*: Required for replication within macrophages
ycsS, *ycsT*, *yopJ*: Type III secretion, essential for virulence.



- Recommendations**
- Continue with development and standardization of diagnostic assays.
 - Consensus for target for infectious disease of interest.
 - Consensus for the choice of platform and data analysis.
 - Research teams/laboratories to develop markers for strain typing.
 - Develop SNP database for emerging infections.
 - Establish and maintain an antibiotic resistance plasmid library.
 - Develop a Training Program and conduct Proficiency Testing to evaluate readiness.

Acknowledgement and Gratitude

The multidisciplinary research capability of our team would have not been possible without the dedicated efforts of everyone at AFIP. Both civilian Army, Air Force and Navy military personnel have rendered skills and conducted compassionate research for our efforts throughout the years.

We are also grateful to CWIP for the opportunity to conduct research aimed at improved health care of our war wounded.

**Glucose Control in Critically Ill Adults at a Military Hospital
59th Medical Operations Squadron (MDOS)**

Brian T. Allenbrand, MD, Lexa E. Rijos, MSN, RN, ACNP-BC, Stacey L. Ward, MSN, RN, CNS-BC, BC-ADM, Tricia L. Garcia, MPH, Joseph Pollard, MPH; Acknowledgments: Hsiang-Yu Chen*, MS, Donna L. Wolf*, PhD

Recent data in critically ill patients suggest aggressive management of hyperglycemia is not always associated with improved outcomes and may be associated with risks. Implementation of hospital-wide policies and standardized insulin protocols will assist providers in selecting the appropriate insulin regimen while avoiding adverse events. In January 2009, an intravenous insulin infusion protocol with new blood glucose (BG) targets of 100 to 150 mg/dL was implemented in critical care units at Wilford Hall Medical Center. The insulin infusion is titrated according to protocol to obtain and maintain a goal value of 100-150 mg/dL. From January to May 2009 a total of 46 patients were placed on the protocol. Average age was 59 (58.8±17.5) and 58.7 % were male. Out of all three units 50% the patients had type 2 diabetes. Percentage of time patients were at target BG goal (100-150 mg/dL) was 52.3±21.1% (53.3±23.4% SICU 49.3±17.3% MICU, 69.6±29.7% CCU). The median duration to achieve goal was 5.7 hours (7.0, 5.4, 1.1, respectively). Hypoglycemia rates (< 60 mg/dL) averaged 0.8%, 1.0%, and 0.7% respectively. Length of stay (LOS) was stratified by vital status. Among survivors, the average LOS was five days with the longest LOS in the MICU (6 days) and shortest in the SICU and CCU (4 days). The largest difference according to vital status was observed in the SICU (3 days vs. 7 days). Although this is an initial evaluation of newly implemented target BG ranges, results shown are comparable to those demonstrated previously in the literature and this facility.

*affiliated with the University of Pittsburgh



Disclaimer



Develop America's Medical Airmen Today ... for Tomorrow

Develop America's Medical Airmen Today ... for Tomorrow

Glucose Control in Critically Ill Adults at a Military Hospital

Brian T. Allenbrand, MD
 Lexa E. Rijos, MSN, RN, ACNP-BC
 Stacey L. Ward, MSN, RN, CNS-BC, BC-ADM
 Tricia L. Garcia, MPH
 Joseph Pollard, MPH

- None of the faculty or planners of this presentation have any financial or other interest, arrangement, affiliation, or relationship with any organization that could be perceived as a real or apparent conflict of interest with the content of this activity
- Government Disclaimer
 - All authored material constitute the personal statements of Dr. Brian T. Allenbrand and are not intended to constitute an endorsement by the USAF or any other federal government entity
- Financial Disclaimer
 - On the speaker bureau for Amylin Pharmaceuticals, Inc. and Eli Lilly and Company

Providing Great Care...Building Warrior Medics

Providing Great Care...Building Warrior Medics



Overview



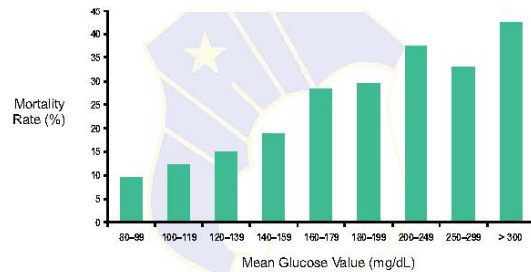
Hyperglycemia and ICU Mortality



Develop America's Medical Airmen Today ... for Tomorrow

Develop America's Medical Airmen Today ... for Tomorrow

- Evidence for glucose control in critically ill patients
- Intravenous insulin infusion protocol (IIP) at Wilford Hall Medical Center
 - Implementation of new glycemic range and outcome measures
 - Implications for deployed medicine
- Future Research



Retrospective review of 1,826 consecutive intensive care unit patients at The Stamford Hospital in Stamford, Connecticut.
 Krninsley JS. *Mayo Clin Proc.* 2003;78:1471-1478.



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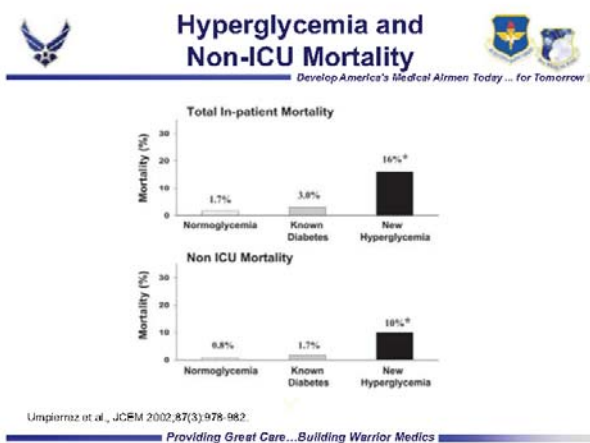
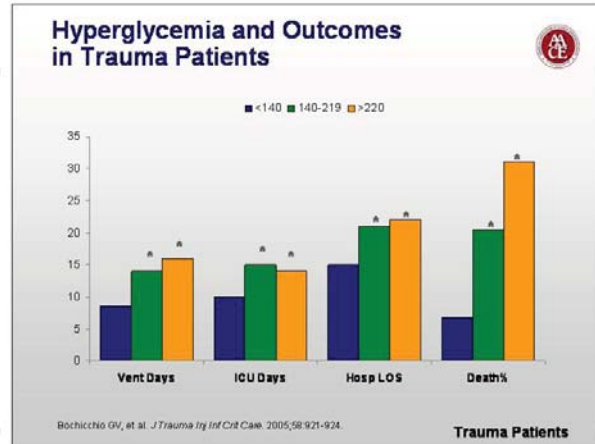
Hyperglycemia and ICU Mortality

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- Mean glucose levels (mg/dL)
 - Survivors: 137.9
 - Nonsurvivors: 172.0

$p < 0.0001$

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The New England Journal of Medicine

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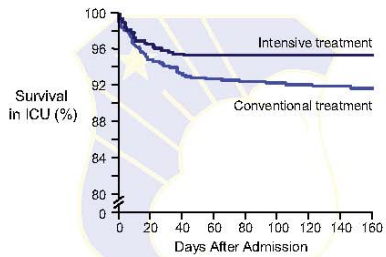
VOLUME 345 NOVEMBER 8, 2001 NUMBER 45

INTENSIVE INSULIN THERAPY IN CRITICALLY ILL PATIENTS

GREET VAN DEN BERGHE, M.D., Ph.D., PETER WOUTERS, M.Sc., FRANK WEKERS, M.D., CHARLES VERHAEST, M.D., FRANS BRUYNICKX, M.D., MET SCHEUT, M.D., Ph.D., DIRK VLAESSELERS, M.D., PATRICK FERDINAND, M.D., Ph.D., PETER LAUMERS, M.D., AND ROGER BOULLON, M.D., Ph.D.

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Van den Berghe Trial
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Conventional: insulin when blood glucose > 215 mg/dL. Goal glucose 180-200 mg/dL.
 Intensive: insulin when glucose > 110 mg/dL and maintained at 80-110 mg/dL.

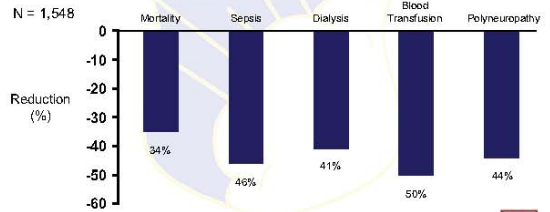
van den Berghe G, et al. *N Engl J Med.* 2001;345:1359-1367.

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Van den Berghe Trial
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Intensive therapy to achieve blood glucose levels of 80-110 mg/dL reduced mortality (-34%), sepsis (-46%), dialysis (-41%), blood transfusion (-50%), and polyneuropathy (-44%)

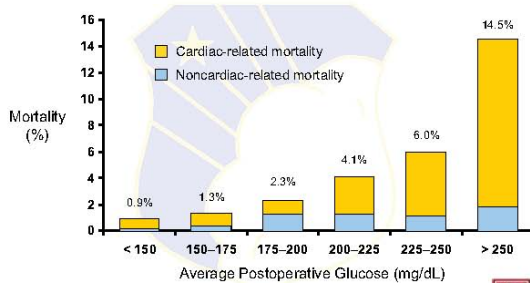


van den Berghe G, et al. *N Engl J Med.* 2001;345:1359-1367.

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CII Reduces Mortality in Diabetics Undergoing Cardiovascular Surgery
 Develop America's Medical Airmen Today ... for Tomorrow



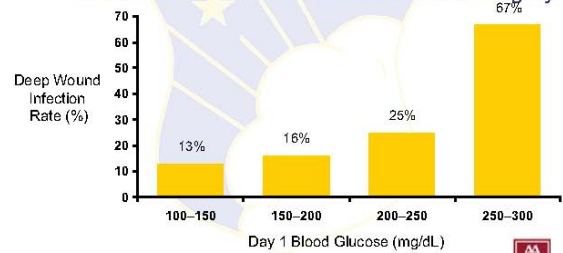
CII = continuous insulin infusion.
 Furnary AP, et al. *J Thorac Cardiovasc Surg.* 2003;125:1007-1021.

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Portland Diabetes Project
 Develop America's Medical Airmen Today ... for Tomorrow

Glucose Control Lowers Risk of Wound Infection in Patients With Diabetes After Cardiac Surgery



Zerr KJ, et al. *Ann Thorac Surg.* 1997;63:356-361

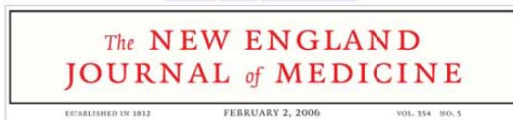
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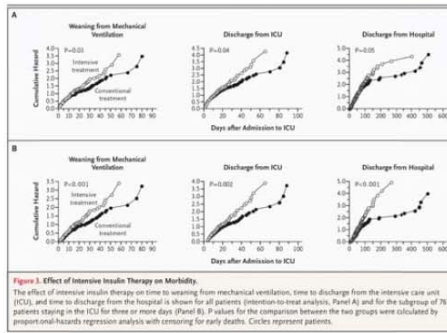


ESTABLISHED IN 1812 FEBRUARY 2, 2006 VOL. 354 NO. 5

Intensive Insulin Therapy in the Medical ICU

Greet Van den Berghe, M.D., Ph.D., Alexander Wilmer, M.D., Ph.D., Greet Hermans, M.D.,
Wouter Meersseman, M.D., Pieter J. Wouters, M.Sc., Ise Milants, R.N., Eric Van Wijngaerden, M.D., Ph.D.,
Herman Bobbaers, M.D., Ph.D., and Roger Bouillon, M.D., Ph.D.

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Van den Berghe MICU Trial

Conflicting Studies

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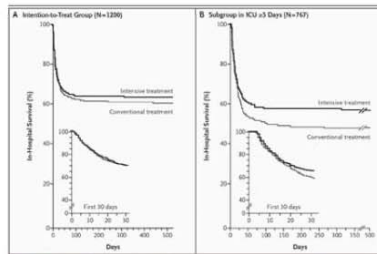


Figure 4. Kaplan-Meier Curves for In-Hospital Survival.
The effect of intensive insulin treatment on the time from admission to the intensive care unit (ICU) until death is shown for the intention-to-treat group (Panel A) and the subgroup of patients staying in the ICU for three or more days (Panel B). Patients discharged alive from the hospital were considered survivors. P values calculated by the log-rank test were 0.49 for the intention-to-treat group and 0.02 for the subgroup staying in the ICU for three or more days. P values calculated by proportional hazards regression analysis were 0.39 and 0.02, respectively.

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Study	N	Setting	Outcome	RRR
DIGAMI	620	CCU (AMI)	1-year mortality	29% (Sig)
Van den Berghe	1548	SICU	ICU mortality	42% (Sig)
DIGAMI 2	1253	CCU	2-year mortality	No difference
Van den Berghe	1200	MICU	Hospital mortality	7% (NS)
HI-5	240	CCU	6-month mortality	-30% (NS)
GluControl	1101	ICU	ICU mortality	-10% (NS)
VISEP	537	ICU	28-day mortality	5% (NS)
De La Rosa	504	SICU/MICU	28-day mortality	-13% (NS)
NICE SUGAR	6104	ICU	3-month mortality	-10.6% (Sig)

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NICE-SUGAR Results



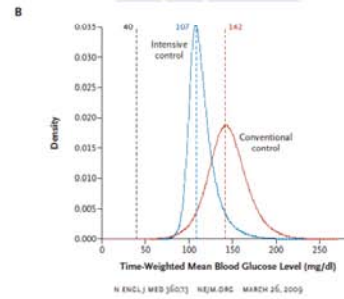
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**Intensive versus Conventional Glucose Control
 in Critically Ill Patients**
 The NICE-SUGAR Study Investigators*

Intensive target 81-108 mg/dL
 Conventional target < 180 mg/dL



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NICE-SUGAR Results

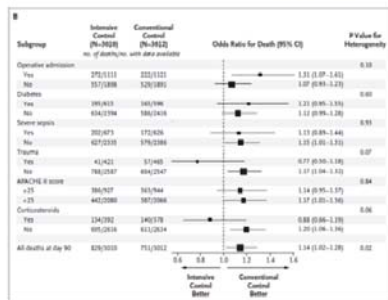


NICE-SUGAR Results



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N ENGL J MED 360(7) NEJM.ORG MARCH 26, 2009

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Outcome Measure	Intensive Glucose Control	Conventional Glucose Control	Odds Ratio or Absolute Difference (95% CI) [†]	Statistical Test	P Value
Death — no. of patients/total no. (%)				Logistic regression	
At day 90	829/3010 (27.5)	751/3012 (24.9)	1.14 (1.02 to 1.28)		0.02
At day 28	670/3010 (22.3)	627/3012 (20.8)	1.09 (0.96 to 1.23)		0.17
Severe hypoglycemia — no. of patients/total no. (%)	206/3016 (6.8)	15/3014 (0.5)	14.7 (9.0 to 25.9)	Logistic regression	<0.001

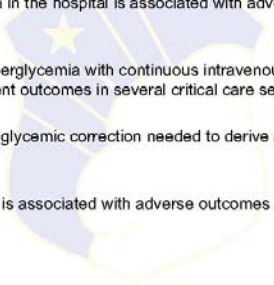


Summary of Evidence



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- Hyperglycemia in the hospital is associated with adverse patient outcomes
- Correcting hyperglycemia with continuous intravenous insulin has improved patient outcomes in several critical care settings
- The degree of glycemic correction needed to derive a clinical benefit is not clear
- Hypoglycemia is associated with adverse outcomes and should be avoided



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ADA/AACE Consensus Statement



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- I. Critically Ill Patients**
- Insulin therapy should be initiated for treatment of persistent hyperglycemia, starting at a threshold of no greater than 180 mg/dL (10.0 mmol/L).
 - Once insulin therapy has been started, a glucose range of 140 to 180 mg/dL (7.8 to 10.0 mmol/L) is recommended for the majority of critically ill patients.
 - Intravenous insulin infusions are the preferred method for achieving and maintaining glycemic control in critically ill patients.
 - Validated insulin infusion protocols with demonstrated safety and efficacy, and with low rates of occurrence of hypoglycemia, are recommended.
 - With IV insulin therapy, frequent glucose monitoring is essential to minimize the occurrence of hypoglycemia and to achieve optimal glucose control.

ENDOCRINE PRACTICE VOLUME 15 NUMBER 4 MAY/JUNE 2009 1

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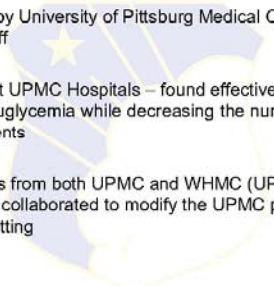


WHMC IV Insulin Algorithm



Develop America's Medical Airmen Today ... for Tomorrow

- Developed by University of Pittsburgh Medical Center (UPMC) staff
- Evaluated at UPMC Hospitals – found effective in achieving euglycemia while decreasing the number of adverse events
- Investigators from both UPMC and WHMC (UPMC and USAF staff) collaborated to modify the UPMC protocol for a military setting



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WHMC IV Insulin Algorithm



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- Implemented as a quality improvement initiative in September 2007 at Wilford Hall Medical Center
- Approved as a Quality Assessment (QA) study by the WHMC Institutional Review Board
- All protocol forms approved by the appropriate forms committee and inpatient safety committee at WHMC
- Initial glucose target 80-130 mg/dL
- In light of new literature, the target glucose range changed to 110-150 mg/dL in January 2009

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 **WHMC IV Insulin Algorithm**  *Develop America's Medical Airmen Today... for Tomorrow*

- Initiation
 - 2 bedside glucometry results > 150 mg/dL X 2 separated by at least 2 hours
 - Admission glucose > 200 mg/dL
- Recommends insulin rate based upon
 - Current insulin infusion rate (maintenance requirement)
 - Glucose level
 - Rate of change
- The Glycemic Management Team trained the inpatient staff in WHMC critical care units

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 **Insulin Titration Algorithm**  *Develop America's Medical Airmen Today... for Tomorrow*

BG (mg/dL)	Current rate 0.5-3.5 units/hr	Current rate 4-6.5 units/hr	Current rate 7-10 units/hr	Current rate >10 units/hr
<70	D/C insulin. Give 50 mL (1 amp) D50 iv and recheck BG in 15 min.... Restart insulin at 1/2 previous rate when BG>80.			
70-79	D/C insulin. Give 20mL D50 iv and recheck BG in 15 min.... Restart insulin at 1/2 previous rate when BG>80.			
80-110	D/C insulin. Recheck in 1 hr. When BG<80, restart insulin at rate decreased by 0.5 unit/hr.	D/C insulin. Recheck in 1 hr. When BG<80, restart insulin at rate decreased by 1 unit/hr.	D/C insulin. Recheck in 1 hr. When BG<80, restart insulin at rate decreased by 2 unit/hr.	D/C insulin. Recheck in 1 hr. When BG<80, restart insulin at rate decreased by 3 unit/hr.
111-150	If BG drop >25 mg/dL, decrease by 1 unit/hr. Otherwise, no change.	If BG drop >25 mg/dL, decrease by 2 unit/hr. Otherwise, no change.	If BG drop >25 mg/dL, decrease by 3 unit/hr. Otherwise, no change.	If BG drop >25 mg/dL, decrease by 4 unit/hr. Otherwise, no change.
151-200	If BG drop 25-50, make no change. If BG<50, decrease by 1 unit/hr. Otherwise, increase rate by 1 unit/hr.	If BG drop 25-50, make no change. If BG<50, decrease by 2 unit/hr. Otherwise, increase rate by 2 unit/hr.	If BG drop 25-50, make no change. If BG<50, decrease by 3 unit/hr. Otherwise, increase rate by 3 unit/hr.	If BG drop 25-50, make no change. If BG<50, decrease by 4 unit/hr. Otherwise, increase rate by 4 unit/hr.
201-250	If BG drop >25, no change. Otherwise give 2 unit iv push AND increase rate by 1 unit/hr.	If BG drop >25, no change. Otherwise give 2 unit iv push AND increase rate by 2 unit/hr.	If BG drop >25, no change. Otherwise give 2 unit iv push AND increase rate by 3 unit/hr.	If BG drop >25, no change. Otherwise give 2 unit iv push AND increase rate by 4 unit/hr.
>250	If BG drop > 25, no change. Otherwise, give 4 units iv push AND increase rate by 1 unit/hr. Call MD if 4 BGS > 250.	If BG drop > 25, no change. Otherwise, give 4 units iv push AND increase rate by 2 unit/hr. Call MD if 4 BGS > 250.	If BG drop > 25, no change. Otherwise, give 4 units iv push AND increase rate by 3 unit/hr. Call MD if 4 BGS > 250.	If BG drop > 25, no change. Otherwise, give 4 units iv push AND increase rate by 4 unit/hr. Call MD if 4 BGS > 250.

