**Title and Subtitle**

**Authors**
Welford C. Roberts, Ph.D. (Editor)

**Performing Organization**
US Air Force
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AF/SG9S
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Falls Church, VA 22041

**Abstract**
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 24-26 August 2010 at the Doubletree Hotel Washington DC – Crystal City, Arlington, VA. The symposium featured two half-days of plenary sessions, one and a half days of scientific presentations, and a poster session. It was organized into four tracks to include: Operational & Medical, Enroute Care, Force Health Protection, and Nursing. These proceedings are organized into five volumes to include one that provides a general overview and all presentation and poster abstracts; the other four each address a specific track. Volume 2 contains abstracts and presentation slides for the Operational & Medical Track.

**Subject Terms**
US Air Force, Medical Service, Medical Research, Operational Medicine

**Security Classification**
SAR

**Distribution Statement**
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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


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 < 0.05. RESULTS: All subjects had a significant (p < 0.001) loss in THM over winter break, losing 3.7% (-28.3 ± 29.3g) on average. The ‘interval’ group lost only 2.9% (-23.0 ± 33.2g), while the ‘control’ group lost 4.9% (-37.3 ± 27.0g), which neared statistical significance (p = 0.061). The ‘endurance’ group lost 3.3% (-25.1 ± 26.7g; 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.
Attenuation of Altitude De-acclimatization / Neocytolysis with Exercise Intervention

Lt Col Michael Brothers, Ph.D.

Outline

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

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 win 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 (+4.5 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)
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 m-breathing protocol (Schmidt & Prowant EJAP 05)
- Numerous Physical performance & physiological testing sessions (3x VO2peak, 6x 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 ≥ 1500m, SL ≤ 330m, for 3 yrs prior to USAFA
Current Study Rationale

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

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:

### Descriptive data

<table>
<thead>
<tr>
<th></th>
<th>All n=53 (29 m, 24 f)</th>
<th>Control n=17 (12 m, 5 f)</th>
<th>Interval n=17 (12 m, 5 f)</th>
<th>Endurance n=19 (14 m, 5 f)</th>
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<td>Age (yrs)</td>
<td>20.6 ± 1.5</td>
<td>20.07 ± 1.12</td>
<td>20.74 ± 1.72</td>
<td>20.91 ± 1.21</td>
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<tr>
<td>Height (m)</td>
<td>1.74 ± 0.08</td>
<td>1.75 ± 0.19</td>
<td>1.73 ± 0.06</td>
<td>1.74 ± 0.18</td>
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<tr>
<td>Weight (kg)</td>
<td>71.6 ± 5.86</td>
<td>71.21 ± 12.13</td>
<td>71.83 ± 5.29</td>
<td>71.82 ± 5.40</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.52 ± 1.94</td>
<td>23.77 ± 2.08</td>
<td>23.81 ± 2.05</td>
<td>22.99 ± 1.56</td>
</tr>
</tbody>
</table>

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 5
  - Total Time > 290 min
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

Optimized CO Re-breathing Method

Integrity - Service - Excellence
**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%

**Normalized THM Between Groups**

**Pre-Break Levels**

**Change in Absolute THM**

**Study Limitations**

- Exercise regimen
- Self-Reporting
- Scheduling
Implications

- MA Deployed troops
- Exercise training
- USAFA implications

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.

Thanks to: Lt Col Michael Zupan (PhD), Dr. Jeff Koehler, Cattle CIty Angeles, Tyler Apl, and Ellyn Radeke (former USAFA researchers), James LaGaspere, Daniel Voynow, Case Schmidt, Elizabeth Hossain (former intern), plus all past and present subjects.

Funding: USAFA Life Sciences Research Center

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HQ USAFA / ADPH
2150 Field House Drive, Bld 111
USAFA Academy CO 80840

Lt Col Michael Zupan
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Integrity - Service - Excellence
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 (VO2 max = 57 mL-1.Kg-1.min) 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 VO2 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.
Alternating Days of Intermittent Hypoxic Exposure on Physical and Cognitive Performance

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

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 unacclimated individual (Oxsom et al).
- Direct application for our newly deployed special tactics operators being deployed to altitude environments.
- Some CCT's are prepositioned and can acclimate throughout deployment.
- Others are based low and fight at moderate altitudes (4-39k).
- Limited reports of AMS.
- Greater need in Afghanistan than Iraq for preexposure.