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 **Metrics**  *Develop America's Medical Airmen Today... for Tomorrow*

- Primary service
 - Medical Intensive Care Unit (MICU)
 - Surgical Intensive Care Unit (SICU)
 - Cardiac Care Unit (CCU)
- Hyperglycemia and hypoglycemia rates
- Time for BG levels to reach target BG range (110-150 mg/dL)
- The percent of time BG levels within the target range
- The frequency of IIP use
- Hospital length of stay (LOS)
- Mortality

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 **Results**  *Develop America's Medical Airmen Today... for Tomorrow*

- A total of 46 patients receiving inpatient treatment were placed on the IIP from January to March 2009
- The average age of those on the IIP was 58 yrs
- The majority of patients had T2D

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Comparisons of Service for the Inpatient Insulin Infusion
 Data (January 2009 – March 2009)



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	CCU (n=2)	MICU (n=20)	SICU (n=24)	P values ^a
Age (years), mean±SD ^b	50.5±9.2	64.6±14.4	54.7±19.4	0.15
Gender, n (%)				0.46
Male	2 (100.0)	10 (50.0)	15 (62.5)	
Female	0 (0.0)	10 (50.0)	9 (37.5)	
Type of diabetes, n (%)				0.41
Type 1 diabetes	0 (0.0)	1 (5.0)	0 (0.0)	
Type 2 diabetes	2 (100.0)	11 (55.0)	10 (41.7)	
Unknown	0 (0.0)	1 (5.0)	5 (20.8)	
No diabetes	0 (0.0)	7 (35.0)	9 (37.5)	

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Comparisons of Service for the Inpatient Insulin Infusion
 Data (January 2009 – March 2009)



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	CCU (n=2)	MICU (n=20)	SICU (n=24)	P values ^a
Time to goal BG at 110-150 mg/dL (hours), median	1.1 (0.1-2.2)	5.4 (4.1-10.6)	7.0 (1.8-10.0)	0.19
Hyperglycemia event, n (%)				
BG>130 mg/dL	2 (100.0)	19 (95.0)	24 (100.0)	0.48
BG>180 mg/dL	2 (100.0)	18 (90.0)	16 (66.7)	0.15
BG>200 mg/dL	1 (50.0)	14 (70.0)	15 (62.5)	0.89
Hypoglycemia event (%)				
BG<60 mg/dL	0.7%	1.0%	0.8%	0.44
BG<40 mg/dL	0.1%	0.3%	0.0	0.54

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Comparisons of Service for the Inpatient Insulin Infusion
 Data (January 2009 – March 2009)



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	CCU (n=2)	MICU (n=20)	SICU (n=24)	P values ^a
Percent of time goal BG at 110-150 mg/dL (%), mean±SD	69.6±29.7	49.3±17.3	53.3±23.4	0.42
Length of stay in ICU (days), median				
Overall	4 (2-6)	6 (2-9)	4 (2-10)	0.90
Live	4 (2-6)	6 (2-9)	4 (1.5-8.5)	0.94
Died		6.5 (4.0-9.5)	7 (2.5-14.0)	1.00

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Insulin Infusion Protocol (IIP) Use



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Percent of Patients who Qualified & Were Placed on IIP			
	Percent of total qualified patients : CCU	Percent of total qualified patients : MICU	Percent of total qualified patients : SICU
May- Dec, 2008 (80-130 mg/dL)	35.6%	25.4%	22%
Jan-March 2009 (110-150 mg/dL)	23.3%	27.7%	27.3%

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WHMC IIP Conclusions



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- Implementations of an IIP at WHMC with a new glycemic target range of 110-150 mg/dL resulted in
 - Average time to target BG range of 5.68 hours
 - Average percent of time at goal glucose ranging 49.3% to 69.6%
 - Low rate of hypoglycemia
- These results are comparable to published protocols from civilian institutions

Krikorian, Armand, Ismail-Beigi, Faramarz, Moghissi, Elie S.
 Current Opinion in Clinical Nutrition & Metabolic Care.
 March 2010 - Volume 13 - Issue 2 - p 198-204

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Limitations



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- Low utilization
 - Increased use of subcutaneous insulin protocol in the ICU
- Military facility unique challenges
 - Deployment of large numbers of staff (medical, nursing, and medical technicians) every six months
 - Alteration of administrative infrastructure related to deployments
 - Paper charting system
 - Bi-weekly rotation of critical care medical staff

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Implications for Air Force Critical Care



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- Intravenous insulin protocols reduce complications due to hyperglycemia and hypoglycemia
- Standardization of care is important in the military setting
 - Large difference in provider/nurse experience with glycemic management
 - Frequent staff turnover due to changes in assignment, deployments

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Implications for Combat Medicine



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- Stress-induced hyperglycemia occurs frequently in service members injured in combat zones
- This hyperglycemia places them at increased risk for poor outcomes
- Glycemic control in the inpatient setting is important in the Air Force theater facilities caring for coalition trauma patients

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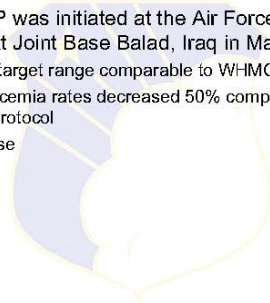


WHMC IIP in a Deployed Setting



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- WHMC IIP was initiated at the Air Force Theater Hospital at Joint Base Balad, Iraq in May 2009
 - Time in target range comparable to WHMC data
 - Hypoglycemia rates decreased 50% compared to former protocol
 - Still in use



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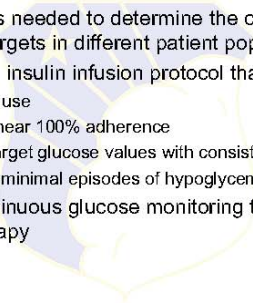


Future Research



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- Research is needed to determine the optimal glycemic targets in different patient populations
- Develop an insulin infusion protocol that:
 - Is easy to use
 - Leads to near 100% adherence
 - Obtains target glucose values with consistency
 - Produces minimal episodes of hypoglycemia
- Use of continuous glucose monitoring to modify insulin therapy



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Comments/Questions?




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**Management and Treatment of Pediatric Obesity in a Military Outpatient Setting
University of Pittsburgh Medical Center (UPMC)**

Jodi Krall, PhD; Acknowledgements: Silva Arslanian*, MD, and Goutham Rao*, MD



The increasing prevalence of obesity in civilian and military dependent populations poses significant challenges in identifying future military recruits with appropriate physical qualifications. In addition, an increasing number of military dependents are diagnosed with risk factors for type II diabetes. The military will be affected by the tremendous humanistic and economic burden unless prevention and treatment programs that include healthy lifestyle changes are implemented. For this reason, the University of Pittsburgh Medical Center partnered with the Air Force to develop an evidenced-based model for primary prevention of type II diabetes at Wilford Hall Medical Center at Lackland Air Force Base. The San Antonio Military Pediatric Center (SAMPC) Pediatric Wellness Center employs a multidisciplinary team approach to provide family-centered lifestyle intervention, counseling, and goal-setting strategies to implement therapeutic behavioral changes in overweight and obese high-risk children and adolescent patients and their families. The Center is also designed to serve as a hub-site for research studies supporting scientific advancement in the understanding of obesity, type II diabetes, and related conditions as well as for testing innovative treatment approaches. This presentation will be used to review the rationale for and design of the program; describe intervention techniques, which include standardized clinic-based lessons and Web-based interactive educational tools; present preliminary findings; and discuss of future directions.

*affiliated with Children's Hospital of Pittsburgh of UPMC and University of Pittsburgh



Management and Treatment of Pediatric Obesity in a Military Outpatient Setting


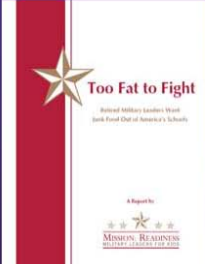
Jodi Krall, PhD
 Project Director
 Diabetes Prevention and Treatment Program
 University of Pittsburgh Medical Center

Acknowledgements



- **Silva Arslanian, MD**
 - Chief, Division of Weight Management & Wellness
 - Children's Hospital of Pittsburgh of UPMC
- **Goutham Rao, MD**
 - Clinical Director, Weight Management & Wellness Center
 - Children's Hospital of Pittsburgh of UPMC
- **Lt. Col. Dale Ahrendt, MD**
 - Chief, Adolescent Medicine
 - Wilford Hall Medical Center, Lackland Air Force Base
- **SAMPC Pediatric Wellness Center Staff**

None of the faculty or planners of this presentation have any financial or other interest, management, affiliation, or relationship with any organization that could be perceived as a real or apparent conflict of interest with the content of this activity.


- "Over 27 percent of all Americans 17 to 24 years of age — over nine million young men and women — are too heavy to join the military."
- "Between 1995 and 2008, the proportion of potential recruits who failed their physicals each year because they were overweight rose nearly 70 percent."

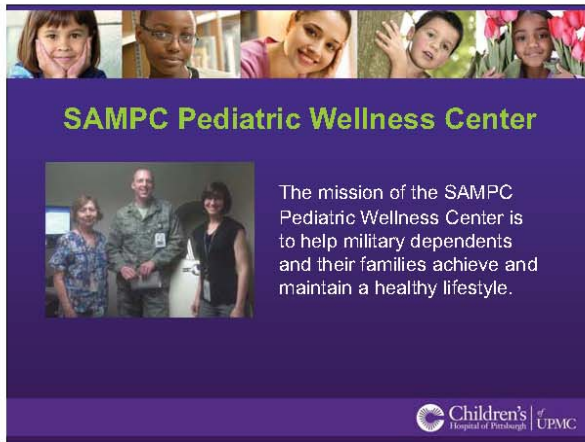
http://dm.miltoothread.com/MPR_Too_Fat_to_Fight-1.pdf

University of Pittsburgh Medical Center Strategic Plan for Diabetes Prevention and Treatment in Civilian And Military Healthcare Beneficiary Populations


- Department of Defense-funded Cooperative Agreements
- Partnership among University of Pittsburgh Medical Center, Children's Hospital of Pittsburgh, University of Pittsburgh, and the United States Air Force (Wilford Hall Medical Center)
- Pediatric Objective: Develop an obesity prevention/treatment program that is sustainable, replicable, and has military significance





SAMPC Pediatric Wellness Center

The mission of the SAMPC Pediatric Wellness Center is to help military dependents and their families achieve and maintain a healthy lifestyle.



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Model of Care

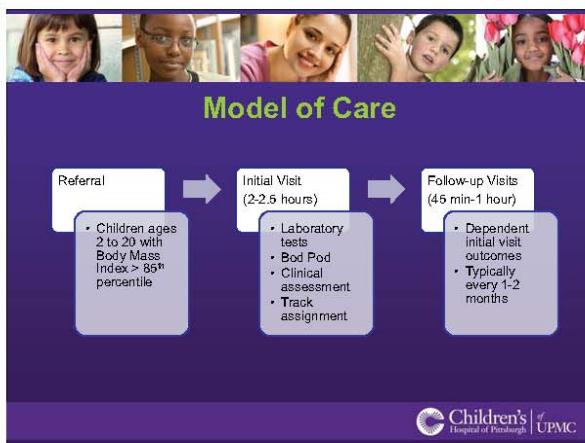
- Stage 1: Prevention plus
- Stage 2: Structured Weight Management
- Stage 3: Comprehensive Multidisciplinary Intervention**
- Stage 4: Tertiary Care Intervention

→

- Multidisciplinary
- Evidence-based
- Behavior-focused
- Family-centered
- Goal: weight maintenance or gradual weight loss until BMI <85th percentile

Ballou and the Expert Committee. *Pediatrics*. 2007;120(Suppl 4):S164-92

Children's Hospital of Pittsburgh of UPMC



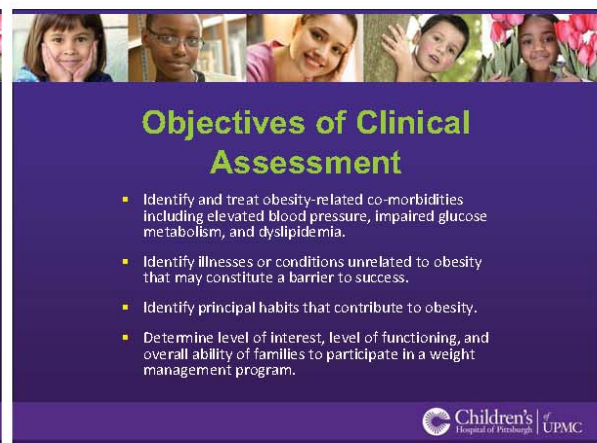
Model of Care

```

    graph LR
      Referral[Referral] --> InitialVisit[Initial Visit (2-2.5 hours)]
      InitialVisit --> FollowUp[Follow-up Visits (45 min-1 hour)]
  
```

- Referral**
 - Children ages 2 to 20 with Body Mass Index > 85th percentile
- Initial Visit (2-2.5 hours)**
 - Laboratory tests
 - Bod Pod
 - Clinical assessment
 - Track assignment
- Follow-up Visits (45 min-1 hour)**
 - Dependent initial visit outcomes
 - Typically every 1-2 months


Children's Hospital of Pittsburgh of UPMC



Objectives of Clinical Assessment

- Identify and treat obesity-related co-morbidities including elevated blood pressure, impaired glucose metabolism, and dyslipidemia.
- Identify illnesses or conditions unrelated to obesity that may constitute a barrier to success.
- Identify principal habits that contribute to obesity.
- Determine level of interest, level of functioning, and overall ability of families to participate in a weight management program.



Children's Hospital of Pittsburgh of UPMC



Medical Assessment

Overall Purpose: Identify any medical or psychological co-morbidities of obesity, identify key habits related to obesity, and make an overall assessment of each child's (and family's) motivation to lose weight and resources available for the weight management effort.



- Past medical and surgical history
- Family history of obesity-related illnesses
- Principal obesity-related habits
- Developmental history
- Review of systems
- Physical exam with focus on identifying obesity-related signs
- Routine laboratory testing

Wellness Assessment

Primary Goal: Identify lifestyle habits contributing to obesity and to negotiate a written agreement with a family to change behaviors, incrementally over time.



- Identification of specific unhealthy dietary habits
- Identification of current level and type of physical activity and sedentary behavior
- Identification of motivation of child and family to make behavior changes in areas where they are most needed.
- Identification of perceived and tangible barriers to change
- Negotiation of a Healthy Lifestyles Goals Agreement based on identified behaviors, child's preference for which behaviors to change, and parents' preference for which behaviors to change.

Wellness Assessment


Underlying principles of the wellness recommendations:


- The overall goal should always be promotion of healthy lifestyle habits. If habits become healthy, weight will take care of itself.
- Diets and other "quick fixes" are largely unsuccessful in children.
- Incremental behavior change in which children and families play a role in deciding which behaviors to change and how quickly is more likely to be successful than drastic behavior change.
- Behavioral or contingency contracting is an effective tool for changing patient behavior.

Psychological Assessment


Overall Goal: Identify behavioral or psychological illness that may interfere with the weight management effort and to identify behavioral or psychological problems that are contributing to weight gain and address them if necessary.






Clinical Tracks


HB4Life Program	Nutrition & PA Education Program	Behavioral Treatment Program	Web-Based Program	Customized Program
<ul style="list-style-type: none"> • 1 year • Monthly visits • Nutrition, PA and behavioral foci 	<ul style="list-style-type: none"> • 1 year • Visits every 3 months • Healthy eating, PA education 	<ul style="list-style-type: none"> • 1 year • Up to 6 visits • Behavioral focus 	<ul style="list-style-type: none"> • Internet program with dietary intake log • Dietary feedback • Supplemental visits every 3-4 months 	<ul style="list-style-type: none"> • Variable length and intensity • Needs/interest based • Geared for difficult circumstances






Healthy Behaviors for Life Clinical Intervention Manual


Description	Lesson Examples:
<ul style="list-style-type: none"> ▪ 13 lifestyle lessons ▪ In-clinic lessons, goal-setting, and at-home assignments for home. ▪ Patient/family decide where to focus efforts ▪ Entire family involvement ▪ On-going support and encouragement in clinic 	<ul style="list-style-type: none"> ▪ "Eating Well While Dining Out" ▪ "Dealing with Teasing and Bullying" ▪ "Smart Snacking" ▪ "Eating and your Emotions" ▪ "Building a Healthy Body Image"





HB4Life.com

HB4Life.com is a Web-based educational and self-monitoring tool through which children and families record dietary and related habits, and can receive feedback electronically or indirectly through their physician or other health care provider.







Healthy Plate



Healthy Plate allows children to add food to a virtual "plate" by either clicking-and-dragging visual representations of foods or by selecting foods by name from a directory.




Hundreds of common foods and beverages have been incorporated into the program and new foods may be created by the participants.



The program immediately calculates the total calories and the nutrient breakdown of the selected foods.

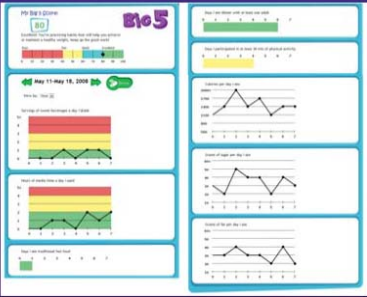






Big 5 Tracker

The Big 5 Tracker uses a series of questions to monitor children's behavior with respect to five principal habits related to obesity.

1. Sugary drinks
2. Media time
3. Fast food
4. Family meal time
5. Physical activity



Responses to the Big 5 Tracker habits and Healthy Plate calories and nutrient intake are scored on a scale of 0 to 100. Scores for each behavior are graphed to provide visual representations of behaviors for a week's time.


Research Registry

- IRB-approved database established to track clinical outcomes, perform retrospective analyses, and identify participants for future research
- Registry data include:
 - Anthropometrics
 - Laboratory values
 - Medical/family history
 - Demographics
 - Caregiver military status

Challenges and Opportunities



- Recruitment and retention
- Challenges unique to a military setting
- Identification of predictors of success and failure in program
- Continual refinement of model of care
- Continuity of care
- Sustainment and replication



Funding Sources

This presentation is based on research sponsored by the U.S. Army Medical Research & Materials Command under agreement #W81XWH-06-2-0024 and W81XWH-07-2-0080 and the Air Force Surgeon General's Office under agreement # FA7014-08-2-0001.



**Budget Impact Analysis of Bariatric Surgery for Morbid Obesity
University of Washington**

Rafael Alfonso

Obesity is reported to increase mortality, morbidity, and costs. Bariatric surgery remains the most effective treatment for long-term weight loss. We developed a payer-based Budget Impact Model (BIM) to assess “Return On Investment (ROI)” for bariatric surgery in obesity compared to non-operative interventions.


The purpose of this BIM is to estimate the financial consequences of adoption of different types of Bariatric surgeries within a specific health care setting given inevitable resource constraints. The BIM can be customized based on the characteristics of the population of interest (i.e. number of lives covered, age, gender, and body mass index) and the alternatives of interventions presented (i.e. Different types of bariatric surgeries and/or different degrees of use of each procedure). Since each bariatric procedure has different costs, and may be associated with different levels of weight loss and complications; the inputs used for the costs, complications, and mortality rates, are derived from a Cost-Effectiveness Model from nationally representative databases and the best estimates from the published literature.

Average annual costs per patients for each procedure are multiplied by the number of eligible subjects receiving the specific procedure. These costs are accumulated over a 10-year period and compared to the cumulative costs of eligible subjects for bariatric surgery who did not receive the procedure. Results are expressed as the increment of total costs per member per year. By examining different scenarios, with different levels of eligibility and mix of surgical procedures, decision makers could estimate accurately the ROI associated with each alternative over time.

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A Financial Model of Bariatric Surgery for Morbid Obesity

Rafael Alfonso-Cristancho, MD, MSc
On behalf of the BOOM Collaborative Group



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BOOM Collaborative Group

- The Bariatric Outcomes and Obesity Modeling (BOOM) Project is a multidisciplinary research collaboration investigating obesity health services.
- Primary collaborators include: Franklin Skip Carr and Larry Belenke (Ventura Healthcare Systems LLC); David Flum MD MPH, Andrew Wright MD, Steve Kwon, MD, Allison Devlin Rhodes MS, Kara MacLeod MPH, Rebecca Gaston Symons, MPH, Erin Machinchick, Katrina Golub MPH (Surgical Outcomes Research Center, University of Washington); Sean Sullivan PhD, Louis Garrison PhD, Rafael Alfonso-Cristancho MD MSc, Bruce Wang PhD, Edwin Wong PhD (Pharmaceutical Outcomes Research and Policy Program, University of Washington); David Arterburn MD, Malia Oliver, Renee Hawkes (Center for Health Studies, Group Health Cooperative); Louis Martin MD MS (Samaritan Physicians).



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Disclosure of conflict of interest

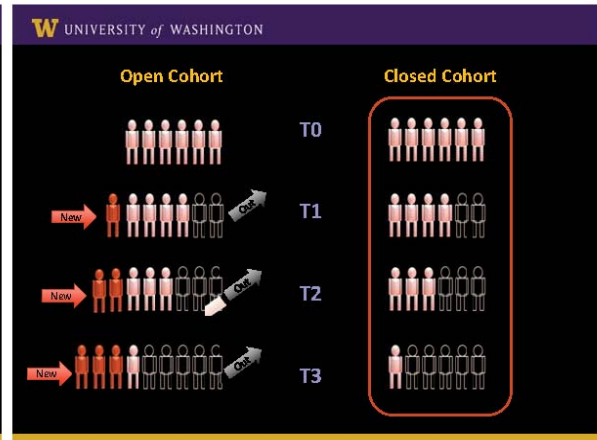
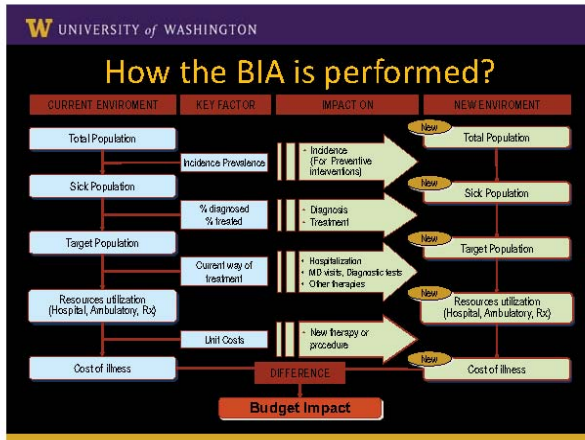
- This work was supported by the HQ AF Surgeon General under Award No. FA 7014-08-0002.
- Opinions, interpretations, conclusions and recommendations are those of the authors and are not necessarily endorsed by the U.S. Air Force

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What is a Budget Impact Analysis?

“The purpose of a BIA is to estimate the financial consequences of adoption and diffusion of a new health care intervention within a specific health care setting or system context given inevitable resource constraints.”

Muskooff JR, Sullivan SD, Annemans L, et al. Principles of Good Practice for Budget Impact Analysis: Report of the ISPOR Task Force on Good Research Practices – Budget Impact Analysis. Value in Health 2007;10:336-47



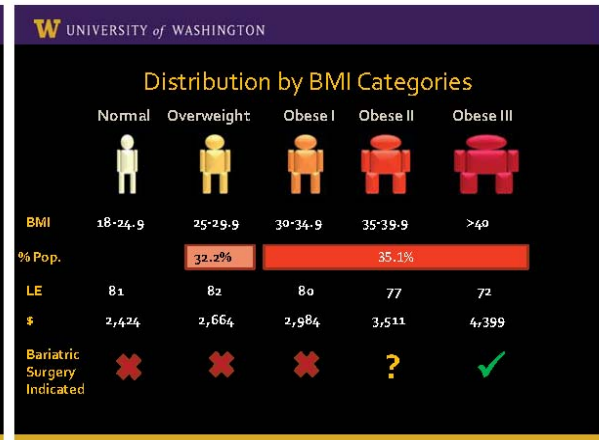
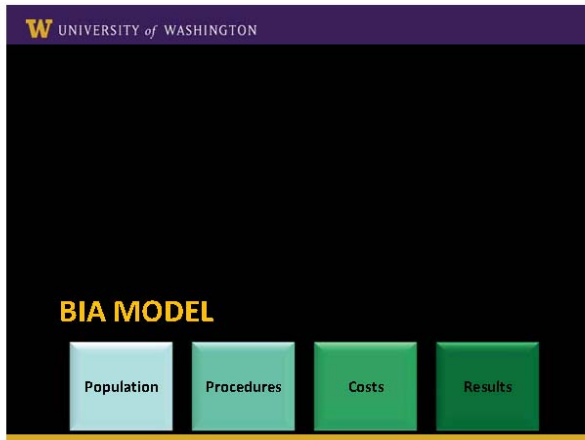
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The case of bariatric surgery for obesity...

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Obesity treatments

- The initial steps are behavioral and non-pharmacological treatments: diet and exercise
- Pharmacological agents (e.g. orlistat, sibutramine) demonstrated modest weight loss over 1 year but the weight lost is usually regained after suspension of therapy.
 - Some cases of serious adverse events have been reported.
 - Rimonabant was withdrawn from the worldwide market in the past year due to increased suicidal risk.
- Surgical alternatives to treat obesity are effective at reducing weight and improving comorbid conditions



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Population*

<p>U.S. General population</p> <ul style="list-style-type: none"> • Approx. 307 million (July 2009) • 5.7% of adult population (Approx. 14 million people) had a BMI >40 kg/m² (NHANES) • 171,000 bariatric surgeries were performed in 2005 (ASBS) 	<p>TRI-CARE</p> <ul style="list-style-type: none"> • Approx. 9.4 million beneficiaries (DEERS) • Air Force (AF) Active Duty (AD) (2001-2007): 608,939 <ul style="list-style-type: none"> – Had bariatric surgery: 49 (< 0.01%) – Had morbid obesity and no bariatric surgery: 4,430 (0.7%) • AF beneficiaries (not AD anytime from 2001-2007): 1,575,257 <ul style="list-style-type: none"> – Had bariatric surgery: 6,964 (0.5%) – Had morbid obesity and no bariatric surgery: 63,863 (4.1%)
---	---

*Closed cohort

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Patients eligible for Bariatric surgery in given year*

	Females		Males		Total	
	N	%	N	%	N	%
BMI >35 & <40 with comorbidities	30,553	5.7%	13,087	2.8%	43,639	4.4%
BMI >40	29,979	5.6%	9,636	2.1%	39,615	4.0%
Total number of patients	60,532	11.4%	22,723	4.9%	83,254	8.3%

*Based on a hypothetical closed cohort of 1 million subjects with the same age, gender and BMI distribution as reported by NHANES

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Procedures: bariatric surgery

Malabsorptive

Biliopancreatic Diversion

Restrictive

Sleeve Gastrectomy

Mixed

AGB

Mixed

RYGB

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Weight loss and DM resolution by type of Surgery

Obese II

Obese III

	TOTAL	AGB	RYGB	GS	BPD
% EBWL	55.9	46.2	59.7	55.5	63.6
% Resolved overall	78.1	56.7	80.3	79.7	95.1
% Resolved <2 y	80.3	55	81.6	81.4	94
% Resolved >2 y	74.6	58.3	70.9	77.5	95.9

Buchwald et al. Am J Med 2009

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Procedure mix

U.S. reference population (1 million)

- Approx. 21% of eligible subjects receive a bariatric procedure in the U.S.
- Gastric bypass, (open & lap) represent 80 to 92% of total number of bariatric procedures in the U.S.
- AGB: approx. 10% of the total number of procedure.

Procedures	N	%
Lap RYGB	9,666	60
AGB	1,611	10
Open RYGB	4,833	30
Sleeve	-	-
Biliopancreatic Div	-	-
Total	16,111	100

Martin M, Beeekley A, Kjerstad R, Sebesta J. Socioeconomic disparities in eligibility and access to bariatric surgery: A national population-based analysis. Surgery for Obesity and Related Diseases. 2010;6(1):3-15.

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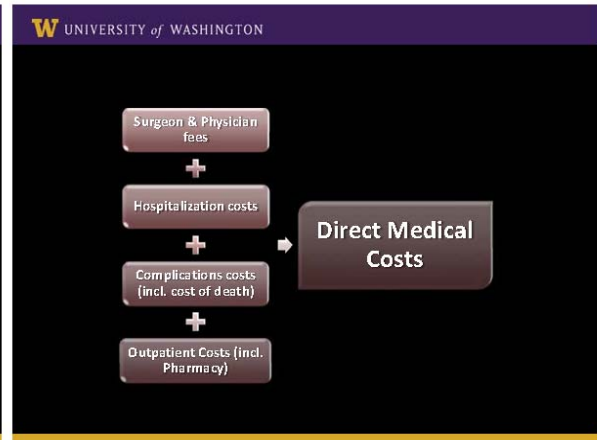
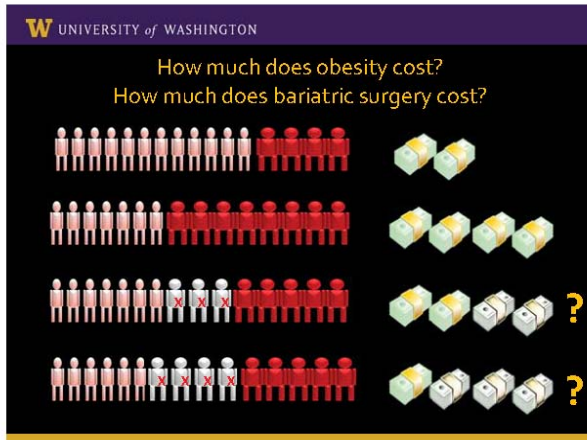
Procedure mix

AF reference population

- AD+Beneficiaries: 2,184,196
- Approx. 75,306 (3.4%) with morbid obesity
- Only 9.3% of morbidly obese underwent bariatric surgery.

Procedures	N	%
Lap RYGB	4,209	60
AGB	701	10
Open RYGB	2,104	30
Sleeve	-	-
Biliopancreatic Div	-	-
Total	7,015	100

Data on file from the R00M Study Group at UW

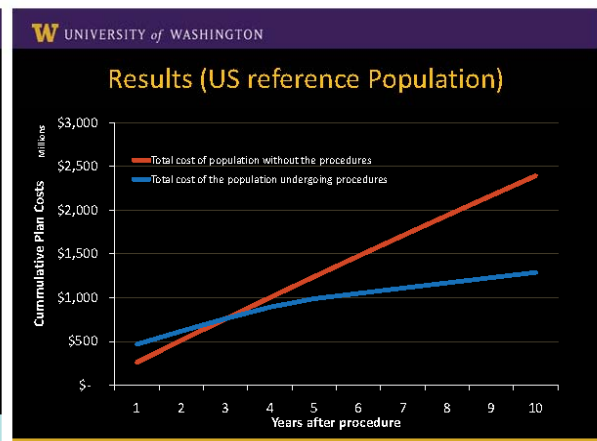


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Costs
 (First 5 years)
 Average Annual Direct Medical Costs

Procedure	Year 1	Year 2	Year 3	Year 4	Year 5
None	\$ 4,550	\$ 4,550	\$ 4,540	\$ 4,530	\$ 4,510
Lap RYGB	\$ 30,800	\$ 7,300	\$ 9,700	\$ 8,800	\$ 5,300
AGB	\$ 19,500	\$ 20,600	\$ 15,300	\$ 10,100	\$ 9,800
Open RYGB	\$ 30,800	\$ 12,500	\$ 12,300	\$ 9,100	\$ 9,100
Sleeve	\$ 30,800	\$ 9,900	\$ 11,000	\$ 9,000	\$ 7,200
Biliopancreatic Div	\$ 25,200	\$ 15,300	\$ 8,100	\$ 9,500	\$ 8,500

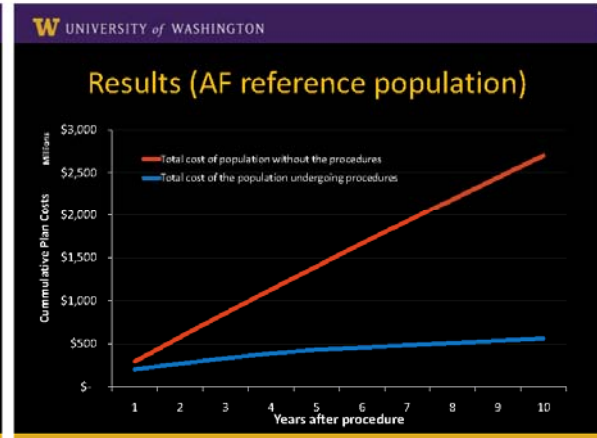
*Rounded values
 Source: BOOM Cost-Effectiveness Model-Reference case



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Results (US reference Population)

BUDGET IMPACT CALCULATIONS	Year 1	Year 3	Year 5	Year 7	Year 10
Total cost of the population without the procedures	281,406,000	267,505,000	259,437,000	253,179,000	244,930,000
Total cost of the population undergoing procedures	506,262,000	156,571,000	106,155,000	65,334,000	64,223,000
Total plan costs with new intervention	356,211,000	338,613,000	328,401,000	320,480,000	310,037,000
Total cost of the population if the intervention is not available	787,668,000	424,076,000	365,592,000	318,512,000	309,152,000
Incremental PMPY	431.46	85.46	37.19	(1.97)	(0.89)



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Results (AF reference population)

BUDGET IMPACT CALCULATIONS	Year 1	Year 3	Year 5	Year 7	Year 10
Total cost of the population without the procedures	292,710,000	278,250,000	269,858,000	263,349,000	254,768,000
Total cost of the population undergoing procedures	203,125,000	62,820,000	42,592,000	26,214,000	25,768,000
Total plan costs with new intervention	322,723,000	306,780,000	297,528,000	290,351,000	280,891,000
Total cost of the population if the intervention is not available	495,834,000	341,069,000	312,450,000	289,562,000	280,535,000
Incremental PMPY	79.26	15.70	6.83	(0.36)	(0.16)

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- ### Conclusions
- In both cases, the Incremental PMPY becomes negative after year five, leading to savings in direct medical costs .
 - By the end of the 10-year period, the highest cumulative costs are for the scenario where no one receives surgery.
 - The results are driven by the number of subjects receiving each of the different procedures and the costs associated with each one over time.
 - The model allows for customization of each parameter to provide useful estimates for the end-user.

**Pilot Study of A Diabetes Prevention Program in A Military Community
USAF, Lackland AFB, TX**

Lisa Strickland, MD, Joseph Pollard, MPH; Acknowledgements: Donna L. Wolf*, PhD, Hsiang-Yu Chen*, Ms, Linda Siminerio*, RN, PhD

INTRODUCTION: Approximately 57 million Americans ≥ 20 years have pre-diabetes, placing them at risk of developing diabetes (T2D) and cardiovascular disease (CVD). Despite having weight and fitness standards, incidence of T2D in military personnel is similar to the civilian population (1.9 vs. 1.6 cases per 1,000 persons per year). Progression to T2D among those with pre-diabetes is not inevitable. The Diabetes Prevention Program (DPP) demonstrated that a lifestyle intervention lowers the risk for developing T2D. **PURPOSE:** Our objective was to determine if a Group Lifestyle Balance (GLB) intervention (based on the DPP), for individuals with metabolic syndrome (MetS), is effective in decreasing risk for T2D and CVD in a military community. **Methods:** This was a non-randomized pilot study. Participants from Wilford Hall Medical Center (WHMC) were screened for MetS ($n = 58$) and participated in a 12- week GLB ($n=19$) that focuses on safe weight loss and physical activity. **RESULTS:** Participants lost an average of 11.4 pounds over the 12 week period ($p < 0.001$). BMI decreased by 2 kg/m² ($p=0.001$). Although not statistically significant, there was a clinically important decrease of 10mmHg in systolic blood pressure ($p = 0.07$). Glucose decreased by 3mg/dl, but was not statistically significant ($p = 0.06$). There was a significant decline in the number of MetS parameters from an average of three to two. **Conclusion:** Adults in a military community can decrease their BMI through participation in a GLB intervention. Effort to train military health professionals, e.g. nurses, dietitians, on the GLB is underway for program dissemination.

*affiliated with the University of Pittsburgh



Develop America's Medical Airmen Today ... for Tomorrow

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Pilot Studies of Diabetes Prevention Programs in A Military Community

Lisa E. Strickland, Capt, USAF, MC
Joseph Pollard, MPH

Acknowledgements: Donna L. Wolf*, PhD, Hsiang-Yu Chen*, MS,
Linda Siminerio*, RN, PhD

*affiliated with the University of Pittsburgh

None of the faculty or planners of this presentation have any financial or other interest, arrangement, affiliation, or relationship with any organization that could be perceived as a real or apparent conflict of interest with the content of this activity.

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Overview



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- Background:
 - Incidence and Costs of Diabetes in the Military
 - Evidence for Lifestyle Intervention and Diabetes Prevention
 - Beginning to Translate the Evidence: The GLB Program
- Diabetes Prevention Programs: Pilot Studies in a Military Setting
- Next Steps: The IDEA Trial
- Summary

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Diabetes in the Military



- Incidence of DM in military vs US residents aged 20-44
 - 1.9:1.6 (1000 person-years)
- Those service members with a body mass index (BMI) of ≥ 30 were **3 times more likely** to have diabetes than those with a normal BMI (18-24.9)
- Junior and Senior enlisted service members were **3 to 4 times more likely** to be diagnosed with diabetes than officers
- African-American and Hispanic service members were **~2 times more likely** to be diagnosed with diabetes than Caucasian service members
- The mean age of all service members was **35.3 (± 8) years old**

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Cost of Diabetes



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- The Centers for Disease Control and Prevention reports that **~11% of American adults have type 2 diabetes and > 20% have prediabetes. About 1.6 million new cases of diabetes were diagnosed in people aged 20 years or older in 2007**
- The average medical expenditures among people with diagnosed diabetes were **2.3 times higher than what expenditures would be in the absence of diabetes**
- **\$116 billion was the total 2007 direct medical costs of diabetes**

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Cost of DM in the Military



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- TRICARE TOBESAHOL (2007) study reported the total annual cost of those beneficiaries (20-65 yo) with diagnosed diabetes to be about **\$300 million**
- The average additional annual medical cost per diagnosed diabetic TRICARE beneficiary is **~ \$2150.00**

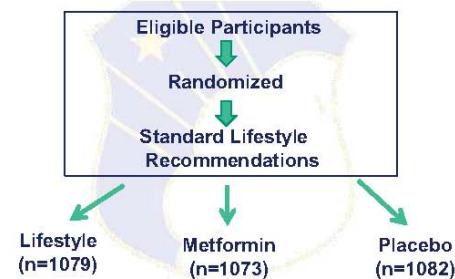
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Diabetes Prevention Program



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The DPP Research Group. *N Engl J Med.* 2002;346:393-403

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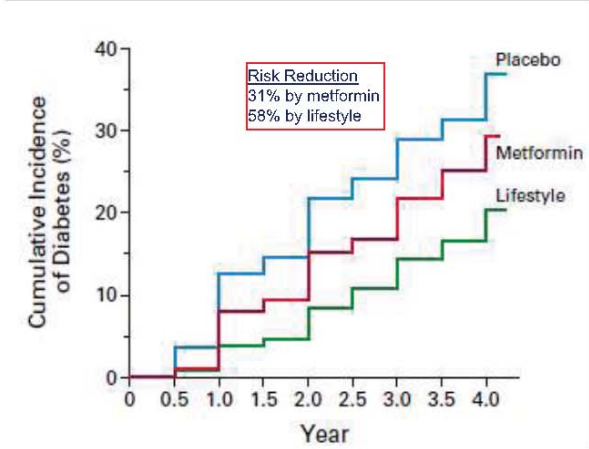
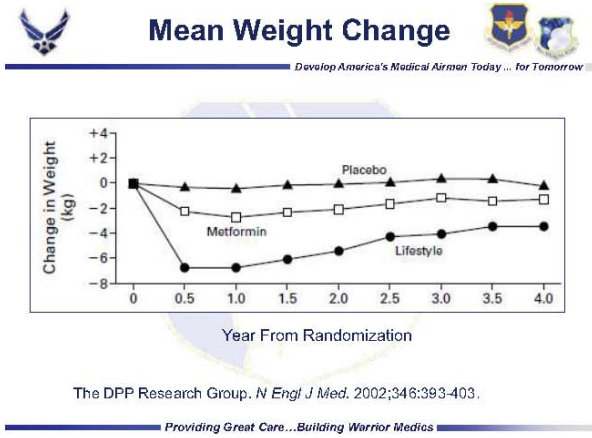


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- Lifestyle intervention group:
 - Goal to lose 7% body weight through low-fat diet and moderate physical activity 150 minutes/week
 - 16-lesson curriculum taught by case managers on one-to-one basis during first 24 weeks
 - Subsequent individual sessions held monthly

The DPP Research Group. *N Engl J Med.* 2002;346:393-403

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10-yr F/U of Diabetes Incidence and Weight Loss in the DPPOS
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- 2766 of original 3150
- All three groups offered group-implemented lifestyle intervention
- Metformin continued
- The original lifestyle group lost, then partly regained weight
- Weight loss with metformin maintained
- Diabetes incidence similar between groups
- Incidence in the 10 yrs since DPP randomization was reduced by 34% in the lifestyle group and 18% in the metformin group compared with placebo

DPPOS, *Lancet* 2009; 374:1677-1686
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	ILS group	Metformin group	Placebo group
DPP (2-8 years)	4.8 (4.1-5.7)	7.8 (6.8-8.8)	11.0 (9.8-12.3)
End of masked treatment (3-2 years)	5.0 (4.3-5.8)	7.7 (6.8-8.8)	10.8 (9.7-12.0)
Bridge period	5.5 (4.1-7.5)	10.6 (8.4-13.2)	7.8 (5.9-10.3)
DPPOS (n=2766)	5.9 (5.1-6.8)	4.9 (4.2-5.7)	5.6 (4.8-6.5)
Combined incidence	5.3 (4.8-5.8)	6.4 (5.9-7.1)	7.8 (7.2-8.6)

Data are incidence rates (95% CI). The bridge period was Aug 1, 2001, to Aug 31, 2002. ILS= intensive lifestyle intervention; DPP= Diabetes Prevention Program.

Table 3: Incidence (cases per 100 person-years) of diabetes during DPP, bridge period, and DPPOS

Period	Placebo	Metformin	Lifestyle
DPP (n=3234)	11.0	7.8	4.8
Aug 2001 to Aug 2002 (n=2216)	10.8	7.7	5.5
DPPOS (n=1994)	5.6	4.9	5.9

Clinical Care/Education/Nutrition/Psychosocial Research
 ORIGINAL ARTICLE

Translating the Diabetes Prevention Program Into an Urban Medically Underserved Community

A nonrandomized prospective intervention study

MIRIAM C. SEIDEL, MS, RD¹
 ROBERT O. POWELL, BS¹
 JANICE C. ZUBOR, PhD²

LINDA M. SIMINERIO, PhD, RN³
 GRETCHEN A. PATTI, PhD³

OBJECTIVE—The objective of this study was to determine if a community-based modified Diabetes Prevention Program Group Lifestyle Balance (GLB) intervention, for individuals with metabolic syndrome, was effective in decreasing risk for type 2 diabetes and cardiovascular disease (CVD) in an urban medically underserved community, and subsequently to determine if improvements in clinical outcomes could be sustained in the short term.

RESEARCH DESIGN AND METHODS—This nonrandomized prospective intervention study used a one-group design to test the effectiveness of a community-based GLB intervention. Residents from 11 targeted neighborhoods were screened for metabolic syndrome (n = 573) and took part in a 12-week GLB intervention (n = 88) that addressed safe weight loss and physical activity.

RESULTS—A marked decline in weight (46.4% lost $\geq 5\%$ and 26.1% lost $\geq 7\%$) was observed in individuals after completion of the intervention. Of these subjects, 87.5% (n = 28) and 66.7% (n = 12) sustained the 5% and 7% reduction, respectively, at the 6-month reassessment. Over one-third of the population (43.5%, n = 30) experienced improvements in one or more components of metabolic syndrome, and 73.3% (n = 22) sustained this improvement at the 6-month reassessment. Additional improvements occurred in waist circumference (P < 0.0001).

interact multiplicatively in the development of the disease. Substantial evidence demonstrates that intensive lifestyle intervention (ILI) can reduce the incidence of type 2 diabetes in individuals at risk (4–6). The Diabetes Prevention Program (DPP) demonstrated a 58% reduction in incidence of type 2 diabetes in subjects who were randomized to the ILI group of the program (5). The ILI consisted of a structured diet and increased physical activity, without medication intervention. Significant reduction of incidence of type 2 diabetes occurred regardless of ethnicity, age, or sex. Moreover, the ILI was effective in reducing risk for cardiovascular disease (CVD) and components of the metabolic syndrome, while remaining cost-effective (7,8).