Intermittent Hypoxic Training for Performance Enhancement

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

Background

- Altitude Training with a normobaric hypoxic environment is currently being utilized to help pre-acclimatize some battlefield airmen before strenuous deployments to moderate to high altitude (above 7,000 ft)
- The current recommended altitude preparation guidelines for using IHE are 5 consecutive days at 4,600 m (15,200 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 altitude tempo on our deploying airmen while still providing the necessary high altitude adaptations

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)

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.
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 14,309 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

Training/Testing Overview (~74 hours/subject)

1. Initial Screening
2. Aerospace Physiology Chamber Training
3. Preliminary Testing for Test Familiarization

Baseline Testing #1:
- 3 environments (hypobaric chamber, sea level, hypoxic tent)
- 1 week washout period at sea level

Baseline Testing #2:
- 3 environments (hypobaric chamber, sea level, hypoxic tent)
- 1 week washout period at sea level

Baseline Testing #3:
- 3 environments (hypobaric chamber, sea level, hypoxic tent)
- 1 week washout period at sea level

Maximal Oxygen Uptake

(followed by Stoop, $\text{SeO}_2$, lactate & AMS)

Testing Protocol

- DEXA Scan
- Maximal Oxygen Uptake
- Battlefield Arman Anaerobic Endurance Test
- Whole Body Reaction Time
  - Pre-Baseline
- Stroop Color/Word Test (SCWT)
- Blood Lactates
- Acute Mountain Sickness (AMS)
  - Environmental Symptoms Questionnaire (ESQ)
  - Lake Louise AMS Scoring System (LLS)
- Oxygen Saturation ($\text{SeO}_2$ level)
Battlefield Airman Anaerobic Endurance Test (Followed by Stroop, SaO2, Isotones & AME)

Makoto Eye-Hand Speed (Followed by Stroop, SaO2, Isotones and AME)

Stroop Colored Word Test
- 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

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: 78 ± 6.2 cm (168-187)
- % Bodyfat: 6.4 ± 6.8% (6.0-26.7%)
### Oxygen Saturation (SaO₂)

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<th>Pre Consecutive</th>
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<tr>
<td>Chamber</td>
<td>75.7 ± 6.0%</td>
<td>79.8 ± 3.7%</td>
<td>77.9 ± 5.1%</td>
<td>78.8 ± 3.5%*</td>
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<tr>
<td>Ground</td>
<td>99.4 ± 3.7%*</td>
<td>98.8 ± 3.8%*</td>
<td>99.8 ± 3.6%*</td>
<td>98.4 ± 0.8%*</td>
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<tr>
<td>Tent</td>
<td>81.8 ± 4.0%</td>
<td>83.1 ± 3.0%*</td>
<td>81.8 ± 3.8%</td>
<td>83.0 ± 3.5%*</td>
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* = p<0.05 (pre vs post); ** = p<0.01 (ground vs tent/Chamber)

### Battlefield Airman Anaerobic Endurance Test Results

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<tr>
<td>Chamber</td>
<td>173 ± 61</td>
<td>189 ± 50</td>
<td>178 ± 65</td>
<td>200 ± 76</td>
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<tr>
<td>Ground</td>
<td>206 ± 81</td>
<td>215 ± 75</td>
<td>209 ± 63</td>
<td>240 ± 74</td>
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<td>Tent</td>
<td>214 ± 70</td>
<td>206 ± 60</td>
<td>215 ± 64</td>
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### Reactive Eye-Hand Results (seconds)

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<th>Pre Consecutive</th>
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<td>Chamber</td>
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<td>Ground</td>
<td>54</td>
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<td>55</td>
</tr>
<tr>
<td>Tent</td>
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### Proactive Eye-Hand Results

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<tr>
<td>Chamber</td>
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<td>78%</td>
<td>63%</td>
<td>70%</td>
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<tr>
<td>Ground</td>
<td>71%</td>
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<td>61%</td>
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<tr>
<td>Tent</td>
<td>53%*</td>
<td>56%**</td>
<td>56%*</td>
<td>56%*</td>
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* = p<0.05 (chamber vs tent); ** = p<0.01 (ground vs tent)
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

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

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

Acknowledgments

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

Study funded by:
Air Force Research Laboratory
Biobehavioral Performance Branch
Biobehavioral and Protection Division
Human Effectiveness Directorate
Brooks City Base, TX 78235
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.
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 34-28 June (with 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
  - 6 running economy assessments with 3 VO2max tests

THM Assessment

Chronic hematological data: THM

Significant main effect of time (p<0.015), no effect of Fe (p=0.173), no interaction (p=0.38)
<table>
<thead>
<tr>
<th>Group</th>
<th>Week</th>
<th>THM</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feet</td>
<td>1b</td>
<td>+1.3 ± 1.9 g</td>
<td>+10.4%</td>
</tr>
<tr>
<td>Placebo</td>
<td>2a</td>
<td>+68.8 ± 9.4 g</td>
<td>+9.4%</td>
</tr>
</tbody>
</table>

- Clearly, the iron group had a shorter acclimatization time.

- Hematological acclimatization is longer in duration than previously thought.

---

**THM Peak**

**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

---

**Running Economy**

- Analogy: mpg

---

**Factors Affecting Running Economy**

- Baunswald et al., 2004

---
Previous USAFA RE Results

**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:**

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Age</th>
<th>Ht (cm)</th>
<th>Wt (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL</td>
<td>44</td>
<td>18.8±0.5</td>
<td>177.1±7.8</td>
<td>70.9±6.0</td>
</tr>
<tr>
<td>MA</td>
<td>11</td>
<td>19.0±1.0</td>
<td>179.5±7.0</td>
<td>75.5±10.8</td>
</tr>
</tbody>
</table>

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

**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% Time for VO_{2peak}
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 ATHM and ALR (R² = 0.806)
- Correlation existed between THM and VO₂peak (R² = 0.62)

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?