Although the DPP's intensive methodology was necessary to study the effectiveness of lifestyle changes in preventing



GLB



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- Reconfiguration of ILI from 16 individual sessions to 12 group sessions
- Inclusion criteria:
 - BMI >25 kg/m²
 - 3 of 5 components of metabolic syndrome
- 78.4% (69 of 88) completion rate
- 46.4% (32 of 69) lost 5%
- 26.1 (18 of 69) lost 7%
- 87.5% & 66.7% sustained wt loss at 6 month f/u

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GLB Results



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Table 2—Change in the proportion of subjects meeting the criteria for components of the metabolic syndrome over time after the GLB intervention (baseline, 3-month, and 6-month reassessment)

	Baseline	3-month reassessment	6-month reassessment	Unadjusted P for trend	Adjusted P*
Abdominal obesity (≥ 102 cm in males, ≥ 88 cm in females)	90.0 (45)	82.0 (41)	68.0 (34)	0.006	0.009
Abnormal HDL cholesterol (<40 mg/dl in males, <50 mg/dl in females)	66.0 (43)	67.8 (43)	65.3 (32)	0.001	0.03
Hypertension (blood pressure $\geq 130/85$ mmHg)	68.0 (34)	58.0 (29)	48.0 (24)	0.04	0.04
Triglycerides ≥ 150 mg/dl (% yes)	58.0 (29)	32.7 (16)	36.7 (18)	0.006	0.6
Glucose ≥ 100 mg/dl (% yes)	42.0 (21)	51.0 (25)	61.2 (30)	0.06	0.01

*Data presented are % (n) unless otherwise indicated. n = 50. All analyses are adjusted for age, sex, race, mean number of GLB classes attended, and time.

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Pilot Study of A Diabetes Prevention Program in A Military Community

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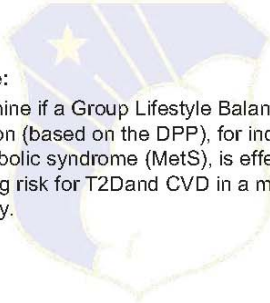
Pilot Study of A DPP in A Military Community



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Objective:

To determine if a Group Lifestyle Balance (GLB) intervention (based on the DPP), for individuals with metabolic syndrome (MetS), is effective in decreasing risk for T2D and CVD in a military community.



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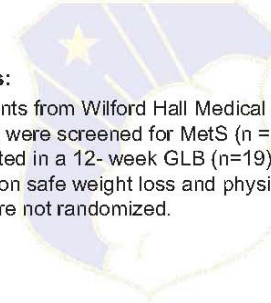
Pilot Study of A DPP in A Military Community



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Methods:

Participants from Wilford Hall Medical Center (WHMC) were screened for MetS (n = 58) and participated in a 12- week GLB (n=19) that focused on safe weight loss and physical activity. They were not randomized.



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Pilot Study of A DPP in A Military Community



Develop America's Medical Airmen Today... for Tomorrow

Results:

- Participants lost an average of 11.4 pounds over the 12 week period ($p < 0.001$)
- BMI decreased by 2 kg/m² ($p = 0.001$)
- Although not statistically significant, there was a clinically important decrease of 10mmHg in systolic blood pressure ($p = 0.07$)
- Glucose decreased by 3mg/dl, but was not statistically significant ($p = 0.06$)
- There was a significant decline in the number of MetS parameters from an average of three to two

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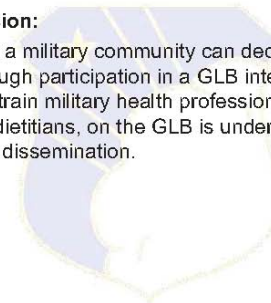
Pilot Study of A DPP in A Military Community



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Conclusion:

Adults in a military community can decrease their BMI through participation in a GLB intervention. Effort to train military health professionals, e.g. nurses, dietitians, on the GLB is underway for program dissemination.



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Develop America's Medical Airmen Today ... for Tomorrow

Pilot Study of A Media-Based DPP



Develop America's Medical Airmen Today ... for Tomorrow

Pilot Study for A Media-Based Diabetes Prevention Program in A Military Community

Lisa Strickland, Capt, USAF, MC
Joseph Pollard, MPH

Acknowledgements: Donna L. Wolf*, PhD, Hsiang-Yu
Chen*, Ms, Linda Siminerio*, RN, PhD

*affiliated with the University of Pittsburgh

Purpose:

The purpose of this feasibility program was to test a media based approach using the Group Lifestyle Balance Program (GLB), an intervention based on the Diabetes Prevention Program (DPP).

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Pilot Study of A Media-Based DPP



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Pilot Study of A Media-Based DPP



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Methods:

The GLB CD-ROM has one session per week outlining the 12-week GLB program. Each month participants came to Goodfellow AFB for group discussions and weigh-ins. A goal of the program was to reach a weight loss goal of 7% in 12-weeks. A total of 76 participants enrolled in the program.

Results:

- Of the 76 participants, 13 completed all 12-weeks of the program
- Participants who completed the program on average lost 10lbs
- Participants who completed the full program (n=13) had an average of a 6% weight loss (+ 2% to - 16.8%)
- Participants reported that they liked the monthly discussions about healthy eating and activity and the weekly motivational e-mails

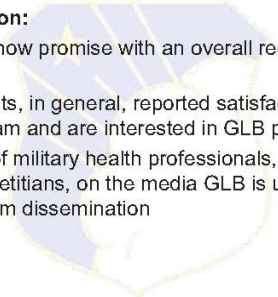
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**Pilot Study of
A Media-Based DPP**

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- Conclusion:**
- Results show promise with an overall reduction in weight
 - Participants, in general, reported satisfaction with the program and are interested in GLB programs
 - Training of military health professionals, e.g. nurses, dietitians, on the media GLB is underway for program dissemination

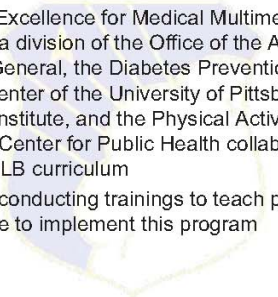


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GLB and the AF


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- Center of Excellence for Medical Multimedia (CEMM)– a division of the Office of the Air Force Surgeon General, the Diabetes Prevention Support Center of the University of Pittsburgh Diabetes Institute, and the Physical Activity Resource Center for Public Health collaborated to produce GLB curriculum
- The AF is conducting trainings to teach people Air Force Wide to implement this program



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ARE YOU TRYING TO LOSE WEIGHT?
 Introducing Group Lifestyle Balance (GLB) Program
Start Date: Week of April 12, 2010
Start Time: 11:30–12:30 PM
Location: Wilford Hall Medical Center



Group Lifestyle Balance (GLB) is a proven lifestyle intervention program. It aims to promote long-term weight loss through healthy eating and physical activity.

You may be eligible to participate in this program if you are:


- Adult (over the age of 18)
- Overweight (BMI greater than 25 kg/m²)
- Not diagnosed with diabetes
- Tobacco ONLY

If you would like to participate in the GLB program, you can enroll in a 12-week intervention program to learn healthy eating techniques and how to develop and sustain a physical activity routine.

There is no cost for the program.

For more information contact:

Callimah
 Athena Martinez – 252-251-2143
 Athena.martinez.af@hhs.med.af.mil
 CE
 Frank Garcia – 252-251-4201
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 Erin.stovall.af@hhs.med.af.mil



**Group Lifestyle Balance Program
Translating What We Know**

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- | | |
|---|---|
| <p>Option 1</p> <ul style="list-style-type: none"> • 12-weeks • Face-to-face meetings once weekly • Healthy eating techniques • Physical activity • No COST | <p>Option 2</p> <ul style="list-style-type: none"> • 12-weeks • Meet 4 times • Receive DVD/CD ROM • Weekly phone calls from prevention team • Healthy eating techniques • Physical activity • No COST |
|---|---|



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Translating What We Know



Develop America's Medical Airmen Today ... for Tomorrow

- Lifestyle Intervention is the most clinically effective and cost effective noninvasive therapy for primary prevention of diabetes
- Patients that participate lose weight
- It becomes clinically relevant to further investigate understanding what motivates patients to participate!

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Impact of A Diabetes Risk Score on Lifestyle Education and Patient Adherence



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- Six bases (Lackland, Keesler, Nellis, Travis, Andrews, and Wright-Patterson)
- Pts enrolled in 12 week Go Lifestyle Balance (GLB) CD-ROM program, based on curriculum from DPP
- BMI \geq 25 and prediabetes
- All will have DRS drawn at baseline, 12 weeks, and 24 weeks
- Experimental group given baseline results, cross over at 12 weeks
- Primary outcomes are weight loss and adherence to program

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Summary



Develop America's Medical Airmen Today ... for Tomorrow

- Diabetes in the military mirrors that of the general population despite fitness standards
- Diabetes can be prevented or delayed in high risk populations through lifestyle modification
- The GLB program is a lifestyle education program showing great promise in the arena of diabetes prevention in a military setting
- Further research is needed on weight control strategies and obesity prevention

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Questions?

Lisa.Strickland.1@us.af.mil

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References



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As cited on slides, additionally:

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Decreased Blood Glucose Levels among Metformin Dependent Diabetics Undergoing Hyperbaric Oxygen Treatment

United States Air Force School of Aerospace Medicine (USAFSAM)/FEER, Brooks AFB, TX

Maj Todd Huhn

BACKGROUND: Previous studies have shown significant decreases in blood glucose levels of insulin-dependent diabetics undergoing hyperbaric oxygen treatment (HBO2). Under normobaric conditions, metformin is not generally associated with hypoglycemia, but there has been little done to look specifically at the effects of metformin on blood glucose levels in diabetics undergoing HBO2. **METHODS:** This case series study evaluated a cohort (n=16) of metformin dependent diabetic patients to determine whether metformin is associated with decreased blood glucose levels while undergoing HBOT. Data was obtained by chart review of patients from 2002-2009. Sixteen patients were identified who were solely dependent on metformin for glucose control. All patients received pre- and post-treatment blood glucose evaluations as well as clinical evaluations for signs and symptoms of hypoglycemia following HBO2. **RESULTS:** Pre-HBO2 glucose averaged 175 mg/dL (range 131-329) and post-HBO2 glucose levels averaged 144 mg/dL (range 63-337.5). Mean blood glucose levels demonstrated a statistically significant decrease of 33.1 mg/dL ($P < 0.005$). None of the patients exhibited signs or symptoms of hypoglycemia. **CONCLUSION:** Statistically significant decrease in blood glucose was identified in diabetic patients receiving HBO2. Although rare, hypoglycemia did occur. Post HBO2 glucose monitoring is recommended in diabetic patients prior to discharge from the hyperbaric facility.



Decreased Blood Glucose Levels Among Metformin-Dependent Diabetics Undergoing Hyperbaric Oxygen Treatment
18 Aug 2010

Todd P Hulm, DO, MPH
Maj, USAF, MC, FS
USAFSAM / FEER

PI: Col (Dr) Robert Michaelson
Lackland AFB

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Introduction



- Background
- Methods
- Results
- Conclusion

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Background



Background



- Diabetics are common wound care patients (Ref 1)
 - 3% of population
 - 50% of lower limb amputations
- Hyperbaric oxygen (HBO2) indicated in selected wound healing

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- Fluctuations in glucose during HBO2 common
 - Physiologic effects of HBO2 increase glucose consumption
 - Long considered danger in recreational divers

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Background



- **Previous studies examined decreased glucose levels (Ref 2)**
 - Non-diabetics: 13.2 mg/dL
 - Diabetics
 - All diabetics: 23.2 mg/dL
 - Insulin dependent: 51 mg/dL

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Background

- **No studies found on metformin-dependent diabetics**
 - Metformin not typically hypoglycemic
 - Will patients respond as non-diabetics or diabetics
- **H₀: Blood glucose levels will not decrease during treatment**
- **H_A: Blood glucose levels will be significantly decreased during HBO2**

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Methods



- **Case series analysis**
 - 2002-2009: appr. 280 wound care patients
 - 16 diabetic patients solely dependent on **metformin**
 - Identified by chart review
 - All were included in study
- **IRB approved by Wilford Hall**

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Methods

- **Hyperbaric exposure**
 - Standard wound care treatment
 - 33-45 FSW compression
 - Total chamber time 107-130 minutes
 - **Patients averaged 27 treatments each (range 2-59)**

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Methods



Results



• Data Collection

- Pre & post-treatment examination
 - Minimum of 125 mg/dL glucose to enter chamber
 - Minimum of 100 mg/dL glucose for discharge (Ref 3,4)
- Documented via proprietary electronic record

• Total of 425 treatments

- Pre and post-treatment levels compared
 - Individual level
 - Composite
- Paired T-test used to compare data

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Patient ID	No. of Sessions	Pre-IBO2			Post-IBO2		
		Mean Glucose (mg/dL)	Median Glucose (mg/dL)	Std. Dev.	Mean Glucose (mg/dL)	Median Glucose (mg/dL)	Std. Dev.
A	26	216.7	227.5	23.3	194.2	190.5	171.1
B	23	244.2	239	34.5	227.3	209	178
C	19	208.7	202	43.3	244.3	235	45.5
D	27	202.2	204	53	202.9	285	41.5
E	36	267.2	271.5	24.5	238.7	235	29.9
F	26	177	167.5	43.2	223.8	217	28.5
G	47	252.2	247	23.4	225.3	222	278
H	59	297.7	293	54.5	292.5	285.5	57.8
I	5	256.2	242	48.8	239.8	224	23.9
J	32	245.4	248	38.2	225	223	21.2
K	2	329	329	97.6	337.5	337.5	84.2
L	57	202.2	203	45.8	237.3	232	39
M	27	245.9	243	39	254.2	255	28.2
N	4	243	231	31.4	255.5	257.5	26.4
O	43	246.7	249	36.2	232.5	235	29
P	21	222.4	203	56.2	255.7	249	36.2
Composite	425	275.4	267	46.9	244.4	235	45.3

Patient ID	Pre-IBO2 Glucose Range (mg/dL)	Post-IBO2 Glucose Range (mg/dL)	Mean Change in Glucose (mg/dL)	R ²	P Value
A	120-275	69-241	-42.5	0.259	<0.0001
B	201-292	202-257	-26.9	0.0477	0.0242
C	123-178	98-279	-54.4	0.592	<0.0001
D	122-249	239-275	-29.3	0.0256	0.395
E	125-221	93-207	-28.4	0.0256	0.00029
F	127-243	82-287	-53.2	0.0239	<0.0001
G	129-297	92-227	-37.8	0.224	0.0227
H	90-329	92-349	-6.2	0.358	0.386
I	94-224	99-247	-25.4	0.094	0.226
J	209-286	85-282	-29.4	0.0238	0.00045
K	249-308	278-397	8.5	1.00	0.535
L	122-223	69-239	-44.8	0.392	<0.0001
M	222-224	205-229	-11.8	0.9765	0.201
N	123-249	222-285	22.5	0.00425	0.579
O	124-256	67-276	-34.2	0.226	<0.0001
P	125-235	228-228	-56.7	0.086	0.0223
Composite			-31.2	0.0226	<0.0001



Discussion



- **Significant decrease in glucose noted (Ref 2,4)**
 - Comparable to existing studies
 - No clinical symptoms

Study	Mean Decrease in Glucose (mg/dL)
Delamora: Non-DM	13.2
Delamora: DM (IDDM+NIDDM)	23.2
Springer: IDDM	51
USAFSAM: Metformin only	31.1

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Discussion



- **Difference between studies for HBO2**
 - USAFSAM protocol: 125 mg/dL
 - More conservative
 - No clinical hypoglycemia
 - Standard protocol: 100 mg/dL
- **Limitations**
 - EHR did not have demographic references
 - EHR did not include interventions

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Discussion



- **EHR has shortfalls**
 - No documentation of interventions
 - Unable to pull demographics
- **USAFSAM screening validated**
 - No clinical hypoglycemia
 - Continue with current protocol

Questions?

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Team Based Approach to Diabetes Care

Wilford Hall Medical Center (WHMC), Medical Wing (MDW), Lackland AFB, TX

Mark True, MD, Nina Watson, RN, CDE, Joseph Pollard, MPH, Acknowledgements: Linda Siminerio*, RN, PhD, Kristine Ruppert*, DrPH

INTRODUCTION: A team approach has repeatedly been shown to improve the quality of care for individuals with diabetes. The Diabetes Center of Excellence (DCOE) at Wilford Hall Medical Center (WHMC) serves as a military regional hub for the provision of quality programs and a specialty clinic with team-based care resources for patients. The DCOE team serves as a referral center for patients with diabetes not meeting clinical targets. **RESULTS:** Patients were seen at the DCOE between January and December 2009. Results are based upon data collected from patients with an initial A1c >6% and documented follow-up A1c (n=378). These patients showed an average A1c decrease of 0.67% (p=0.001). Patients with an initial A1c >7% (n=323) showed an average decrease of 0.84% (p=0.001); patients with an initial A1c >8% (n=238) showed an average decrease of 1.12% (p=0.001); and patients with an initial A1c >9% (n=134) showed an average A1c decrease of 1.62% (p=0.001). **CONCLUSION:** These results indicate that a team-based specialty diabetes clinic in a military facility has a positive impact on glycemia. Additional study is needed to evaluate the impact on other metabolic outcomes.

*affiliated with the University of Pittsburgh



Disclosure Slide



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Team-Based Approach to Diabetes Care

Mark W. True, Lt Col, USAF, MC
Nina A. Watson, RN, MSN, CDE
Joseph Pollard, MPH
Linda Siminerio, RN, PhD, CDE
Kristine Ruppert, DrPH

- None of the faculty or planners of this presentation have any financial or other interest, arrangement, affiliation, or relationship with any organization that could be perceived as a real or apparent conflict of interest with the content of this activity

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Overview



Diabetes Epidemiology



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- Defining the key problem in diabetes care
- Diabetes Center of Excellence team-based practices
 - Team-based appointment model
 - Use of home-grown IT tool to facilitate team-based effort
 - Use of nursing staff for insulin titration between visits
- Future Directions

- 23.6 million diabetics in US
 - 17.9 million diagnosed
 - 5.7 million un-diagnosed
- 57 million pre-diabetics
- 7th leading cause of death

CDC. National Diabetes Fact Sheet, 2007.
Source: 2003–2006 National Health and Nutrition Examination Survey estimates of total prevalence (both diagnosed and undiagnosed) were projected to year 2007.

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Diabetes Complications



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- Heart disease → 2-4x more likely
- Stroke → 2-4 x more likely
- Blindness → 12-14k new cases each year
- Kidney failure/dialysis → 46k new cases yearly
- Nervous system disease → amputations → 71k/yr

CDC. National Diabetes Fact Sheet, 2007.
 Source: 2003-2006 National Health and Nutrition Examination Survey estimates
 of total prevalence (both diagnosed and undiagnosed) were projected to year 2007.
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Why should AFMS care about diabetes?



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- "It's mostly a problem of retirees...right?"
- FY 06 -- TRICARE treatment costs for its 622,000 diabetic beneficiaries → billions
 - \$10,000+ allocated per patient, per year
- Current level of care
 - 40% of diabetic patients achieve blood sugar control goals
 - Fewer diabetic patients achieve all 3 glucose, lipid and blood pressure goals
- Significant additional costs are being incurred due to the high incidence of associated complications stemming from diabetes management shortfalls

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Why diabetes research?



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- Focus of AFMS research should be on wartime priorities first and peacetime care of our beneficiaries second
- We exist for wartime...this is why we wear the uniform
- However, if we don't control the diabetes epidemic, we will bankrupt the MHS and hinder our ability to focus on our primary wartime requirements
- Additionally, we need to research methods to ensure that we have an optimum fighting force through diabetes prevention measures

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Defining the problem



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- US population – 24 million people with diabetes
 - Endocrinology shortage: only 4,000 in clinical practice
 - Certified Diabetes Educators shortage: 30,000 diabetes educators (15,000 certified diabetes educators)
- US Air Force
 - 8 endocrinologists, ~ 20 CDEs in dedicated positions
 - ~40,000 people with diabetes in AF healthcare system
 - Includes active duty and family members, retirees and spouses
- Result: bulk of chronic diabetes care provided at primary care level

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Comprehensive Diabetes Visit



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Table 8—Components of the comprehensive diabetes evaluation

<p>Medical history:</p> <ul style="list-style-type: none"> Age and characteristics of onset of diabetes (e.g., DMCA, symptoms, laboratory findings) Family patterns, physical activity habits, nutritional status, and weight history, growth and development in children and adolescents Diabetes education history Review of previous treatment regimens and response to therapy (A1C records) <p>Current treatment of diabetes, including medications, meal plan, physical activity patterns, and results of glucose monitoring and patient's use of data:</p> <ul style="list-style-type: none"> DMCA frequency, activity, and cause Hypoglycemia episodes Hypoglycemia awareness Any severe hypoglycemia: frequency and cause History of diabetes-related complications: <ul style="list-style-type: none"> Microvascular: retinopathy, nephropathy, neuropathy (history, including history of loss of vision, autonomic, including sexual dysfunction and gastroparesis) Macrovascular: CHD, cerebrovascular disease, PAD Other psychosocial problems*, dental disease* <p>Physical examination:</p> <ul style="list-style-type: none"> Height, weight, BMI Blood pressure determination, including orthostatic measurements when indicated Cardiovascular examination* Thyroid palpation Skin examination (for acanthosis nigricans and insulin injection sites) Comprehensive foot examination: <ul style="list-style-type: none"> Inspection Palpation of distal pulses and posterior tibial pulses Transillumination of pupils and Achilles reflexes Determination of proprioception, vibration, and monofilament sensation 	<p>Laboratory evaluation:</p> <ul style="list-style-type: none"> A1C, if results not available within past 2-3 months If not performed/obtainable within past year: <ul style="list-style-type: none"> Fasting lipid profile, including total, LDL, and HDL cholesterol and triglycerides Urea function tests Test for serum albumin excretion with spot urine albumin:creatinine ratio Urea creatinine and calculated GFR TSH in type 1 diabetes, dyslipidemia, or women over age 50 years <p>Referrals:</p> <ul style="list-style-type: none"> Annual dilated eye exam Family planning for women of reproductive age Referral to dietitian for MDD* DMCAE Foot examination Mental health professional, if needed <p>* See appropriate criteria for these categories.</p>
--	--

DIABETES CARE, VOLUME 33, SUPPLEMENT 1, JANUARY 2010

Who can do all of these things
 in a 15-minute visit
 every 3-6 months?

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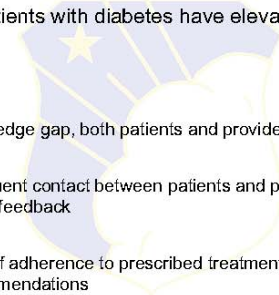


Failure to Meet Goals



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- Most patients with diabetes have elevated Hgb A1c
- Why?
 - Knowledge gap, both patients and providers
 - Infrequent contact between patients and providers, lack of timely feedback
 - Lack of adherence to prescribed treatment recommendations



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Diabetes Center of Excellence Inception



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- Started in January 2009, funded through Congressional special interest program
- Several areas of focus:
 - Adult: outpatient care, primary prevention, inpatient
 - DCOE is terminology for adult portion of program
 - Pediatric: diabetes/obesity prevention, diabetes
 - Congressional program also provides staffing to pediatrics clinics
- Focus of this presentation: **Adult outpatient care**

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Best Practice 1: Team-Based Appt Model



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1. Prior to scheduled appt
 - Lab work gets done 1-2 weeks prior to appt
 - Pts instructed to record BG 4x/day for 7 days
2. Check-in process
 - Completed by clinic support staff
 - Download glucose meter
 - Vitals signs/foot exam
 - Review of symptoms, medications, prevention screening (ophthalmology, microalbumin, etc.)
 - All data on a shared drive spreadsheet application

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Team-based Appt Model



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3. Physician/Clinician visit (includes staff endocrinologists, fellows, residents, NPs)
4. Nurse Educator/CDE visit
 - Review diabetes self-management plan
 - Review changes in medications
 - Provide lifestyle modification coaching as needed
 - Set patient oriented goals for next visit
 - Schedules any additional services
 - Next 3 month appointment set up

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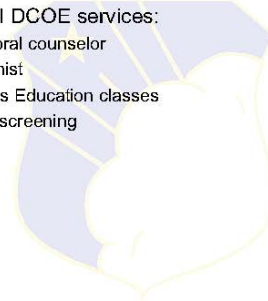


Team-based model



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- Additional DCOE services:
 - Behavioral counselor
 - Nutritionist
 - Diabetes Education classes
 - Retinal screening



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Best practice #2: IT tool to promote teamwork



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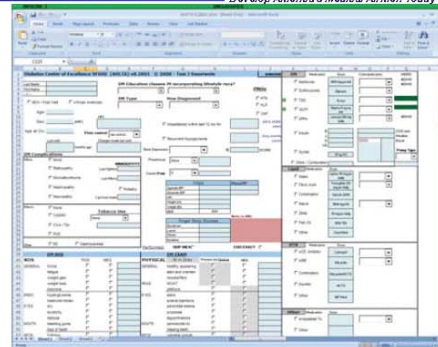
- We use a common spreadsheet application in the DCOE to assist providers in meeting standards of care
 - Very well received by our providers
 - Facilitates team-based approach (all can access it)
 - Prompts and enforces standards of care
 - Standardizes gathering/storing of information and documentation

DCOE Spreadsheet highlights

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Best Practice #3:
Nurse Contact between provider visits





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- Certified Diabetes Educator
 - 1:1 f/u as needed to assist patient with medication titration or lifestyle changes
 - Review SMBG/food/exercise logs
 - Reinforce desired behaviors
- Insulin titration
 - Reinforce patient instructions for self-titration
 - Protocol for assisting patient with self-titration
 - Insulin titration forms

Editorials

How Our Current Medical Care System Fails People With Diabetes

Lack of timely, appropriate clinical decisions

The one approach that has proven to be effective is using specially trained nurses or pharmacists, under appropriate supervision, with authority to make medication changes without consulting the physician as long as the changes fell within approved treatment algorithms. In randomized clinical trials, A1C levels fell threefold more in 1,969 patients followed by nurses and pharmacists compared with 1,573 patients under usual care (7).

an approval achieved the improvements, whereas as had minimal effect. factor that underlies the cally trained nurses or improve the outcomes of that timely and appropriate decisions are made. The decision appropriate because they are ved treatment algorithms. iness of these decisions is rant. The fact that more ent with the patient, not e dealing specifically with o outside of the office via communication, is critical outcomes. For the most the minority of patients erta and polydipsia acc- w/ hyperreflexia or those

Diabetes Care, volume 33, number 2, February 2010

LANTUS® INSULIN ADJUSTMENT

Take one shot of Lantus®(glargine) insulin at 10 pm. Your starting dose is 10 units of Lantus®(glargine).

Take your fasting blood sugar every day before breakfast. You will adjust your Lantus®(glargine) insulin to normalize your before breakfast fingerstick blood sugar.

If your morning fingerstick blood sugar remains greater than 120, for 3 days in a row increase your Lantus®(glargine) insulin dose by 2 units. Continue to increase your dose every 3 days until your morning glucose is less than 120.

If you experience unexplained low blood sugars (<70) at any time of the day, do not increase your Lantus®(glargine) dose that day.

If 2 consecutive morning blood sugars are less than 80, decrease your Lantus®(glargine) insulin dose by 4 units.

Levemir® (detemir) & NovoLog® Self-Adjustment

BEFORE BREAKFAST take:

10 units of NovoLog® (aspart) insulin

BEFORE LUNCH take:

10 units of NovoLog® (aspart) insulin

BEFORE SUPPER take:

10 units of NovoLog® (aspart) insulin

BEFORE bedtime take:

30 units of Levemir® (detemir)

IF FINGERSTICK BLOOD SUGARS ARE ABOVE THE TARGET:

If your blood sugar **before breakfast** is over 120 for 3 consecutive days, increase the Levemir® (detemir) insulin taken at 10:00 pm by 5 units. Continue increasing your Levemir® insulin every 3 days until your blood sugar before breakfast is less than 120.

If your blood sugar **before lunch** is over 140 for 3 consecutive days, increase the NovoLog® insulin taken with breakfast by 2 units. Continue increasing the breakfast NovoLog® insulin every 3 days until your before lunch blood sugar is less than 140.

If your blood sugar **before dinner/supper** is over 140 for 3 consecutive days, increase the NovoLog® insulin taken with lunch by 2 units. Continue increasing the lunch NovoLog® insulin every 3 days until your before supper blood sugar is less than 140.

If your blood sugar at **bedtime** is more than 140 for 3 consecutive days, increase the NovoLog® insulin taken with dinner/supper by 2 units. Continue increasing the dinner/supper NovoLog® insulin every 3 days until your bedtime blood sugar is less than 140.

**SUPPLEMENTAL
Sliding Scale Insulin**

Use **NovoLog® (aspart)** for the supplemental sliding scale.

Check your fingerstick blood sugar 4 times a day and record. Give **NovoLog® before meals only** according to the following scale (in addition to your normal dose):

Blood sugar reading	Action
<70 Call Nurse if recurrent	Eat or drink 15 gm of carbohydrate (CHO), ¼ c of fruit juice or regular soda, 1 c of milk, or 3 glucose tablets
<u>70</u> - <u>150</u>	Do not change dose
<u>150</u> - <u>200</u>	Inject <u>1</u> extra units
<u>201</u> - <u>250</u>	Inject <u>2</u> extra units
<u>251</u> - <u>300</u>	Inject <u>3</u> extra units
<u>301</u> - <u>350</u>	Inject <u>4</u> extra units
> <u>350</u>	Inject <u>5</u> extra units

Type Of Insulin	Appearance	Starts Working	Main Effect	Duration
NovoLog® (aspart)	Clear	< 30 min	30-90 min	3-4 hours

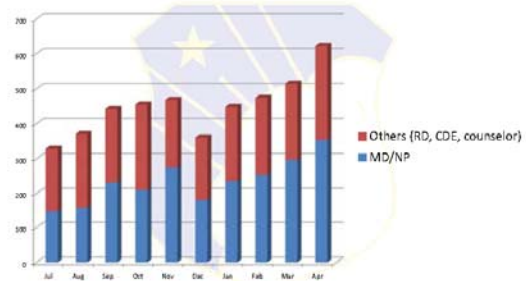
If you have any difficulty in adjusting your insulin, or have questions about your insulin therapy, feel free to call Nurse Wingate @ 292-7594, Nurse Kipatrick @ 292-2915, Nurse Watson @ 292-0352 or Nurse Gonzalez @ 292-3762 for assistance.



DCOE Patient Visits



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DCOE Impacts on DM2



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- Jan 09 to Dec 09 impact on Hgb A1C

Initial A1C	Number of patients w/ at least one follow-up	Average A1C drop at follow-up visit
>6.0%	378	0.67%
>7.0%	323	0.84%
>8.0%	238	1.11%
>9.0%	134	1.62%

Note these stats are from referred patients that "failed" traditional primary care management

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DCOE Impacts on DM2



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- Jan 09 to Dec 09

Initial A1C	Number of patients w/ at least one follow-up	Average A1C drop at follow-up visit
6 - 7 %	49	0.30%
7 - 8 %	88	0.00%
8 - 9 %	103	0.39%
> 9 %	134	1.62%

Note these stats are from referred patients that "failed" traditional primary care management

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A1C < 7% Target in Question



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The NEW ENGLAND JOURNAL of MEDICINE

Effects of Intensive Blood Glucose Outcomes in Patients

ORIGINAL-ARTICLE

Glucose Control and Vascular Complications in Veterans with Type 2 Diabetes

ORIGINAL-ARTICLE

William Duckworth, M.D., Carlos Abraira, M.D., Thomas Mitrz, M.S., Domenico Sada, Ph.D., Nicholas Emanuele, M.D., Peter D. Beaven, M.D., Franklin J. Zieve, M.D., Ph.D., Jennifer Mavris, M.D., Stephen N. Davis, M.D., Bradley Hayward, M.D., Stuart R. Warren, J.D., Ph.D., Steven Goldman, M.D., Madeline McCamren, Ph.D., M.F.H., Mary Ellen Vitik, William G. Henderson, Ph.D., and Grant D. Huang, M.P.H., Ph.D., for the VADT Investigators*

ACCORD Study Group, NEJM 2008; 358:2545-2559.
 ADVANCE Collaborative Group, NEJM 2008; 358:2560-2572.
 VADT Investigators, NEJM 2009; 360:129-139.

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	ACCORD	ADVANCE	VADT
Study size (n)	10,251	11,140	1,791
BMI	32.2	28	31
Years of DM	10	8	11.5
Baseline A1c	8.3	7.5	9.4
Prior CVD	35%	32%	40%
A1C (%) (Intensive vs. Control)	6.4 vs. 7.5 *	6.4 vs. 7.0 *	6.9 vs. 8.4 *
Nonfatal MI (%)	3.6 vs 4.6 *	2.7 vs.2.8	6.3 vs. 6.1
CV Death (%)	2.6 vs. 1.8 *	4.5 vs. 5.2	2.1 vs.1.7
Microvascular	-	21% ↓ nephropathy	-
Take home	↓ risk MIs, but ↑ risk death in intensive arm	Glucose control has no impact on CV events, but ↓ Microvascular risk	Glucose control has no impact on CV events



Future Directions



Develop America's Medical Airmen Today ... for Tomorrow

- With the Congressional program coming to a close, it is unclear how much of the DCOE program will be sustained long-term
- It is clear that the AFMS is not increasing, but reducing, personnel
- There are many tangible lessons that can be taken from our experience

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Lessons Learned



Develop America's Medical Airmen Today ... for Tomorrow

- Team-based care model is effective!
 - We should not rely on individual providers to solely deliver care to diabetic patients
- Primary care clinics can set up similar models for diabetic patients; NPs/PAs/CNS participation encouraged
 - We helped Goodfellow AFB establish a "diabetes day" model over the past year, and A1C levels dropped by 0.5%
- Family Health Initiative (FHI) program has disease management focus with designated disease managers
 - These disease managers should develop team-based models of care within their MTFs based upon DCOE practices
- Nurse contact between provider visits is beneficial

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IT can help



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- In resource competitive environment, we must start looking to use IT solutions to do more for us
- We used a locally developed IT tool to facilitate team-based approach
- There is a need for expanding these types of solutions for AF-wide use

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Diabetes IT System



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- Key capabilities needed in a Diabetes IT System:
 - Computerized information support system that accurately tracks outpatient diabetics and prompts action when needed (i.e., diabetes registry with alerts)
 - Easy-to-follow protocols of care that are available to clinicians on their computer desktops at the point of patient care
 - Populates display with appropriate clinical information
 - Ensures the appropriate questions are asked by clinician
 - Provides automated decision support in accordance with recognized standards of care
 - Consolidates findings/decisions into standardized EMR note
- Note that a chronic disease management platform for diabetes would also work for any other chronic disease

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Progress towards a Diabetes IT solution



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- Requirements for a Diabetes IT System (DITS) were validated at the Air Force SGROCC in June 2009
- Development of Capability Development Document (CDD) completed and approved Apr 2010
- Computer-Aided Decision Support (CADS) system developed at Walter Reed is a potential solution; we are participating in a multi-site validation trial
- CarePoint could also be further developed
- However, funding is not currently readily available for full-scale development and implementation

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Summary



Develop America's Medical Airmen Today... for Tomorrow

- Diabetes epidemic exceeds our current resources
- Team-based care model is effective in improving care, especially for diabetic patients that have failed traditional management
 - Appointments can be structured to facilitate team interaction
 - IT tools can help facilitate team interaction, and reinforce standards
 - Use of trained nursing staff b/t visits for insulin titration
- Need for broader IT development to bridge projected resource gaps

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**The Effect of Special Duty Subpopulations on the Prevalence of Secretive Behaviors in the USAF
United States Air Force School of Aerospace Medicine (USAFSAM)**

Col Mary Brueggemeyer

In the USAF, special duty status is defined as FLY, PRP (Personnel Reliability Program) or SCI (Special Compartmented Information) related duties. It is used to designate mission critical populations upon whom the AF Medical Service (AFMS) can apply focused preventive efforts to maintain human performance and insure mission success. These special duty subpopulations differ in work culture and job stress that may influence the prevalence of secretive behaviors such as alcohol abuse, suicidality and partner/child abuse. Knowledge about the prevalence of secretive behaviors within these special duty subpopulations could help focus prevention efforts. The USAF NORTHSTAR Project uses an anonymous community assessment (CA) survey to measure secretive behaviors by base and special duty status, but does not stratify by special duty subpopulation. Using official USAF manpower allocations, bases with predominant special duty subpopulations were grouped together. The 2008 CA survey was analyzed using the special duty subpopulation groups. Results showed that aircrew bases (AC) were more likely to report alcohol problems than SCI bases (OR 1.64, CI 1.25-2.15, $p=0.002$); PRP bases were more likely to report suicidal thoughts than AC bases (OR 2.33, CI 1.29-4.19, $p=0.004$) and SCI bases were more likely to report spouse emotional abuse than AC bases (OR 1.77, CI 1.19-2.65), $p=0.004$) or PRP bases (OR 1.34, CI 1.01-1.79, $p=0.04$). Special duty subpopulations are not homogenous. Knowledge of the risk and protective factors within these communities will improve prevention of secretive behaviors and reduce mission impact. Future CA surveys should stratify by special duty subpopulation.



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The Prevalence of Secretive Behaviors in USAF Special Duty Subpopulations

Mary T. Brueggemeier, MD, MPH
Col, USAF, MC, FS
RAM-X

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Introduction

- ▼ Introduction
 - ▼ Secretive Behaviors
 - ▼ NORTH STAR Project
 - ▼ Community Assessment Survey
 - ▼ Special Duty Populations
 - ▼ Purpose and Relevance
- ▼ Methods
- ▼ Results
- ▼ Discussion
- ▼ Conclusions

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Introduction



- Secretive Behaviors
 - ▼ Suicidality
 - ▼ Family Maltreatment
 - ▼ Substance Abuse

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Introduction

- NORTH STAR Project
 - ▼ Community Capacity model
 - ▼ Risk factors
 - ▼ Protective factors
 - ▼ Interagency approach
 - ▼ CAIB and IDS
 - ▼ Use community assessment to guide implementation of evidence-based prevention programs

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 **Introduction** 

Community Assessment Survey

- ✓ Measures community risk and protective factors and prevalence of secretive behaviors

Suicidality

- CDC tool
- Suicidal thoughts
- Suicidal behavior



Alcohol Use

- WHO AUDIT tool
- Alcohol consumption
- Alcohol problems

Family Maltreatment



- Validated measurement tool (SUNY researchers)
- Partner emotional and physical abuse
- Child emotional and physical abuse

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 **Introduction** 



- ✓ 2003 Pilot Survey
 - ✓ 3 USAF Bases
 - ✓ Prevalence of SB: 20.4%
 - ✓ Special Duty Population (FLY + PRP + SCI)
 - ✓ Prevalence of SB: 19.1%
- ✓ Conclusions
 - ✓ Respondents willing to report SB on anonymous survey
 - ✓ SBs are prevalent in USAF including special duty personnel

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 **Introduction** 

- ✓ Special Duty Population (SDP)
 - ✓ PRP- SCI- FLY
 - ✓ Not homogeneous
 - ✓ Different missions, job stressors, culture and support

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 **Introduction** 

- ✓ Behavioral health treatment seeking patterns
 - ✓ Study #1 (Rowan, 1996)
 - ✓ SDP had lower rates of self-referral
 - ✓ SDP had higher rates of negative career impact by avoiding or delaying professional assistance
 - ✓ SDP was 68% TS-SCI on intelligence training base

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Introduction

- ▼ Behavioral health treatment seeking patterns
 - ▼ Study #2 (Rowan, 2006)
 - ▼ SDP less likely to self-refer (p<0.04)
 - ▼ TS-SCI had higher command-directed referral (14%) than Aircrew (0%)
 - ▼ Aircrew had higher peer directed referral (50%) than TS-SCI (14%)
 - ▼ PRP not adequately represented

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Introduction

- ▼ 2008 Community Assessment: Large SCI- AFB
 - ▼ >90% of SDP is TS-SCI
 - ▼ Suicidality: 6.1% vs 3.0% (USAF SDP)
 - ▼ Female to male emotional abuse: 22.7% vs. 14.2%

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Introduction

- ▼ Purpose of Study:
 - ▼ Further define the effect of special duty subpopulations on the prevalence of secretive behaviors across the Air Force
 - ▼ Change future community assessment surveys to stratify special duty subpopulations
 - ▼ Focus USAF leadership on building protective factors in special duty subpopulations.

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Methods

SCI BASES	%FLY	%PRP	%SCI
Base 1	0%	0%	100%
Base 2	0%	0%	100%
Base 3	0%	0%	100%
Base 4	1%	0%	99%
Base 5	1%	0%	99%
Base 6	2%	0%	98%
Base 7	2%	0%	97%
Base 8	3%	0%	97%
Base 9	1%	2%	97%
Base 10	4%	0%	96%
Base 11	7%	0%	93%
Base 12	7%	0%	93%
Base 13	7%	0%	93%
Base 14	8%	0%	92%
Base 15	9%	0%	91%

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Methods

- ✓ Compared summary statistics for each secretive behavior by special duty subpopulation group
- ✓ 2 x 2 contingency tables
- ✓ Odds Ratios with 95% confidence intervals
- ✓ Chi Square with p-value < 0.05 *

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Results: Demographics

VARIABLE	FLY	PRP	SCI
AGE			
18-25	38%	36%	19%
26-45	67%	66%	75%
46+	3%	2%	6%
RANK			
Enlisted	24%	25%	60%
Officer	76%	25%	40%
YEARS IN SERVICE			
0-5	4%	3%	19%
6-10	29%	27%	20%
11-15	12%	14%	20%
16-20	10%	15%	25%
20+	4%	12%	18%
MARITAL STATUS			
Married	64%	68%	71%
Single	33%	25%	20%
Divorced	3%	7%	9%
CHILDREN			
None	63%	69%	42%
1 or more	37%	31%	58%

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Results: Suicidality

Suicidal Thoughts by Group				
	SCI	PRP	FLY	Total
Yes	74	59	14	147
No	2453	1404	775	4632
Total	2527	1463	789	4779
Suicidal Behavior by Group				
	SCI	PRP	FLY	Total
Yes	3	5	2	10
No	2525	1459	788	4772
Total	2528	1464	790	4782

Special Duty Subpopulation	Suicidal Thoughts		
	OR	CI	p-value
PRP vs. SCI	1.39	0.98 - 1.97	0.06
PRP vs. FLY	2.33	1.29 - 4.19	0.004
SCI vs. FLY	1.67	0.94 - 2.97	0.1

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Results: Alcohol Use

Alcohol Consumption by Group				
	SCI	PRP	FLY	Total
Yes	56	72	33	161
No	2507	1423	775	4705
Total	2563	1495	808	4966
Alcohol Problem by Group				
	SCI	PRP	FLY	Total
Yes	54	48	34	136
No	2509	1447	774	4730
Total	2563	1495	808	4966

Special Duty Subpopulation	Alcohol Consumption			Alcohol Problem		
	OR	CI	p-value	OR	CI	p-value
PRP vs. SCI	2.26	1.59 - 3.23	<.0001*	1.54	1.03 - 2.26	0.03*
FLY vs. SCI	1.91	1.23 - 2.95	0.003*	2.04	1.32 - 3.16	0.001*
PRP vs. FLY	1.18	0.78 - 1.81	0.46	0.75	0.48 - 1.18	0.24

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Results: Partner Abuse

Partner Emotional Abuse by Group				
	SCI	PRP	FLY	Total
Yes	170	73	30	273
No	1910	1103	588	3612
Total	2080	1176	623	3885
Partner Physical Abuse by Group				
	SCI	PRP	FLY	Total
Yes	28	19	9	56
No	2004	1151	601	3756
Total	2032	1150	610	3792

Special Duty Subpopulation	Partner Emotional Abuse			Partner Physical Abuse		
	OR	CI	p-value	OR	CI	p-value
SCI vs. PRP	1.34	1.01 - 1.79	0.04*	0.83	0.46 - 1.50	0.54
SCI vs. FLY	1.77	1.19 - 2.65	0.004*	0.93	0.44 - 1.99	0.85
PRP vs. FLY	1.32	0.85 - 2.04	0.21	1.12	0.50 - 2.49	0.78

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Discussion: Does this make sense?