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: Dr. Bill Byrnes & Dr. Randy Wilber; Capt. John Magregor; Maj. Andrew Preble, Maj. Chris Rafter; Maj. Christine Mierwein; Col. Robert Edmonds, Col. Andrew Griswold, Col. A. Almeida, and Capt. J. App (former USAF AFB research); Maj. L. Terry, Maj. Ben Rees, Mr. Dan Thurston, (HPL, internal), staff at the USAF AFB subject!

Research funded by: HQ USAF-SGSR, APRL, and USAF HERC.

USAFA Human Performance Laboratory
HQ USAF/ADPH
2169 Field House Drive, Ste 111
USAFA Academy CO 80840

Jeff Nelson, Ph.D.
jeffnelson@usafa.edu

Integrity - Service - Excellence
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 AFRRI**

*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

**Presentation Objectives**

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

**Background**

- AFRRI 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

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

Medical Consequences of Acute Radiation Injury

- Gastrointestinal (5-20 Gy)
- Hematopoietic (1-6 Gy)
- Subclinical
- CNS (>20 Gy)
- Increasing Dose
### Detonation Casualties

<table>
<thead>
<tr>
<th></th>
<th>1 KT</th>
<th>10 KT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prompt fatalities:</td>
<td>&gt;7k</td>
<td>&gt;13k</td>
</tr>
<tr>
<td>Expectant (&gt;630 cSv):</td>
<td>~16k</td>
<td>~114k</td>
</tr>
<tr>
<td>Intensive care (IC) ward (530-830):</td>
<td>~19k</td>
<td>~90k</td>
</tr>
<tr>
<td>IC/minimum care ward (300-530):</td>
<td>~33k</td>
<td>~141k</td>
</tr>
<tr>
<td>Minimum care ward (150-300):</td>
<td>~66k</td>
<td>~150k</td>
</tr>
<tr>
<td>Outpatient (70-150):</td>
<td>~83k</td>
<td>~159k</td>
</tr>
<tr>
<td>Health monitoring (25-70):</td>
<td>~106k</td>
<td>~128k</td>
</tr>
<tr>
<td>Worried well (&lt;25):</td>
<td>&gt;150k</td>
<td>&gt;212k</td>
</tr>
</tbody>
</table>

### 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.

### Scientific Program

- Protection
  - Candidate screening
  - Drug evaluation
- Assessment
  - Biodosimetry: Cytogenetics and Molecular markers
  - Automation
- Treatment
  - Drug evaluation
  - Combined effects
  - Heavy metal toxicity

### Scientific Functional Schematic

- [Diagram showing radiation therapy and patient care processes]
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.ofri.usuhs.mil/research/biocmt.htm
Website for biodosimetry toxic:
http://www.ofri.usuhs.mil/outreach/biocmt.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
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 decorption

Photomicrograph of J774 cells untreated (Panel A) or treated with depleted uranium (Panel B) for 24 h then stained with 2-(5-bromo-2-pyridylazo)-5-diethylaminophenol to indicate uranium deposits.
Radiobiology Education and Training Opportunities

- Graduate Education in Radiobiology
  - PhD established within USU Molecular and Cellular Biology Program. Radiation Biology track
  - New 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/CE/CHE credits
- 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.

CDL Mark Melanson
Col Andy Huff
Dr. Christopher Liton
CPO John Gistad
LTG Steven Tobias
Mr. Steve Miller
LT Matthew Deshazo

AFMS Symposium Presentation Team:
Maj Michael Dempsey
Maj Joanna Haug

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

AFRRI 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 by 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-Diaz, 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
    • 5 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, matériel, 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 MEDRETE

5 months prior to mission start:
- Team members are identified (up to 6 residents PGY-2,3, Army and AF Staff (5-6), Dentists, Language (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
Honduras MUC Rotation – Didactic Portion (2 Weeks)

Week 1
Monday
AM – Travel Medicine
PM – Life Skills
ISO/PEP

Tuesday
AM – Mission Overview
PM – Anti-Terrorism/Red/City/Weapons/Dental/Medical

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

Week 2
Monday
AM – FM Preparation
PM – Initial Reaction
PM – Operations Training
PM – Logistics Training
PM – Anti-Terrorism/Red/City/Weapons/Dental/Medical

Tuesday
AM – MMHAC Module Part 1
PM – Anti-Terrorism/Red/City/Weapons/Dental/Medical

Wednesday
AM – MMHAC Module Part 2
PM – Anti-Terrorism/Red/City/Weapons/Dental/Medical

Honduras MUC Rotation – Didactic Portion (2 Weeks)

Week 2
Thursday
AM – MMHAC Exercises
PM – Anti-Terrorism/Red/City/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/City/Weapons/Dental/Medical

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 formulation and manages all medications and supplies through mission execution
- Funding
  - Staff funded from the Pediatric Department (Army) and SOUTHAF (AF)
  - Logisticians 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 NHT 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

**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
  - Liaison Officers, OIC, NCOIC
  - Coordination for all activities including:
    - Recruitment of staff
    - Acquisition of security through Honduran Military
    - Immunization records for randomization of households to be surveyed
    - Average rounds at regional hospital and tertiary care center

San Antonio Military Pediatric Center Honduras MEDRETE Program

**The Mission**

- Concept:
  - 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.
Team members train at worksite prior to initiating household surveys.