FLY

- ✓ Strong wingman culture
- ✓ Dedicated flight surgeon and technicians focused on keeping the flyer flying
- ✓ Use alcohol and social gatherings ("role call") to reduce stress in the community

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Discussion: Does this make sense?

PRP

- ✓ Lost focus and support
- ✓ Increased operations tempo and inspections
- ✓ Medical support focused on restriction from duty
- ✓ Larger enlisted & younger population
- ✓ Possibly significant SCI population influence on results (PRP 2/3 & SCI 1/3)
- ✓ Increased risk for suicidality and alcohol problems

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Discussion: Does this make sense?

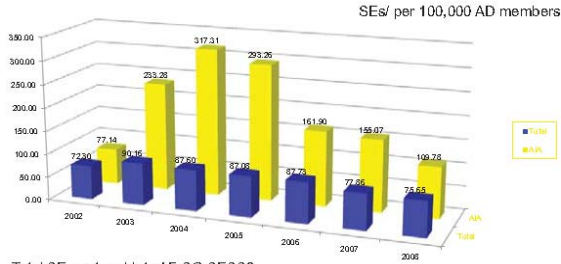
SCI

- ✓ Initial hypothesis: SCI would have higher rates of suicidality and partner emotional abuse.
 - ✓ Only partner emotional abuse was significantly higher for this group
- ✓ Secretive community
- ✓ No wingman culture
- ✓ No dedicated medical support
- ✓ Low density and high demand

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Total Suicide Event Rate: AF vs AF ISR Agency



Total SEs entered into AF SG SESS2
Population Data from AFPC RAW - IDEAS

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Discussion: Other Evidence

Positive screening responses				PTSD Screening Questions	AMXS	IS
Self referrals to Mental Health (MHC)				Have had any nightmares about it or thought about it when you did NOT want to?	8.3%	41.7%
	# in Squadron	# MHC	Rate	Tried hard NOT to think about it, went out of your way to avoid situations that remind you of it?	8.3%	33.3%
MXS	357	7	20/1000	Were constantly on guard, watchful, or easily startled?	8.3%	50.0%
AMXS	563	12	21/1000	Felt numb or detached from others, activities, or your surroundings?	25.0%	41.7%
SFS	267	8	30/1000			
IS	329	12	36/1000			

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Special Duty Demographics

Population	Totals	Percent	Comments
Total USAF	330K		Not including new 6K downsizing
Special Duty	106K		Total positions coded in one of SD types
SCI		7-100%	All bases; Mean 66%
PRP		0-67%	Specific bases
Fly		0-93%	Only 3 bases > 90%; most mixed

NOTES OF INTEREST:

Special Duty status applies to approximately 1/3 of the Air Force.
SCI personnel are 1/5 of the entire AF!
Flyers are only 7% of the entire Air Force!
SCI personnel currently are 3 times more numerous than FLY personnel.
PRP only constitutes 4% of the AF (about half of the FLY).

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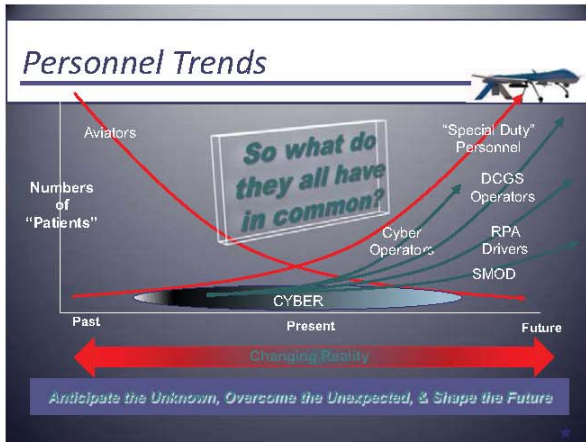
Special Duty Demographics

Population	Totals	% AF/% SD	Comments
Total USAF	330K		
Special Duty	106K	32%	Special Duty % (% total AF)
FLY	23.9K	7%/22%	Some overlap with both PRP & SCI
PRP	13.3K	4%/13%	Overall small % of AF in nuclear enterprise
SCI	69K	21%/65%	1/5 of entire AF!

NOTES OF INTEREST:

Special Duty status applies to approximately 1/3 of the Air Force.
SCI personnel are 1/5 of the entire AF!
Flyers are only 7% of the entire Air Force!
SCI personnel currently are 3 times more numerous than FLY personnel.
PRP only constitutes 4% of the AF (about half of the FLY).

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Non Physical Effects of Warfare

- Combat Fatigue
- 1000 Yard Stare
- Shell Shock
- Battle Wary Soldier
- Battle Fatigue
- Combat Stress Reaction
- PTSD

- SERE Experience
- Stanford Prison Experiment
- Hollywood
- Disneyland

27

Welcome to the Future

... The NEW COMBAT ZONE!

- Telecommuting to the war zone.
- "Tele-WARFARE"

28

Limitations

- ∨ Overlap between special duty subpopulations
 - ∨ This study: most significant for PRP and SCI
 - ∨ In general: most bases are a mix of SCI and FLY
- ∨ Self-reported survey from 2008
- ∨ Confounders: many other factors can influence secretive behavior besides special duty status
 - ∨ Age, marital status, officer, enlisted, etc...
 - ∨ Regression analysis and modeling

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Conclusions



- ✓ **Special duty subpopulations are not homogenous**
 - ✓ FLY more likely to report alcohol problems
 - ✓ PRP more likely to report alcohol problems and suicidality
 - ✓ SCI more likely to report spouse emotional abuse
- ✓ **SCI makes up a large percentage of the air force and special duty subpopulation.**
- ✓ **Common denominator = combatant**
 - ✓ In the past, combatant = pilot/aircrew
 - ✓ Built protective culture to insure mission completion
 - ✓ Extend to other special duty populations

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Conclusions



- ✓ **Medical group, specifically flight surgeons, should understand the differences in culture, behavior, stressors and protective factors within the special duty subpopulations at their base**
- ✓ **The community assessment survey is a valuable tool for evaluating a base community**
 - ✓ Use NORTHSTAR model/CAIB/IDS to develop community based preventive strategies for the special duty population
 - ✓ More valuable if special duty status was stratified into Fly – PRP – SCI

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Questions



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**The Association between Mental Health and Cigarette Smoking in Active Duty Military Members
United States Air Force School of Aerospace Medicine (USAFSAM)/FEER RAM-X**

Maj/Dr. Erich Schroeder

Despite an overall decrease in smoking in the armed forces, the prevalence of smoking in the military remains at approximately thirty-three percent. Previous research has shown an association between mental health status and cigarette smoking. This cross sectional prevalence study examined four specific mental health predictors and the outcome variable any smoking. The four specific mental health predictors include “needed further depression evaluation,” “received mental health counseling,” “perceived need for mental health counseling,” and “depression or anxiety medical prescription.” The outcome variable any smoking is defined as smoking one or more cigarettes in the past 30 days. The population included active duty military members serving in the United States Army, Air Force, Navy and Marine Corps. The data was collected during the 2005 Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel, a component of the Defense Lifestyle Assessment Program. The sample size included 13,603 subjects. This study consisted of descriptive statistics, univariate analysis, and multivariate logistic regression analysis of the four mental health predictors and the any smoking outcome variable. Univariate analysis and multivariate adjustment showed the data to be reliable. These analyses also showed an association between the four mental health predictors and any smoking, but not necessarily that mental health predicted smoking. More research and analysis is required to better determine the association of mental health with smoking in this population. This research could help guide public health officials in the development of smoking prevention and cessation programs not only for the military population, but also for the population at large.



**IS THERE AN ASSOCIATION
 BETWEEN MENTAL HEALTH AND
 CIGARETTE SMOKING IN ACTIVE
 DUTY MILITARY MEMBERS?**

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 **Introduction: Aim and Goals** 

- **To determine if a relationship exists between mental health disorders and cigarette smoking in active duty military members**
 - Data from the 2005 Department of Defense (DoD) Survey of Health Related Behaviors (HRB) Among Active Duty Military Personnel
- **Goal is to improve health and readiness of service members**

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 **Background: General Tobacco Use** 

- **Tobacco use is the single most preventable cause of death and disease in the US (Centers for Disease Control and Prevention, 2005)**
- **Approximately 21 percent of the US population (approximately 45 million people) smoke cigarettes (CDC, 2005)**

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 **Background: General Tobacco Use Cost** 

- **Total annual public and private health care expenditures: \$96.7 billion (CDC, 2006)**
- **Taxpayers' yearly federal and state tax burden: \$70.7 billion or \$630 per household (CDC, 1993)**
- **Smoking-caused health costs and productivity losses per cigarette pack: \$10.28 (CDC, 2006)**
- **Average retail price per pack in the US (including sales tax): \$4.20 (CDC, 2006)**

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Background: Tobacco Culture in Armed Forces



- Cigarettes included in C-rations and K-rations during WWII and Korean War (Blake, 1985)
- Many young recruits started to smoke immediately after joining the military; “smoke breaks” often used as both reward and punishment (Cronan, 1989)
- In the 1980s, DoD initiated health promotions measures to improve health and (DoD Directive, 1986)

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Background: Cigarette Use and Cost in Armed Forces



- Cigarette usage in military has declined over past 20 years, 51% versus 32%
- Heavy smoking also declined within the DoD from 1980 to 2005, from 34.2% to 11.0%
- Smoking related healthcare costs in the DoD: approx \$530 million / year
- Associated lost productivity costs: approx \$345 million a year (Conway, 1998)

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Background: Mental Disorders



- Mental disorders are a common ailment in the United States
- It is estimated that approximately 1 in 4 adult Americans are afflicted with a diagnosable mental disorder
- Mental disorders are the leading cause of disability in the United States for individuals 18-44 years old (National Institute of Mental Health, 2008)

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Background: Mental Disorders in the Military



- Almost 1 in 5 respondents to the 2005 HRB Survey indicated a perceived need for mental health care within the past 12 months
 - About 15 percent received that care
- Post-deployment, 38% of soldiers and 31% of Marines report psychological symptoms (Mental Health Task Force)
- Mental disorders appear to be the most important source of medical and occupational morbidity in active duty military members (Hoge, Lesikar, Guevara, Lange, Brundage, Engel, Messer, and Orman, 2002).

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 **Background: Mental Disorders and Cigarette Smoking**

- Researchers have found high smoking rates in selected populations of people with mental illness
- Anxiety disorders, as well as smoking behavior variables and alcohol abuse or dependence, are predictive of nicotine dependence (Schumann, Hapke, Meyera, Rumpfb, Johna 2004)
- Active pre-existing psychogenic disorders predicted initial onset of smoking as well as transition to nicotine dependence (Breslau, Novak, and Kessler 2004)
 - Major depression, anxiety disorders, and substance use disorders

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 **Background: Mental Disorders and Cigarette Smoking**

- Interestingly, nicotine has been used to treat certain mental disorders
 - Parkinson’s Disease, Alzheimer’s Disease, attention deficit/hyperactivity disorder, Tourette’s Syndrome, and depression
- Research currently being conducted on selective neuronal acetylcholine receptors (Mihailescu and Drucker-Colin, 2000)

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 **Methods**

- Analysis of a cross sectional prevalence study
- Analysis includes:
 - descriptive statistics
 - univariate analysis
 - multivariate logistic regression analysis

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 **Methods**

- Study population of 16,146 active duty military members who responded to the HRB survey
- Sample size of 13,603 subjects
 - Eliminated those individuals that did not have responses or had inappropriate responses

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Methods



- **Dependent and independent variables include specific survey questions as well as recodes**
- **Dependent variable: any cigarette smoking during the past 30 days – “any smoking”**

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Methods



- **Independent variables:**
 - **need for further depression evaluation**
 - **reception of mental health treatment in the past 12 months**
 - **perceived need for mental health counseling in the past 12 months**
 - **prescription of medications for depression or anxiety**



Methods



- **Covariates included sociodemographic, occupational, and behavioral factors**
- **Sociodemographic and occupational factors that affect cigarette smoking (Bray, 2006) included:**
 - **age, marital status, gender, pay grade, education level, deployment, and ethnicity**
- **Behavioral factors that affect cigarette smoking (Cherpitel, 1999 and Schumann, Hapke, Meyera, Rumpfb, Johna 2004) included:**
 - **impulsivity, alcohol use, and exercise have been shown to affect cigarette smoking**

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Methods



- **Descriptive statistics were calculated using weighted samples**
- **Univariate analysis was conducted between the outcome variable “any smoking” and the four mental health predictor variables**
 - **Percentages of any smoking among the mental health predictors were calculated also**



Methods



- Covariates were included in the multivariate analysis if they met two criteria
- First, covariates must be associated with “any smoking” in unadjusted regression analysis ($p \leq 0.25$)
- Second, covariates could not be highly correlated with each other
 - Education and paygrade

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Methods



- Analysis conducted using use STATA © version 10.0 (STATA Corp., College Station, TX) as the statistical software program
- Results reported as odds ratios with respective 95% confidence intervals



Results: Sample Characteristics of Predictor and Outcome Variables



Results: Sample Characteristics of Covariates



Table One. Sample characteristics of the outcome variable any smoking and the four mental health predictors (n = 13,603).^a

Characteristics	Unweighted sample	Weighted sample	Weighted % ^b
Any smoking in the past 30 days			
Yes	3,567	267,479	31.7
No	10,036	576,649	68.3
Mental health related			
Needed further depression evaluation (Yes)	2,735	185,745	22.0
Received mental health counselling (Yes)	2,217	142,713	16.9
Needed mental health counselling (Yes)	2,420	151,328	17.9
Depression or anxiety prescription (Yes)	734	38,101	4.5

^a Data Source of Health Related Behaviors Among Active Duty Military Personnel.
^b Percentages may not add up to 100 due to rounding.

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Table Two. Sample characteristics of sociodemographic, occupational, and behaviour covariates (n = 13,603).^a

Characteristics	Unweighted sample	Weighted sample	Weighted % ^b
Sociodemographics			
Gender (Female)	3,338	127,449	15.1
Age (in years)			
17-20	1,051	115,760	13.7
21-25	3,428	265,631	31.5
26-34	3,682	261,175	30.9
35+	5,442	201,336	23.8
Ethnicity			
White, non-Hispanic	8,563	557,219	66.0
Black, non-Hispanic	2,090	140,037	16.6
Hispanic	1,624	72,797	8.6
Other	1,326	73,975	8.8
Education			
High School or less	3,412	272,772	32.3
Some college	5,941	374,214	44.3
College or more	4,250	197,042	23.3
Marital Status			
Not married	5,029	376,491	44.6
Married, spouse not present	1,048	52,149	6.2
Married, spouse present	7,516	415,487	49.2

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Results: Sample Characteristics of Covariates - continued



<i>Occupational</i>			
Service			
Army	3,041	269,343	31.9
Navy	3,794	219,971	26.2
Marine Corps	2,925	108,769	12.9
Air Force	3,849	246,044	29.1
Paygrade			
Enlisted	10,666	699,540	82.2
Officer	3,537	150,588	17.8
Deployment in past 3 years* (Once or more)			
Behavior	7,914	472,591	56.0
Impulsivity*			
Not at all	2,832	140,959	16.7
A little	7,854	474,272	56.2
Some	2,465	184,130	21.8
A lot	312	44,766	5.3
Heavy Drinker* (Yes)	2,014	152,894	18.1
Exercise* (No)	3,110	193,062	22.9

* In 10 days of study, total number of days Army, Active Duty, Reserve, National Guard, and Air Force personnel were deployed in the past 3 years.
* Impulsivity was measured up to 100 days in smoking.
* Defined as consumption of four or more drinks on the same occasion at least once in the past 30 days.
* Defined as alcohol in any amount on the last 30 minutes, maximum of 2 beverage units.

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Results: Association Between Predictors and Outcome



Table Three. Associations between mental health predictors and any cigarette smoking in the past 30 days (n=13,603)*

Mental health variables	Any Smoking				
	Unadjusted model		P-value	Adjusted model ^b	
	%	OR (95% CI)		OR (95% CI)	P-value
Needed further depression evaluation					
No	18.6	1.00		1.00	
Yes	29.4	1.82 (1.59-2.08)	<0.001	1.24 (1.08-1.43)	0.003
Received mental health counseling					
No	14.5	1.00		1.00	
Yes	22.1	1.67 (1.49-1.88)	<0.001	1.42 (1.25-1.62)	<0.001
Needed mental health counseling					
No	15.6	1.00		1.00	
Yes	23.0	1.61 (1.45-1.80)	<0.001	1.28 (1.13-1.45)	<0.001
Depression or anxiety prescription					
No	3.8	1.00		1.00	
Yes	6.0	1.60 (1.26-2.05)	<0.001	1.49 (1.15-2.02)	0.003

* Results obtained from four unadjusted models for each of the predictor variables and four adjusted models for each of the predictor variables.
^b The adjusted model is adjusted for the covariates gender, age, ethnicity, marital status, service, paygrade, deployment in past three years, impulsivity, heavy drinking, and exercise.

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Results: Association Between Covariates and Outcome



Table Four. Unadjusted and adjusted* associations between covariates (sociodemographic, occupational, and behavioral characteristics) with any smoking (n=13,603).

Characteristics	Unadjusted model		Adjusted model ^b	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Sociodemographic				
Gender (Male)				
Female	0.65 (0.58-0.73)	<0.001	0.90 (0.79-1.03)	0.126
Age (in years)				
17-20	1.00		1.00	
21-25	0.97 (0.79-1.18)	0.739	0.96 (0.77-1.20)	0.718
26-34	0.57 (0.46-0.69)	<0.001	0.86 (0.67-1.10)	0.238
35+	0.28 (0.22-0.37)	<0.001	0.56 (0.41-0.77)	0.001
Ethnicity				
White, non-Hispanic	1.00		1.00	
Black, non-Hispanic	0.44 (0.38-0.51)	<0.001	0.44 (0.37-0.52)	<0.001
Hispanic	0.70 (0.59-0.85)	<0.001	0.53 (0.43-0.66)	<0.001
Other	0.94 (0.77-1.14)	0.495	0.91 (0.74-1.12)	0.368
Marital status				
Not married	1.00		1.00	
Married, spouse not present	0.78 (0.59-1.02)	0.073	1.00 (0.78-1.28)	0.989
Married, spouse present	0.59 (0.49-0.70)	<0.001	1.02 (0.83-1.25)	0.851

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Results: Association Between Covariates and Outcome - continued



<i>Occupational</i>				
Service				
Army	1.00		1.00	
Navy	0.75 (0.60-0.94)	0.012	0.78 (0.66-0.91)	0.003
Marine Corps	0.87 (0.69-1.09)	0.217	0.66 (0.53-0.82)	<0.001
Air Force	0.47 (0.37-0.60)	<0.001	0.57 (0.48-0.68)	<0.001
Paygrade				
Enlisted	1.00		1.00	
Officer	0.16 (0.13-0.20)	<0.001	0.20 (0.16-0.25)	<0.001
Deployment in past 3 years (No)				
Once or more	1.32 (1.15-1.52)	<0.001	1.31 (1.17-1.47)	<0.001

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Results: Association Between Covariates and Outcome - continued



Discussion: Results Summary



<i>Behavior</i>			
<i>Impulsivity</i>			
Not at all	1.00		1.00
A little	1.87 (1.54-2.27)	<0.001	1.33 (1.08-1.65) 0.010
Some	3.67 (2.96-4.56)	<0.001	1.72 (1.32-2.24) <0.001
A lot	7.40 (5.43-10.10)	<0.001	2.54 (1.82-3.55) <0.001
<i>Heavy Drinker (No)</i>			
Yes	4.04 (3.39-4.83)	<0.001	2.67(2.28-3.11) <0.001
<i>Exercise (Yes)</i>			
No	1.09 (0.94-1.27)	0.228	1.12 (0.95-1.31) 0.178

*The adjusted *yo-odd* is adjusted for the covariates of interest and further depression screening. The three other primary predictors have similar results.

- If one marked “yes” to one or more of the primary predictor questions, then that individual had an increased likelihood of having smoked a cigarette in the past 30 days
- Consistent with previous research
- However, odds ratio not at two

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Discussion: Covariates of Interest



Discussion: Military Impact



- Two covariates of interest
 - deployment in the past three years
 - exercise
- Deployment results as expected
- Exercise results not as expected
 - Military requires minimum level of fitness

- Mental disorders appear to be the most important source of medical and occupational morbidity in active duty military
- These morbidities secondary to mental health disorders likely includes an increased cigarette smoking prevalence

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Discussion: Military Impact



- Therefore, could decrease these morbidities by:
 - increasing support for effectively diagnosing and treating mental health patients
 - initiating smoking cessation programs and policy.

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Discussion: Strengths



- Large sample size
- Validated questions and responses
- Results are consistent both internally and externally
- Findings are applicable
- Confidence intervals

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Discussion: Weaknesses



- Data is self reported
- Causation cannot be determined
- Odds ratios at not at two
- Study did not differentiate between the varying levels of cigarette use

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Discussion: Future Research



- Conduct power analysis
- Cohort study to determine causation
- Investigate association between mental health predictors and level of cigarette usage i.e. heavy smokers
- Determine if there is an association between different levels of alcohol consumption (binge drinking, occasional drinking, etc) with cigarette smoking

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Conclusions



- **There is an association between mental health and any smoking in active duty military members**
- **Consistent with previous literature**
- **Findings could be applied in the development of smoking prevention and cessation programs**

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Questions?