Team members, Honduran guards and guides work together to reach the households by HMMWV and hiking to remote locations.

Household level surveys of children 6-59 months of age.
Capacity Building & Nutrition Assessments

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

The last two days of the mission we wound 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

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

- 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.

Random (n=1402) and Convenience (n=1101) Data: Prevalence of Stunting, Undernutrition, Wasting and Anemia

<table>
<thead>
<tr>
<th>Region</th>
<th>Sex (m/f)</th>
<th>Mean Age in Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Ana (n=77)</td>
<td>53.2/46.8</td>
<td>31.6</td>
</tr>
<tr>
<td>Santa Elena (n=106)</td>
<td>50/50</td>
<td>31.7</td>
</tr>
<tr>
<td>Santiago Purín (n=298)</td>
<td>48.7/51.3</td>
<td>33.4</td>
</tr>
<tr>
<td>Lepaterique (n=197)</td>
<td>50.4/46.0</td>
<td>31.0</td>
</tr>
<tr>
<td>Chiapas (n=145)</td>
<td>49.7/50.3</td>
<td>29.58</td>
</tr>
<tr>
<td>Santa María (n=63)</td>
<td>52.4/47.6</td>
<td>33.4</td>
</tr>
</tbody>
</table>
Proceedings of the 2010 AFMS Medical Research Symposium
Volume 2  Operational & Medical

Number of Individuals living in a Household by Municipality

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Number of Cases</th>
<th>Average number in household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santiago Puringla</td>
<td>298</td>
<td>6.55</td>
</tr>
<tr>
<td>Santa Ana</td>
<td>77</td>
<td>7.65</td>
</tr>
<tr>
<td>Santa Elena</td>
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<td>6.56</td>
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<td>Lopaterique</td>
<td>197</td>
<td>6.17</td>
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<tr>
<td>Chinacla</td>
<td>145</td>
<td>7.12</td>
</tr>
<tr>
<td>Santa Maria</td>
<td>63</td>
<td>7.02</td>
</tr>
</tbody>
</table>

Prevalance of Malnutrition and Anemia by Municipality

Publications

San Antonio Military Pediatric Center Honduras MEDRETE Program

Graduate Survey Results

Identifying Children at Risk for Nutritional Crisis in Rural Honduras

Authors: J. Diler, M. Kommers, A. Lepard, D. Long, R. Schwartz, W. White, T. Ancuta, A. Alvarado, C. Chen, J. Diler, E. Giordano, E. White
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.

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.
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

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.
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 biosampling
- Controlled access, secure electronic communication (SIPRNET)

Key Card Entry – Camera monitored

Bacteriology

Automated Bacterial ID Systems

BD Phoenix
Biolab Micro-station
Omnikan
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
- M48 Workstation

Immunology

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

- SECTOR® Imager 8000
- PR2 from MSD
- Boviris M1M Detector
**Virology**

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

**Swine Flu**

- Swine Flu Culture Collection
- Diagnostics
- Antiviral drug Discovery

**Animal Testing**

- Animal Proximal Efficacy Testing of Candidate Therapeutics/Devices

**Pollinator**

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 optimized treatments for patients through Advanced Therapies, Bioinformatics, Tissue Banking, and Personalized Medicine

- Proving ground for emerging wound care technologies and treatments in support of healthcare beneficiaries with wounds
- Biobanking: Collection and storage of blood, wound tissue/field, bone, autologous purification, 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 public-private partnerships to enhance the quality of care for wounded personnel

---

**Complex Wound Biospecimen Network**

- Military-based biospository 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
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
- Massspectrometry

Wound effluent:
- Cytokines
- Chemokines
- Quantitative
- Massspectrometry

Serum & Wound Effluent Temporal Relationships
Complex Relationships Requiring Advanced Analytical Tools

Probabilistic (Bayesian) Model
Predicting Normal Healing at 1st Debridement
(Serum MCP-1 and IL-6 and Effluent MCP-1)
**Combat Wound Initiative Program**

**Complex Wound and Limb Salvage Center**

- Clinical Service
- Acute Care Services
- Research
- Biostatistics
- Service Line
- Operations
- Radiology
- Respiratory Therapy
- IT
- Benefits
- Tuition

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**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 readmissions, focused management
- **Graduate Medical Education**: Resident and staff education; retraining of patients lost to network and multi-service consultation supports GME mission

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

Identification of Bacteria

Combat Wound

Isolated Bacteria

PhoeniX Identification System

Biolom paneed Identification System

Omniolog Identification System
Isolation of an Antibiotic Resistance Carrying Plasmid from an Enterobacter Sp from a Wound Sample

Agarose Gel Electrophoresis of the Plasmid(s)

Lane 1: Enterobacter sp Lane 2: Plasmid

Phenol:Chloroform extraction

Normal human integument is exposed to a potential reservoir of antibiotic resistance genes: Journal of Wound Care 17(2): 391–399 (July 2008)

Ongoing Biofilm Studies

Biokine 200

Efficiency of novel antibacterial agents for treating polymicrobial wound infections

ROTATING DISC REACTOR

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

- After a century of fighting infectious diseases, emerging and reemerging systems are present in nearly every human health.
- Infectious Disease Diagnoses: 'The recognition' of effective disease control and prevention efforts, including surveillance.