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**The Association between Mental Health and Hypertension in the 2005 DoD Population Survey
United States Air Force School of Aerospace Medicine (USAFSAM)**

Lt Col/Dr. Scott Zaleski

Major objectives within Healthy People 2010 include improving hypertension and mental health management of the American population. Cases of either diagnosis may be incompatible with military service even with optimum treatment. The Department of Defense regularly conducts a survey of health related behaviors among active duty military personnel. The 2005 DoD Survey was conducted to obtain information regarding health and behavioral readiness among active duty military personnel to assess progress toward selected Healthy People 2010 objectives.

This study is a cross-sectional prevalence design looking at the association of hypertension treatment with mental health issues (whether there is a significant association between the self-reported occurrence of hypertension and the self-reported occurrence of mental health issues in the 2005 DoD Survey). In addition to these variables, this survey examined the contribution of various sociodemographic, occupational, and behavioral covariates. An analysis of the demographic composition of the study variables was followed by logistic analysis, comparing outcome variables with each of the independent variables. Following univariate regression analysis, multivariate regression was performed with adjustment (for those variables with an unadjusted alpha level less than or equal to 0.25).

All the mental health related indicators were associated with hypertension treatment. The same relationship was maintained after multivariate adjustment. The covariates remaining as significant ($p < 0.05$) in the final model included gender, age, race/ethnicity and obesity. Optimum health of the individual can be facilitated through discovery of treatable cases, to minimize disruptions of military missions, and even allow for continued military service.



**THE ASSOCIATION BETWEEN
MENTAL HEALTH AND
HYPERTENSION**
IN THE 2005 DEPARTMENT OF DEFENSE POPULATION
SURVEY

25 Aug 2010 Scott D. Zaleski, Lt Col, USAF, MC, FS
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OVERVIEW



- Introduction
 - Background
 - Study Aim
- Methods
- Results
- Discussion
- Conclusion

2



Background



Background



- **Healthy People 2010 objectives**
 - decade-long health promotion program
- **Objectives**
 - Improve the health of all Americans
- **Objective 12-09**
 - reducing proportion with high blood pressure
- **Objective 18-7,9**
 - Increase receipt of needed mental health services

- **2005 DoD Survey**
- **Survey of Health Related Behaviors Among Active Duty Military Personnel**
- **Assessing progress toward several selected *Healthy People* objectives**
- **Objectives include**
 - Mental health
 - Hypertension

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Mental Health & Hypertension



MH and HPT in the Military



- Medical co-morbidity among Mental Health (MH) patients
- 22% prevalence of HPT among MH pts (second only to obesity)
- MH risk factors
 - Reduced activity levels, impaired self-help skills, medication side effects, non-adherence
- Need to recognize and treat comorbidities

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- Discovery of treatable cases
 - Allow optimum health of individuals
 - Allow continued military service
 - Minimize disruption of mission
- Enhance recognition and treatment of cases
- Optimizing MH treatment can optimize HTN treatment among them

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Public Health Significance



Hypothesis



- Providers to scrutinize MH patients for co-morbid HPT
- Vigilance for discovery and proper treatment of concomitant illnesses

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- Whether or not the self-reported occurrence of HPT is related to the self-reported occurrence of mental health issues
- Null Hypothesis: there is no association between the two
- Alternate Hypothesis: there is a significant association

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METHODS



- Cross-sectional prevalence design
- 2005 DoD Survey: 16,946 final sample
- Group sessions at military installations, or by mail response (dual mode)
- All four branches
- Stratification of demographic and organizational characteristics

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Mental Health Data



- Inquiries
 - May have a need for further depression evaluation
 - At any time in the past 12 months, did you feel you needed counseling or therapy from a mental health professional (either military or civilian)
 - Received mental health counseling in past 12 months
 - Have you been prescribed medication for depression, anxiety, or sleeping problems by a doctor or other health professional in the past 6 months

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Hypertension Data



- Inquiry: Are you currently taking any of the following actions to help lower your blood pressure:
 - Diet to lose weight, cut down on salt or sodium in diet, exercise, stop smoking, cut down on use of alcohol, or take prescribed blood pressure medicine
- Created analytical variable for the self-reported presence of HPT treatment
 - “Ever taken action to reduce high blood pressure”

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Covariates: Demographics



- Age (four categories: ≤ 20 , 21-25, 26-34, ≥ 35)
- Race/ethnicity (based on US Bureau of Census)
 - white, non-Hispanic, black non-Hispanic, Hispanic, and other
- Gender
- Education (high school or less, some college, and college degree or more)
- Marital status (single, married but spouse not present, and married and spouse present)

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**Covariates:
Military/occupational status**



- Branch of service (Army, Navy, Marine Corps, and Air Force)
- Rank (enlisted, pay grades E0-E9, and officers, pay grades Second Lieutenant through General)
- Deployment (deployed at least once in the last three years or not)

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Covariates: Behavioral/lifestyle status



- Heavy drinking (Defined as consumption of five or more drinks on the same occasion at least once a week in the past 30 days)
- Smoking (smoker within the last 30 days)
- Obesity (BMI > 30 Kg/m²)

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Statistics



- Demographic composition
 - Un-weighted and weighted analyses
 - Weighted percentages
- Univariate analysis
 - Comparing outcome variable with each of the independent variables
 - Percentages of HPT treatment among the independent variables

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Statistics



- Multivariate analysis
- Covariates included
 - If they were not highly correlated with one of the other covariates
 - Education level and enlistment only ones highly correlated
 - If they were associated with HPT treatment in unadjusted regression analysis with an alpha level less than or equal to 0.25

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Statistics



RESULTS: Descriptive Characteristics



- Logistic regressions were carried out using Stata 10.0 ©
- Reported as odds ratios (OR) with accompanying 95% confidence intervals (CI)

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- Engaged in some form of HPT treatment: 26%
- Having taken medications: 5%
- Received mental health counseling : 17%
- Need for counseling: 18%
- Need for evaluation for depression: 22%

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RESULTS: Descriptive Characteristics



RESULTS: Descriptive Characteristics



- Male (85%)
- Older than 25 years of age (54.8%)
- Married (56%)
- At least some college education (67.9%, with 24% receiving full degrees)
- 67% were non-Hispanic whites/ 8.5% were Hispanic

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- Enlisted category (81.9%)
- Those who have and have not been deployed (at 56% and 44%, respectively)
- 17.9% heavy drinkers
- 31% smokers
- 12% of the participants were obese

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Unadjusted analysis



Multivariate adjustment



- All MH indicators were associated with HPT
 - Needing MH evaluation: 12% ↑ HPT Rx (OR=1.12; CI=0.96-1.31; p=0.142)
 - Need for MH counseling : 14%↑ HPT Rx (OR=1.14; CI=0.99-1.33; p=0.075)
 - Received mental health counseling: 38% ↑ HPT Rx (OR=1.38; CI=1.16-1.64; p<0.0005)
 - Used medications for MH reasons: 36% ↑ HPT Rx (OR=1.36; CI=1.04-1.77; p=0.024)

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- All MH indicators remained associated with HPT
 - Needing MH evaluation: 30% ↑ HPT Rx (OR=1.30; CI=1.10-1.53; p=0.0003)
 - Need for MH counseling : 26%↑ HPT Rx (OR=1.26; CI=1.08-1.48; p=0.005)
 - Received mental health counseling: 50% ↑ HPT Rx (OR=1.50; CI=1.26-1.79; p<0.0005)
 - used medications for MH reasons: 44% ↑ HPT Rx (OR=1.44; CI=1.09-1.91; p=0.0012)

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Multivariate adjustment



Multivariate adjustment



- Negative confounding without adjusting for covariates (ORs greater, lower p-values post-adjustment)

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- Covariates remaining as significant (p < 0.05) in the final model
 - Gender, Age, Race/ethnicity , Obesity
- Adjusted associations in the same direction as the unadjusted associations
 - non-Hispanic blacks and other race/ethnicity and obese were more likely for HPT Rx
 - Women less likely for HPT Rx

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Discussion



- The null hypothesis is rejected in favor of the alternate hypothesis: There is a significant association between mental health and hypertension in the 2005 Department of Defense Population Survey
- Consistent and statistically significant association was seen when multiple indicators of mental health status were compared to the outcome of taking any action to reduce high blood pressure

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Conclusion

- A discernable association between the self-reported occurrence of hypertension and the self-reported occurrence of mental health issues
- Multiple variables noted to be individually associated with the outcome of HPT
- Factors remaining as significant predictors in multivariate regression
 - Included gender, race, age, and obesity

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Strengths, Future Work



- The robust size of the respondent pool (13,057) contained a representative sampling of 808,115 DoD active duty members
- Sequential surveys will allow the trending of these behaviors in a well-defined population over time
- Regular nature of this DoD survey can follow these relationships over time

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Limitations

- Cultural differences: ambiguities in interpretation of questions
- Segments of the population may be represented less than accurately due to non-response
- Some biases possible with self-reporting
 - Poor recall bias
 - Response bias due to perceived deleterious effects on military careers

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**Limitations: Concepts of
Causality**



**THE ASSOCIATION BETWEEN MENTAL
HEALTH AND HYPERTENSION**



- **Dichotomous nature of the variables does not lend itself to a dose-response demonstration**
- **cross-sectional design of this study does not allow investigating causal relationships or any temporal association**
- **HPT & MH: multi-factorial issues; specificity difficult to demonstrate**
- **Questions?**

**Psychosocial Stress of RPA Operators
United States Air Force School of Aerospace Medicine (USAFSAM)**

Aeromedical Psychologist Wayne Chappelle

USAF Remotely Piloted Aircraft (RPA) operators are placed in the unique position of engaging in around the clock "tip-of-the-spear" surveillance, reconnaissance, and precision strike aerial operations in theaters of conflict while simultaneously living at home and juggling the demands of their domestic life. This unique aspect of RPA operations has raised questions about the impact on the health of RPA operators. Research has found RPA operators to experience greater levels of fatigue in comparison to airborne aircrew (i.e., AWACS, JSTARS). Yet, concerns regarding negative changes in psychological health effecting performance and readiness are abundant. However, no empirical studies have been conducted to officially screen for PTSD, clinical levels of psychological distress, and other changes in psychological health. To fill the current gap, this study had RPA operators (pilots, sensor operators, and mission intelligence coordinators) from AFSOC, ACC, ANG, and Reserve MQ-1 Predator, MQ-9 Reaper squadrons complete standardized, commercial, questionnaires assessing the psychological health and levels of clinical stress diagnostic of a mental health disorder (including PTSD). Comparisons were made between active duty, and national guard/reserve units.

This study provides key information on the prevalence of symptoms among such RPA operators and informs flight medicine physicians and operational leadership the extent of mental health services needed. This study provides a measure to gauge the extent of symptoms to best ensure that adequate resources are available to sustain the readiness of these airmen so they may continue to fly, fight, and win.



Every Airman a Force Multiplier

Psychological Health Stress Screening of RPA Operators

Wayne Chappelle, Psy.D., ABPP
 Kent McDonald, Col, USAF, MC, FS
 USAF School of Aerospace Medicine



BACKGROUND

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- ✓ Questions & concerns from AF leadership re: impact on psychological health of operators
 - ✓ Unit CCs & Flight Docs
 - ✓ operational tempo (manning, hours, shift work)
 - ✓ systemic stressors (involuntary assignments, hold on PCS moves, career progression concerns)
 - ✓ geographical location (commute, limited access to services)
 - ✓ human-machine interface & developments in technology
 - ✓ nature of the work (deployed in garrison w/ domestic life)
 - ✓ High interest from HAF/CSAF, AFMOA (PTSD), MAJCOM/SGPs (ACC/AFSOC), ISR/SGP



2



BACKGROUND

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- ✓ Research needed to fully understand nature of RPA operations and impact on operator health
- ✓ Supports aeromedical consultations to:
 - ✓ USAF/SG: UAS aeromedical policy / standards (i.e., FCIIU)
 - ✓ MAJCOM/SGP's: ACS RPA operator medical consultations in neurology, psychiatry / psychology, internal medicine.
 - ✓ Enhance aeromedical screening / selection of non-pilot (e.g., Beta Test) RPA pilot applicants



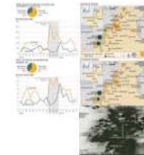
STRESS SURVEY

Every Airman a Force Multiplier



- ✓ Concern re: impact of operations on MH of RPA ISR precision strike operators (Predator/Reaper)

- ✓ Subjective stress
- ✓ Occupational fatigue
- ✓ Clinical Distress
- ✓ PTSD



- ✓ Predator/Reaper crew compare with:
 - ✓ Other Unmanned ISR platforms (Global Hawk)
 - ✓ Manned aircrew ISR platforms (AWACS)
 - ✓ Non-combatant control groups (enlisted/officer)

3

4



STRESS SURVEY
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- ✓ 10 – 15 minutes to complete
- ✓ Multiple choice, write-in responses
- ✓ Demographics (Personal & Occupational)
- ✓ Sources of Stress (write-in & rate)
- ✓ Standardized Measures/Instruments
 - ✓ Occupational fatigue
 - ✓ Clinical Distress
 - ✓ PTSD
- ✓ Non-standardized items (likert rating scales)
 - ✓ Subjective stress
 - ✓ Medical & mental health service utilization
 - ✓ Alcohol usage, relationship changes, job satisfaction



6

METHOD
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- ✓ Participants: Active duty, Reserve, National Guard units actively maintaining Combat Air Patrols (CAPs) in theater
- ✓ Instructions: Participants briefed on purpose and nature of the survey in-person by local flight surgeon and/or MH representatives from USAFSAM research team
- ✓ Distributed at CCs call or during operational shifts (Sq CC preference)
- ✓ Anonymous surveys placed in pre-addressed envelope sealed by participants given to flight surgeon or research team member
- ✓ Non-combatant airmen (enlisted/officer) from various support & logistic operations supporting ISR RPA operations were also included from local RPA installations.

STRESS SURVEY
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Malasch Burnout Inventory (MBI)

- ✓ Self-report, standardized
- ✓ 16 items to assess symptoms of occupational burnout
- ✓ Summary score with specificity re: the level of burnout present
- ✓ Provides cut-scores for clinically significant fatigue / burnout.
- ✓ Fatigue scale was used by Tvaryanas (2006) in one of the first published studies re: RPA operations & operator fatigue

Item	1	2	3	4	5
1. I feel emotionally exhausted					
2. I feel physically exhausted					
3. I feel mentally exhausted					
4. I feel emotionally drained					
5. I feel physically drained					
6. I feel mentally drained					
7. I feel emotionally fatigued					
8. I feel physically fatigued					
9. I feel mentally fatigued					
10. I feel emotionally exhausted					
11. I feel physically exhausted					
12. I feel mentally exhausted					
13. I feel emotionally drained					
14. I feel physically drained					
15. I feel mentally drained					
16. I feel emotionally fatigued					
17. I feel physically fatigued					
18. I feel mentally fatigued					

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STRESS SURVEY

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Outcome Questionnaire-45 (OQ45)

- ✓ Self-report, standardized instrument. 45 items to assess clinical distress
- ✓ Overall score with cut-offs for normal and clinical levels
- ✓ Commonly used in outpatient mental health centers (including USAF)

Outcome Questionnaire (OQ-45)
Instructions: Read each item carefully and circle the number under the heading that best describes how you have been feeling over the last week. Use the following "keys" as guidelines: 1=never, 2=sometimes, 3=often, 4=always.

Item	Never	Sometimes	Often	Always
1. I feel lonely and isolated.				
2. I feel nervous or jittery.				
3. I feel sad or depressed.				
4. I feel like I am not in control of my life.				
5. I feel like I am not doing my best.				
6. I feel like I am not interested in things I used to do.				
7. I feel like I am not able to concentrate.				
8. I feel like I am not able to get things done.				
9. I feel like I am not able to relax.				
10. I feel like I am not able to sleep.				
11. I feel like I am not able to eat.				
12. I feel like I am not able to work.				
13. I feel like I am not able to study.				
14. I feel like I am not able to play sports.				
15. I feel like I am not able to go to school.				
16. I feel like I am not able to go to work.				
17. I feel like I am not able to go to school.				
18. I feel like I am not able to go to work.				
19. I feel like I am not able to go to school.				
20. I feel like I am not able to go to work.				
21. I feel like I am not able to go to school.				
22. I feel like I am not able to go to work.				
23. I feel like I am not able to go to school.				
24. I feel like I am not able to go to work.				
25. I feel like I am not able to go to school.				
26. I feel like I am not able to go to work.				
27. I feel like I am not able to go to school.				
28. I feel like I am not able to go to work.				
29. I feel like I am not able to go to school.				
30. I feel like I am not able to go to work.				
31. I feel like I am not able to go to school.				
32. I feel like I am not able to go to work.				
33. I feel like I am not able to go to school.				
34. I feel like I am not able to go to work.				
35. I feel like I am not able to go to school.				
36. I feel like I am not able to go to work.				
37. I feel like I am not able to go to school.				
38. I feel like I am not able to go to work.				
39. I feel like I am not able to go to school.				
40. I feel like I am not able to go to work.				
41. I feel like I am not able to go to school.				
42. I feel like I am not able to go to work.				
43. I feel like I am not able to go to school.				
44. I feel like I am not able to go to work.				
45. I feel like I am not able to go to school.				

STRESS SURVEY

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Post Traumatic Stress Check List - Military Version (PCL-M)

- ✓ Self-report, standardized
- ✓ 17 items to assess PTSD
- ✓ Summary score with cut-offs for degree of PTSD symptoms reported
- ✓ Commonly used in outpatient community, & AF medical/mental health clinics
- ✓ Commonly used in outcome research to identify military personnel at risk for PTSD

PCL-M
Instructions: Mark in a list of problems and concerns that someone has had in response to military-related experiences. Please mark each one positively, that is, one of the numbers in the right-hand column that you have been bothered by that problem. (DSM-IV, 2000, 2002)

Problem	Never	Sometimes	Often	Always
1. Recurrent, disturbing memories, thoughts, or feelings of a stressful military experience?				
2. Recurrent, disturbing dreams of a stressful military experience?				
3. Suddenly acting or feeling as if a stressful military experience were recurring?				
4. Feeling very upset when reminded of a stressful military experience?				
5. Avoiding military-related activities, places, or people?				
6. Avoiding military-related activities, places, or people?				
7. Avoiding military-related activities, places, or people?				
8. Avoiding military-related activities, places, or people?				
9. Avoiding military-related activities, places, or people?				
10. Avoiding military-related activities, places, or people?				
11. Avoiding military-related activities, places, or people?				
12. Avoiding military-related activities, places, or people?				
13. Avoiding military-related activities, places, or people?				
14. Avoiding military-related activities, places, or people?				
15. Avoiding military-related activities, places, or people?				
16. Avoiding military-related activities, places, or people?				
17. Avoiding military-related activities, places, or people?				

DEMOGRAPHICS

Every Airman a Force Multiplier

Overall Total # of Respondents = 1502*

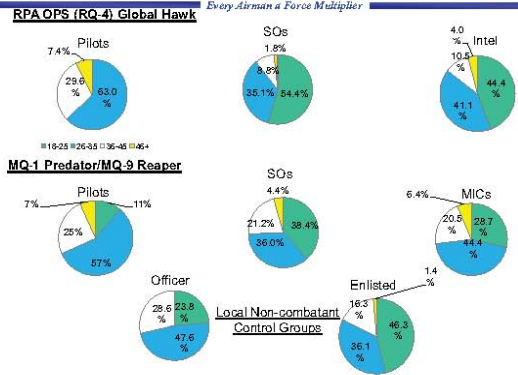
- ✓ MQ-1 Predator & MQ-9 Reaper
 - ✓ Active duty & National Guard
 - ✓ Pilots = 205
 - ✓ SOs = 203
 - ✓ MICs = 171
 - ✓ Total = 579
 - ✓ Local Non-combatant Control Groups
 - ✓ Active duty (Support & Logistics)
 - ✓ Enlisted = 577
 - ✓ Officers = 51
 - ✓ Total = 628
- ✓ RQ-4 Global Hawk
 - ✓ Active Duty
 - ✓ Pilots = 57
 - ✓ SO/Image Analysts = 114
 - ✓ Intel = 124
 - ✓ Total = 295

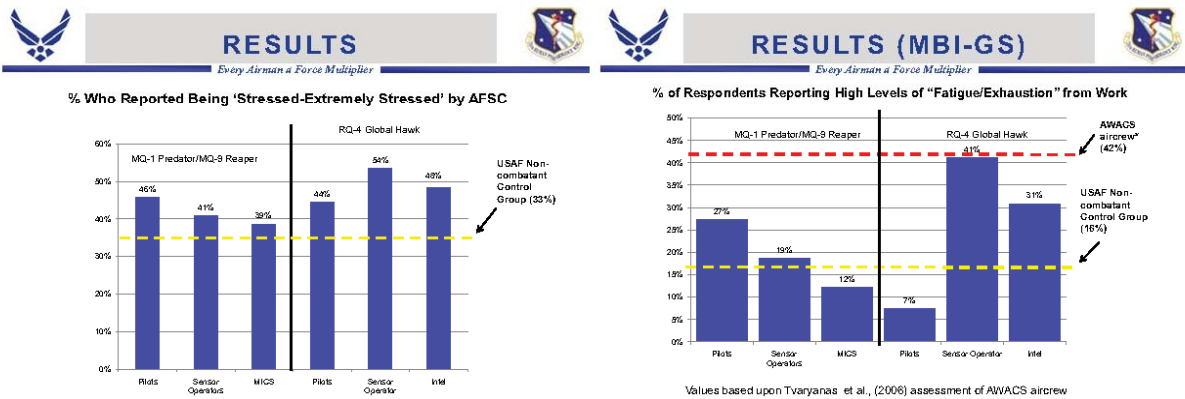
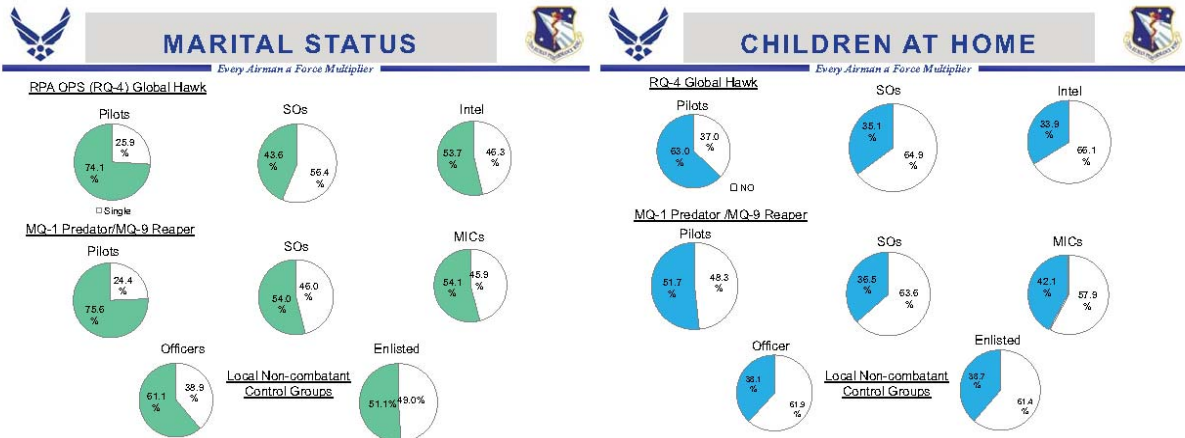