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 measure of effectiveness of surveillance systems: Difficult to assess contributions of the surveillance systems.
- No clear distinction of infections that spread rapidly or silently can be detected before they are widely disseminated.

Microbial World: A Challenging Frontier

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

Bacteria could have traveled through space on comets if some have remained alive since the early solar system. The lack of water on the early Earth could cause bacteria to exist in a state of dormancy in the environment.

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).
- Timing of reports: 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

- "Typing" are defined by the technology
  - PFGE (CDC "Gold Standard")
  - TIG 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 (e.g., RFLP). Fingerprints are platform specific.
  - **Direct Analysis**: Requires sequence information. Inherits screening of samples from a large number of related and unrelated organisms (ex. MLST).

MassArray Compact System

- Synthetech
- Mass Spec Platforms
- Mass Spec optimized for Genomic analysis
- Data Analysis Software

SNP Genotyping with iPLEX® Gold

- Isolate genomic DNA
- Design PCR & Exon-specific SNPs
- SNP Amp & PCR
- MassArray & Mass Spectrometer
- MassArray® MICRO-TOP

- Thaw, grow, & isolate as necessary
- Design PCR & Exon-specific SNPs
- Set up master reaction with PLEX® reagents
- Condition & automated dispensing
- Data acquisition, automated genotyping calling, and allele analysis is 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.
- Dated sequence variations, new sequence types and clustering.

**Sequenom Analysis**

- Target sequence
- PCR using primers tagged with 762SP or primers
- Transcription
- Rnase A treatment
- Fragments analysis by 103H-TOF

**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 HYP21 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
Parameters for Optimal Molecular Signatures
 expo. Automated High Throughput capability (Sterile sample type)

Whole Genome Sequence

Signature Design

Assay Platform

Validated Pathogen Signature Assay

Single Nucleotide Polymorphism (SNP)

DNA molecule 1 differs from DNA molecule 2 at a single base-pair location (a SNP polymorphism).

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, Eith 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)

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
Glucose Control in Critically Ill Adults at a Military Hospital

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Disclaimer

• 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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  • All authored material constitutes 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.

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  • On the speaker bureau for Amylin Pharmaceuticals, Inc. and Eli Lilly and Company

Overview

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

Hyperglycemia and ICU Mortality

Mean Glucose Value (mg/dL)

Mortality Rate (%)

Retrospective review of 1,818 consecutive intensive care unit patients at The Stanford Hospital in Stanford, California.

61
Hyperglycemia and ICU Mortality

- Mean glucose levels (mg/dL)
  - Survivors: 137.9
  - Nonsurvivors: 172.0
  - \( p < 0.0001 \)

Hyperglycemia and Outcomes in Trauma Patients

- \(<140\)
- \(140-180\)
- \(>180\)

Trauma Patients

Hyperglycemia and Non-ICU Mortality

- Intensive Insulin Therapy in Critically Ill Patients
- Umpierrez et al., JAMA 2002; 288:976-987
Van den Berghe MICU Trial

The NEW ENGLAND JOURNAL OF MEDICINE

Intensive Insulin Therapy in the Medical ICU

Conflicting Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Region</th>
<th>Outcome</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-GAM 1</td>
<td>820</td>
<td>CCU (All)</td>
<td>1-year mortality</td>
<td>26% (Sig)</td>
</tr>
<tr>
<td>Van den Berghe</td>
<td>1454</td>
<td>S/ICU</td>
<td>ICU mortality</td>
<td>42% (Sig)</td>
</tr>
<tr>
<td>D-GAM 2</td>
<td>1253</td>
<td>CCU</td>
<td>2-year mortality</td>
<td>No difference</td>
</tr>
<tr>
<td>Van den Berghe</td>
<td>1200</td>
<td>MICU</td>
<td>Hospital mortality</td>
<td>7% (NS)</td>
</tr>
<tr>
<td>Hi-5</td>
<td>240</td>
<td>CCU</td>
<td>3-month mortality</td>
<td>-30% (NS)</td>
</tr>
<tr>
<td>GluControl</td>
<td>1101</td>
<td>ICU</td>
<td>ICU mortality</td>
<td>-10% (NS)</td>
</tr>
<tr>
<td>V/SEP</td>
<td>637</td>
<td>ICU</td>
<td>28-day mortality</td>
<td>6% (NS)</td>
</tr>
<tr>
<td>De La Rosa</td>
<td>504</td>
<td>S/CMICU</td>
<td>28-day mortality</td>
<td>-13% (NS)</td>
</tr>
<tr>
<td>NICE SUGAR</td>
<td>6104</td>
<td>ICU</td>
<td>3-month mortality</td>
<td>-10.6% (Sig)</td>
</tr>
</tbody>
</table>
Intensive versus Conventional Glucose Control in Critically Ill Patients

The NICE-SUGAR Study Investigators

Intensive target 81-108 mg/dL
Conventional target = 100 mg/dL
Summary of Evidence

- 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.
- Hyperglycemia is associated with adverse outcomes and should be avoided.

ADA/AACE Consensus Statement

1. 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 100 to 180 mg/dL (5.6 to 10.0 mmol/L) is recommended for the majority of critically ill patients.
   - Intermittent insulin infusions are preferred to continuous insulin infusion protocols, which demonstrate safety and efficacy, and are less prone to episodes of hypoglycemia or hyperglycemia.
   - With IV insulin therapy, frequent glucose monitoring is essential to minimize the occurrence of hypoglycemia and to achieve optimal glucose control.

WHMC IV Insulin Algorithm

- Developed by University of Pittsburg 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.

- Implemented as a quality improvement initiative in September 2007 at Willford 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.
WHMC IV Insulin Algorithm

- Initiation
  - 2 bedside glucometry results > 160 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

Insulin Titration Algorithm

<table>
<thead>
<tr>
<th>BG (mg/dL)</th>
<th>Current rate</th>
<th>Current rate</th>
<th>Current rate</th>
<th>Current rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-220</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
</tr>
<tr>
<td>220-250</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
</tr>
<tr>
<td>250-300</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
</tr>
<tr>
<td>&gt;300</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
<td>2.5-3.5 units</td>
</tr>
</tbody>
</table>

Metrics

- 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 (110-180 mg/dL)

Results

- A total of 46 patients receiving inpatient treatment were placed on the IIP from January to March 2000
- The average age of those on the IIP was 58 yrs
- The majority of patients had T2D
### Comparisons of Service for the Inpatient Insulin Infusion Data (January 2009 – March 2010)

<table>
<thead>
<tr>
<th></th>
<th>CCU (n=2)</th>
<th>MICU (n=20)</th>
<th>SCU (n=24)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean±SD</td>
<td>58.4±8.2</td>
<td>64.6±14.4</td>
<td>55.7±20.4</td>
<td>.15</td>
</tr>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2 (100.0%)</td>
<td>10 (50.0%)</td>
<td>8 (33.3%)</td>
<td>.44</td>
</tr>
<tr>
<td>Female</td>
<td>0 (0.0%)</td>
<td>10 (50.0%)</td>
<td>9 (37.5%)</td>
<td></td>
</tr>
<tr>
<td>Type of diabetes, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1 diabetes</td>
<td>0 (0.0%)</td>
<td>1 (5.0%)</td>
<td>0 (0.0%)</td>
<td>.41</td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td>2 (100.0%)</td>
<td>11 (55.0%)</td>
<td>6 (25.0%)</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>0 (0.0%)</td>
<td>3 (15.0%)</td>
<td>7 (29.2%)</td>
<td></td>
</tr>
<tr>
<td>No diabetes</td>
<td>0 (0.0%)</td>
<td>7 (35.0%)</td>
<td>9 (37.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of time goal BG at 110-150 mg/dL, mean±SD</td>
<td>69.6±25.7</td>
<td>49.3±17.3</td>
<td>53.3±23.4</td>
<td>.02</td>
</tr>
<tr>
<td>Length of stay in ICU (days), median</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>4 (2-6)</td>
<td>6 (2-9)</td>
<td>4 (2-10)</td>
<td>.90</td>
</tr>
<tr>
<td>Liver</td>
<td>4 (2-6)</td>
<td>6 (2-9)</td>
<td>4 (2-8.5)</td>
<td>1.04</td>
</tr>
<tr>
<td>Diastolic</td>
<td>65 (40-95)</td>
<td>75 (5-140)</td>
<td>75 (5-140)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### Insulin Infusion Protocol (IIP) Use

<table>
<thead>
<tr>
<th></th>
<th>CCU (n=2)</th>
<th>MICU (n=20)</th>
<th>SCU (n=24)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of Patients who Qualified &amp; Were Placed on IIP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of total qualified patients: CCU</td>
<td>35.6%</td>
<td>25.4%</td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>Percent of total qualified patients: MICU</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of total qualified patients: SCU</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Hypoglycemia event, n (%) |