*30 - 50% response rate from participating units

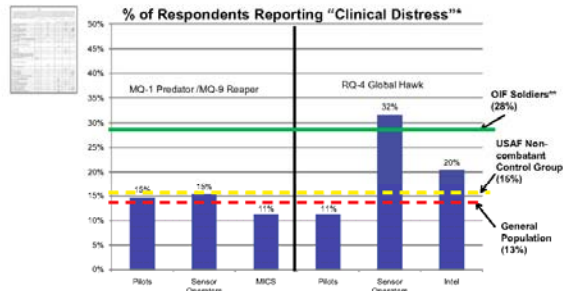
AGE

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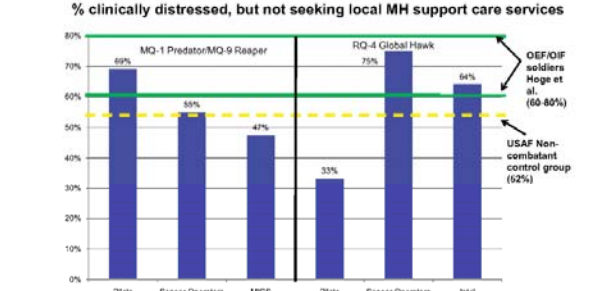
RESULTS (OQ45)
Every Airman a Force Multiplier



*OQ45 Cut-off score of 63+--- symptomatic of clinically significant anxiety/depression
 **Value based upon Hoge et al. (2004, 2007) screening of soldiers returning from deployment following tour in support of OIF

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RESULTS
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RESULTS
Every Airman a Force Multiplier

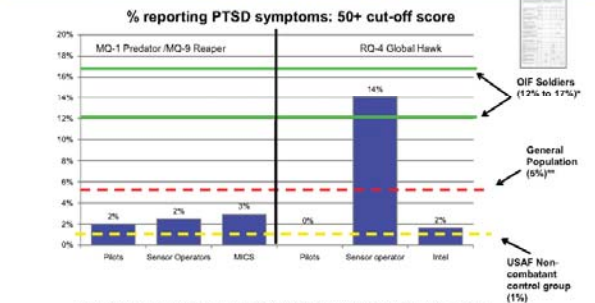
✓ Mental health stigma and access to care (such as shift work) reported as contributing factors for not obtaining care

If your use of support services has changed what do you attribute the change to?
 I don't use them because I would lose my security clearance. I don't know how to get a waiver in the outside world and not be able to support my family.

If your use of flight medicine services has changed what do you attribute the change to?
 Never used it. No time to go. Working too much!!!



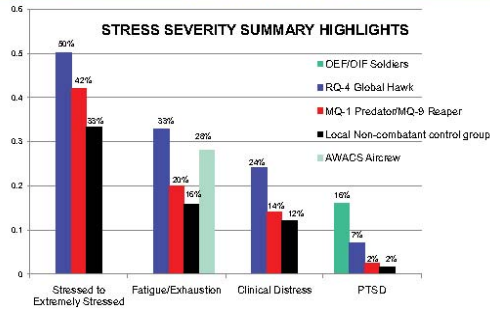
RESULTS (PCL-M)
Every Airman a Force Multiplier



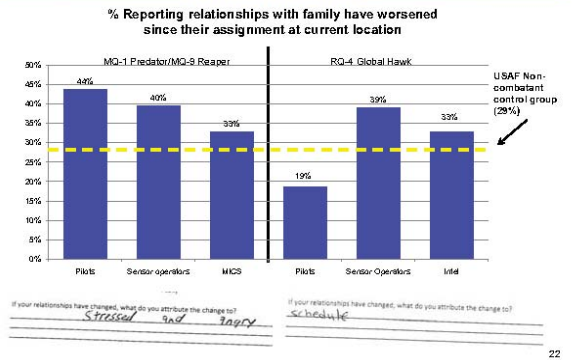
*Value based upon Hoge et al. (2004, 2007), Schell & Marshall (2008), Vasterling (2006) screening of soldiers returning from deployment following tour in support of OIF.
 **Value based upon Diagnostic & Statistical Manual of Mental Disorders

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RESULTS
Every Airman a Force Multiplier



RESULTS
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RESULTS
Every Airman a Force Multiplier

- Pilots, Sensor Operators, and MICs (sources of stress)**
- ▼ **Shift work, schedule changes**

 - "Shift changes every month."
 - "Rotating every 30 days."
 - "Strange hours, working weekends, shift changes, all impact family life."
 - ▼ **Long hours & low manning**

 - "Too much to do, not enough people!"
 - "Can't make plans due to low manning."
 - "Never ending surge & restricted leave"
 - ▼ **Job duties (low interest, cynicism)**

 - "A monkey can do 90% of my job"
 - "No hope I will ever go back to flying!"
 - "This job is totally unchallenging"
 - "I didn't ask for this job!"
 - ▼ **Maintaining relationships w/ family & friends**

 - "Not being around to do stuff at home."
 - "Family care is complicated due to shift work."
 - "I sleep when my family is awake."
 - "Shift work & unhappiness in my job impacts relationships."
 - ▼ ***Career Progression (pilots)**

 - "Career possibilities are terrible!"
 - "I can't do the things I need to compete for promotion when saturated by long hours/shift work."
- Majority of reported stressors are operationally based and do not reference exposure to combat

23

DISCUSSION
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- ▼ **At-Risk Operators**
- ▼ Long hours (50+hours/week)
 - ▼ Shift work (with frequent changes)
 - ▼ Single or married/children & having family troubles
 - ▼ Conflict with others at work
 - ▼ High level of cynicism about RPA duties
 - ▼ Chronic occupational fatigue
 - ▼ Age (18-35)
 - ▼ Career & future prospect concerns
 - ▼ Lack of access/utilization of medical & MH services
 - ▼ Hold status/involuntarily assigned
- 
- 
- 

24



RECOMMENDATIONS

Every Airman a Force Multiplier



RECOMMENDATIONS

Every Airman a Force Multiplier



Pilots, Sensor Operators, MICs (Predator/Reaper)

- ✓ Operational Tempo
 - ✓ "Increase manning to allow for leave/reduce operational surge."
 - ✓ "Longer rotations of shifts to allow for adjustment"
 - ✓ "Switch to a 4-on-3-off work schedule."
 - ✓ "Extend flight medicine/service hours to overlap with mid/night shifts"
- ✓ Health Oriented
 - ✓ "Improve quality, quantity, access to fitness equipment/gym"
 - ✓ "Better and more health food in the snacks"
- ✓ Geographic
 - ✓ "Relocate to a place closer... commute time ruins family/personal life" with
 - ✓ "Find a location way more desirable than this!"
- ✓ Career & Morale Oriented (cross-trained aircrew)
 - ✓ "Provide a clear promotional path & incentives for RPA operators"
 - ✓ "Allow me to fly SOMETHING, even a Cessna."
 - ✓ "Show us some hope that we will go back to flying!"

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Access to Care

- ✓ Flexible flight medicine hours (care extended to mid/night shifts)
- ✓ Implementation of OQ45 screener in flight medicine
- ✓ Experienced MH provider co-located within flight medicine
- ✓ Experienced MH provider giving outreach "line-side" briefings to units/Sqs re: operational & relational stress specific to Creech operations.
- ✓ Prevention based stress inoculation specific training to RPA operations/stressors within training pipeline curriculum for Pilots, SOs, and MICs.
- ✓ Outreach efforts to family– via supportive services

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QUESTIONS

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**Multivariate Analysis of MAB-II and MicroCog Neuropsychological Screening in Rated USAF Pilots
United States Air Force School of Aerospace Medicine (USAFSAM)**

Maj/Dr. Bret Heerema

BACKGROUND: Intelligence testing and neuropsychological screenings have multiple uses in the selection and assessment of United States Air Force (USAF) pilots and pilot applicants. These tests are a critical part of USAF medical flight screening and aeromedical waiver procedures after neurological insult for aircrew. The purpose of this study is to assess the factorial structure regarding a measure of intelligence testing given to USAF pilot training applicants (manned as well as unmanned) during medical flight screening. Is the factorial structure of intelligence testing different for such a specialized occupational group different from the general population? **METHODS:** Principal components analysis was conducted on the intelligence test scores from the Multidimensional Aptitude Battery-Second Edition (MAB-II) administered to 10,612 USAF pilot applicants selected for training. Subtest and measurement model correlations were also estimated. **RESULTS:** Neuropsychological screening consisting of the MAB-II suggests there are three correlated indices unique to the rated USAF pilot population in contrast to the two-factor measurement model of the general population. In addition to verbal intelligence quotient (IQ) and performance IQ factors, a visual processing speed IQ comprised of the arithmetic, digital symbol, and spatial score subtests is present in this population. Confirmatory factor analysis using this model of the MAB-II showed positive correlations between the factors and between specific subtests. **CONCLUSIONS:** There are significant differences between the general population and rated USAF pilots' intelligence test scores. The relationship of these scores must be well understood to effectively evaluate how other aptitudes are affected with changes in any particular subtest. Neuropsychologists should be sensitive to such differences and use population specific normative data in evaluating the cognitive disposition of rated USAF pilots. Further studies are needed to determine the role of these factors in performance in the pilot population leading to more accurate predictive cognitive aptitudes.



Background

**Multivariate Analysis
 of MAB-II
 Neuropsychological Screening
 in Rated USAF Pilots**

Maj Bret Heerema, MD, MS, MPH
 USAFSAM, Brooks City-Base
 25 Aug 10

- Intelligence Testing in Rated USAF Pilots
 - Multidimensional Aptitude Battery – Second Edition (MAB-II)
 - MicroCog
 - Administered to all pilot candidates at Aeromedical Consultation Service (ACS) prior to and after pilot training

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Background

- MAB-II
 - Consists of 10 subtests
 - Verbal intelligence quotient (VIQ)
 - Information
 - Comprehension
 - Arithmetic
 - Similarities
 - Vocabulary
 - Performance intelligence quotient (PIQ)
 - Digit symbol coding
 - Picture completion
 - Spatial analyses
 - Picture arrangement
 - Object assembly
 - Full scale intelligence quotient (FSIQ)

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Background

- MicroCog
 - 18 Subtests
 - 5 First-level indices
 - Spatial processing
 - Attention/mental control
 - Reasoning/calculation
 - Memory
 - Reaction time
 - 2 Second-level indices
 - Speed of information processing (SIP)
 - Accuracy of information processing (AIP)
 - 2 Third-level indices (differently weighted aggregate of first-level)
 - General cognitive functioning
 - General cognitive proficiency

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Background

- All indices for both MAB-II and MicroCog
 - Mean = 100
 - Standard deviation = 15
- USAF pilot population compared to general population
 - FSIQ ~92nd percentile (121)
 - VIQ and PIQ ~90th percentile (119, 120)
 - MicroCog generally the same
- Purpose of this study
 - Does USAF pilot population have same factorial structure as the general population?

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Method

- Results from 10,612 pilot candidates included
- Confirmatory factor analyses using structural equation modeling (AMOS 17)
 - Evaluates correlation between variables (subtests)
 - Subtests in general population lead to VIQ and PIQ as well as FSIQ
 - Redundancy test using $\Delta \chi^2$ with Δ degrees of freedom
 - Evaluated at $p < 0.05$
 - Significant χ^2 indicates a difference in two models and model with better fit (more complex) should be used
- Two-, Three-, Four-, and Five-factor models were evaluated

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Results

Indices	2 Factor	3 Factor
VIQ	Information	Information
	Comprehension	Comprehension
	Arithmetic	
	Similarities	Similarities
PIQ	Vocabulary	Vocabulary
	Digital Symbol	
	Picture Completion	Picture Completion
	Spatial Score	
Visual Processing	Picture Arrangement	Picture Arrangement
	Object Assembly	Object Assembly
Speed		Arithmetic
		Digital Symbol
		Spatial Score



Results

Model	χ^2	Deg freedom	GFI	CFI	RMSEA
2 Factor	459.826	26	.991	.981	0.040
3 Factor	364.108	23	.993	.985	0.037
	95.718	3			

p-value < 0.0001

GFI = "goodness-of-fit index"
 CFI = "comparative fit index"
 RMSEA = "root mean square error of approximation"

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Results

- Four- and Five- factor models also evaluated
 - No goodness-of-fit parameters met

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Results

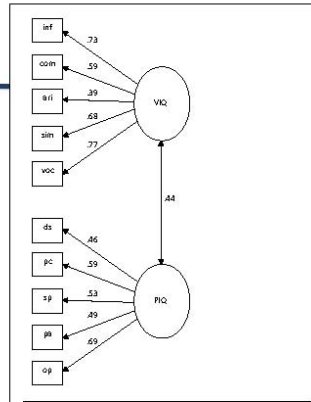


Figure 1: Confirmatory Factor Analysis of the MAB-II, two-factor model

308, 5 AUG 10



Results

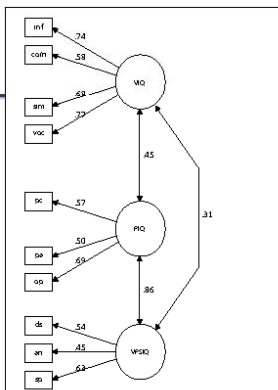


Figure 2: Confirmatory Factor Analysis of the MAB-II, three-factor model

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Discussion

- Arithmetic (general and numerical reasoning; problem solving) is relatively independent of other verbal aptitudes compared with:
- Digital Symbol (adaptation to new set of demands; visual learning and coding, figural memory, and speed of information processing)
- Spatial Score (ability to visually and mentally rotate abstract two-dimensional images of objects in different positions; figural-domain reasoning)
- “Visual Processing Speed”

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Discussion

- Numerical reasoning may influence, to some degree, performance in areas regarding visual coding and visual-rotation aptitudes and vice versa
- Predictive value of cognitive aptitude
 - May change our understanding of which factors have a large role in performance (especially in pilot population)
 - Also keys us into understanding of the relationship between scores
 - Closer scrutiny in assessing which aptitudes can be affected

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Conclusion

- Pilot population better fits 3-factor model in MAB-II
 - In addition to VIQ and PIQ, Visual Processing Speed IQ
 - Arithmetic
 - Digital Symbol
 - Spatial Score
- Further assessment needed
 - Predictive value / cognitive aptitude for
 - Flight training
 - ACS evaluation / RTFS
 - Determine pilot population normative data for 3 indices

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Questions


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Risk of Prostate Cancer in USAF Aviators
United States Air Force School of Aerospace Medicine (USAFSAM)

Col Marc Goldhagen

BACKGROUND: There have been several studies indicating elevated incidence of prostate cancers in aviators both in the civilian and military sectors. Some studies show an increased risk for cancer in aviators and some do not. These studies compare aviators with the general population and these two cohorts can differ substantially in terms of socioeconomics, health surveillance, and environmental exposures. We were interested in conducting a controlled study in which prostate cancer incidence was compared in aviators using a reference group which is more similar to the aviators. **METHODS:** This retrospective analysis compared incidence of prostate cancer between USAF aviation officers and non-aviation officers using the Automated Cancer Tumor Registry of the Department of Defense linked to personnel records from the USAF Personnel Center. **RESULTS:** Crude incidence ratios were compared to SEER data of the overall US population showed slightly lower incidence in USAF personnel. Kaplan-Mier survival curves showed no difference between the USAF aviators and non-aviators. Cox Proportional Hazards model also confirmed no difference between the two groups after controlling for age and race. **DISCUSSION:** This study showed no difference in prostate cancer incidence between USAF aviators and non-aviators. While the study included a relatively large sample size, limitations of the study include a young population group, in which low incidence would be expected.




**Prostate Cancer Comparison: USAF
 Aviators and non-Aviators**




U.S. AIR FORCE UNCLASSIFIED


"Aces"
 David M Rogers, MD, MPH
 Lt Col, USAF, MC, SFS



Prostate Cancer


- Prostate Cancer in Aviators:
 - Exposure risk factors?
 - Screening dilemmas.....





Prostate Cancer

- Second leading cause of cancer death in men (after lung ca)
- Estimated 2 million men in US have prostate cancer
- 1 in 6 men will be diagnosed in lifetime
- 1 in 30 men will die from the disease
- Interest in Cosmic Radiation in early 1990s, studies showed increased incidence of prostate cancer in aviators



Prostate Cancer in Aviators

- Prostate CA incidence or mortality reported:
 - 1992 US Commercial Pilots PMR 1.46 (95% CI: 1.06-2.03)
 - 1996 Air Canada Pilots SIR 1.87 (90% CI: 1.38-2.49)
 - 1996 USAF Aircrew Prostate CA not mentioned
 - 2003 Nordic Commercial Pilots SIR 1.21 (95%CI 0.93-1.54)



Prostate Cancer Incidence

- Many studies showed non-statistically significant elevated SIR for prostate CA in aviators
- All based on tumor registry or death certificate data
- Comparison of aircrew population (pilots) to GENERAL POPULATION



RAM attention 2005 SJAFB

- Chaz Shurlow, RAM 2008
- Observed 5 Prostate CA cases in a 3 year period
- Erich Koda, RAM 2009B further described with AMWTTTS data



MD Anderson / Univ TX SPH Interest

- Combined project with MD Anderson Cancer Center and UTHSC SPH :
 - Prostate Cancer Incidence in the USAF:
 - Goal of further describing impact of early testing, study the cancer biology for prostate adenocarcinoma, study effect of exposures
 - USAFSAM: Compare incidence rates of prostate cancer between USAF aviator and USAF non-aviator officers
- IRB approval from MD Anderson, UTHSC, 711 HPW, AFIP



Data Sources

- Automated Cancer Tumor Registry Database (DoD tumor registry)
 - All USAF MTFs required to use, trained registrars
 - Prostate Cancer by TISSUE DIAGNOSIS 1987-2008
- Air Force Personnel Center Database
 - ACTUR matched by SSN to occupation codes from active duty officers in the Air Force Personnel Center database
- Aviator officers defined as >200 hours in any aircraft, any crew position



Statistical Analysis

- Survival Analysis Models
- Entry into cohort defined as most recent of:
 - Age 35 years
 - Entry into active duty
- End point defined as earliest occurrence of:
 - Prostate cancer diagnosis
 - Separation from active duty
 - Age 70 years
 - April 3, 2010 (date data pulled)



Statistical Analysis

- Survival Analysis Methods
 - Accounts for person-time effects vs. crude ratios
 - Kaplan-Maier Survival Curve
 - Cox Proportional Hazards
 - Enables analysis of covariate effects
 - Similar results with Mantel-Haenzel techniques
 - Databases merged with SAS 9.1x, Stat analysis with Stata 10.1/IC



Results

- 169,078 records of USAF male officers identified
 - 106,418 records included in cohort
 - Entry/exit dates fell within study definition
- 196 records (prostate ca) auto-matched from ACTUR
 - 71 career USAF aviators
 - 125 USAF non-aviators
- Total time-at-risk: 966,000 person-years



Demographics

- Mean age at diagnosis for both aviators and non-aviators
 - 50 years (range 36-67)
- Race Demographics for aviators with prostate cancer
 - 96% Caucasian
 - 4% African American



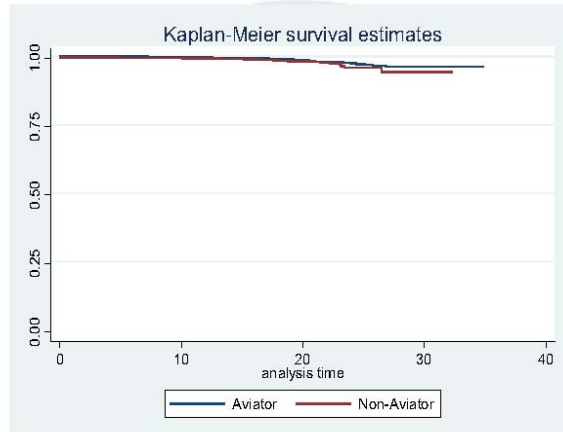
Demographics

■ Career flying hours for each group

- Prostate cancer
3,039 hrs (+/- 1384 hrs)
- No prostate cancer
3,079 hrs (+/- 1474 hrs)



Stat significant difference (P<0.001)



Odds Ratios

■ Cox Proportional Hazards Model:

- Odds ratios estimated by Hazards Ratio for prostate cancer
- Aviators to non-aviators, controlling for age
 - HR 1.07 (95% CI: 0.80-1.44)
- Aviators to non-aviators, controlling for age and race
 - HR 1.15 (95% CI: 0.85-1.56)



Discussion

- Data sources good quality
- Prior studies compared aviators to the general population (civilian)
- Differences in military aviator vs civilian aviator population
 - Flying hours
 - Altitude of flight





Discussion

- Race proportion
 - African-American men have higher incidence of prostate CA
- Young population used here
 - Average age at diagnosis: 50 years
 - US general population
 - >70% of pts with prostate cancer diagnosed after age 65 years



Conclusion

- USAF aviators did not carry an excess risk of prostate cancer in this study



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Questions / Comments