<table>
<thead>
<tr>
<th></th>
<th>CCU (n=2)</th>
<th>MICU (n=20)</th>
<th>SCU (n=24)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG&lt;50 mg/dL</td>
<td>1 (50.0%)</td>
<td>3 (15.0%)</td>
<td>1 (4.2%)</td>
<td>.08</td>
</tr>
<tr>
<td>BG&lt;30 mg/dL</td>
<td>1 (50.0%)</td>
<td>1 (5.0%)</td>
<td>1 (4.2%)</td>
<td>.08</td>
</tr>
<tr>
<td>Hypoglycemia event (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG&lt;50 mg/dL</td>
<td>8.3%</td>
<td>1.6%</td>
<td>0.8%</td>
<td>0.44</td>
</tr>
<tr>
<td>BG&lt;40 mg/dL</td>
<td>0.5%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>0.54</td>
</tr>
</tbody>
</table>
WHMC IIP Conclusions

- 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 46.3% to 69.6%
  - Low rate of hypoglycemia
- These results are comparable to published protocols from civilian institutions

Limitations

- 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

Implications for Air Force Critical Care

- 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

Implications for Combat Medicine

- 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
WHMC IIP in a Deployed Setting

- 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

Future Research

- 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

Comments/Questions?
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 Kral, 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 AFB Base
- SAMPC Pediatric Wellness Center Staff

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

- 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 2005, the proportion of potential recruits who failed their physicals each year because they were overweight rose nearly 10 percent."
**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.

---

**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 <50th percentile

---

**Model of Care**

1. **Referral**
   - Children ages 2 to 19 with Body Mass Index ≥ 95th percentile

2. **Initial Visit**
   - 2 to 3 hours
   - Laboratory tests
   - Body Mass Index
   - Clinical assessment
   - Task assignment

3. **Follow-up Visit**
   - 6 to 9 months
   - Dependent initial visit outcome
   - Typically every 1-3 months

---

**Objectives of Clinical Assessment**

- Identify and treat obesity-related co-morbidities including elevated blood pressure, impaired glucose metabolism, and dyslipidemia.
- Identify lifestyle 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.
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 Lifestyle Goals Agreement based on identified behaviors, child’s preferences for which behaviors to change, and parental preferences for which behaviors to change.

Wellness Assessment

Underlying principles of the wellness recommendations:

- The overall goal should always be promotion of healthy lifestyle habits. 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.
Proceedings of the 2010 AFMS Medical Research Symposium
Volume 2  Operational & Medical

Clinical Tracks

HB4Life Program | Nutrition & PA Education Program | Behavioral Treatment Program | Web-Based Program | Customized Program
--- | --- | --- | --- | ---
1 year | 1 year | 1 year | 1 year | 1 year
Monthly visits | Monthly visits | Monthly visits | Monthly visits | Monthly visits
Nutrition; PA and behavioral tool | Nutrition; PA and behavioral tool | Nutrition; PA and behavioral tool | Nutrition; PA and behavioral tool | Nutrition; PA and behavioral tool

Healthy Behaviors for Life Clinical Intervention Manual

Description
- 13 weekly lessons
- Clinic, home and follow-up visits
- Home assignments for families
- Patient/family education

Lesson Examples:
- “Leading a Healthier Life”
- “Dealing with Stress and Bullying”
- “Smart Snacking”
- “Feeling and your Emotions”

Healthy Plate

Healthy Plate allows children to add foods to a virtual “plate” by selecting icons representing food categories. The program calculates the total calories and the nutrient breakdown of the selected foods.

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.
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 Plots calories and minutes scores 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 & Materiel Command under agreement #W81XWH-08-2-0024 and W81XWH-07-2-0080 and the Air Force Surgeon General’s Office under agreement # FA7014-08-2-0601.
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.
A Financial Model of Bariatric Surgery for Morbid Obesity

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

BOOM Collaborative Group

- The Bariatric Outcomes and Obesity Modeling (BOOM) Project is a multidisciplinary research collaboration investigating obesity health services.
- Primary collaborators include: Franklin Ship Carr and Larry Belova (Western Healthcare Systems LLC), David Flann MD MPH, Andrew Wright MD, Elena Koura MD, Alison Ochoa Rhodes MD, Sara McLeod MPH, Rebecca Catanio Symsma, MPH, Erin McAdam, Karina Cole MPH (Bariatric Outcomes Research Center, University of Washington), Sean Saffern PhD, Leslie Cottin PhD, Rafael Alfonso-Gristancho MD Msc, Bonnie Wang MD, Edwin Waugh PhD (Pharmaceutical Outcomes Research and Policy Program, University of Washington); David Arterburn MD, Molly Ollier, Renee Fawkes (Center for Health Studies, Group Health Cooperative); Evan Martin MD MS (Samaritan Physicians).

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.

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.”

**How the BIA is performed?**

**CURRENT ENVIRONMENT**
- Total Population
- Sick Population
- Target Population
- Total Patients
- Out of House

**KEY FACTOR**
- % diagnosed % treated

**MID-STEP**
- Infections
- Pneumonia
- Sepsis

**NEW ENVIRONMENT**
- Total Population
- Sick Population
- Target Population
- Hospital

**DIFFERENCES**
- Budget Impact

---

**Open Cohort**

1. `T0`
2. `T1`
3. `T2`
4. `T3`

**Closed Cohort**

**The case of bariatric surgery for obesity...**

**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
  - Renal insufficiency along with hypotension can occur from the metabolite methylnorepinephrine in the past year due to increased suicidal risk
- Surgical alternatives to treat obesity are effective at reducing weight and improving comorbid conditions
**Population**

**U.S. General population**
- Approx. 317 million (July 2009)
- 5.7% of adult population (Approx. 24 million people) had a BMI > 30 kg/m² (NHANES)
- 371,000 bariatric surgeries were performed in 2006 (Medicare)

**TRI-CARE**
- Approx. 5.6 million beneficiaries (2010)
- Air Force (AF) Active Duty (AD) (2001-2009) 689,989
  - Died before weight loss surgery: 41,146 (< 0.06%)
  - Died before weight loss surgery: 1,436,979 (0.26%)
  - Died before weight loss surgery: 4,406 (0.07%)
- AF beneficiaries (not AD) anytime from 2001-2009: 1,379,237
  - Died before weight loss surgery: 584,986 (0.43%)
  - Died before weight loss surgery: 60,082 (4.46%)

*Closed cohort

**Patients eligible for Bariatric surgery in given year**

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI &gt;30kg/m², with</td>
<td>10,053</td>
<td>5,737</td>
<td>15,790</td>
</tr>
<tr>
<td>comorbidities</td>
<td>2.8%</td>
<td>2.8%</td>
<td>2.8%</td>
</tr>
<tr>
<td>BMI &gt;30</td>
<td>29,979</td>
<td>9,666</td>
<td>39,645</td>
</tr>
<tr>
<td>2.1%</td>
<td>4.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of patients</td>
<td>30,532</td>
<td>15,403</td>
<td>45,935</td>
</tr>
</tbody>
</table>

*Based on a non-observational closed cohort of 1 million adults with the same age, gender and other substantive comparability criteria.
### How much does obesity cost?

How much does bariatric surgery cost?

![Graph showing cost comparison](image)

### Costs (First 5 years)

* Average Annual Direct Medical Costs

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>$4,550</td>
<td>$4,550</td>
<td>$4,540</td>
<td>$4,530</td>
<td>$4,510</td>
</tr>
<tr>
<td>Lap RYGB</td>
<td>$20,800</td>
<td>$7,700</td>
<td>$9,700</td>
<td>$8,820</td>
<td>$5,300</td>
</tr>
<tr>
<td>AGB</td>
<td>$19,500</td>
<td>$20,600</td>
<td>$15,300</td>
<td>$11,020</td>
<td>$9,600</td>
</tr>
<tr>
<td>Open RYGB</td>
<td>$20,800</td>
<td>$12,500</td>
<td>$12,310</td>
<td>$9,100</td>
<td>$9,500</td>
</tr>
<tr>
<td>Sleeve</td>
<td>$20,800</td>
<td>$9,800</td>
<td>$11,000</td>
<td>$9,000</td>
<td>$7,200</td>
</tr>
<tr>
<td>Biliopancreatic Div</td>
<td>$25,200</td>
<td>$15,300</td>
<td>$8,100</td>
<td>$9,500</td>
<td>$8,300</td>
</tr>
</tbody>
</table>

*Estimated values

Source: NICE Cost-Effectiveness Model Reference case

### Results (US reference Population)

![Graph showing cost over time](image)
Results (US reference Population)

<table>
<thead>
<tr>
<th>BUDGET IMPACT CALCULATIONS</th>
<th>Year 1</th>
<th>Year 3</th>
<th>Year 5</th>
<th>Year 7</th>
<th>Year 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost of the population</td>
<td>281,436,000</td>
<td>269,339,000</td>
<td>295,432,000</td>
<td>293,295,000</td>
<td>244,500,000</td>
</tr>
<tr>
<td>without the procedures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost of the population</td>
<td>506,292,000</td>
<td>546,191,000</td>
<td>506,120,000</td>
<td>60,339,000</td>
<td>61,229,000</td>
</tr>
<tr>
<td>undergoing procedures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total plan costs with new</td>
<td>706,219,000</td>
<td>708,673,000</td>
<td>758,639,000</td>
<td>750,920,000</td>
<td>710,027,000</td>
</tr>
<tr>
<td>intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost of the population</td>
<td>787,501,000</td>
<td>776,076,000</td>
<td>738,692,000</td>
<td>756,622,000</td>
<td>735,712,000</td>
</tr>
<tr>
<td>if the intervention is not</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental PMPY</td>
<td>621.46</td>
<td>62.46</td>
<td>37.19</td>
<td>(1.97)</td>
<td>(0.09)</td>
</tr>
</tbody>
</table>

Results (AF reference population)

- 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.
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
Pilot Studies of Diabetes Prevention Programs in A Military Community

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

Acknowledgements: Debra L. Wolf, PhD; Hsiang-Yu Chen*, MS;
Linda Emmerich*, RN, PhD

*affiliated with the University of Pittsburgh

Overview

- Background:
  - Incidence and Oal 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

Diabetes in the Military

- Incidence of DM in military vs US residents aged 20-44
  - 1.9:1.6 (100 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 (18.5-24.9)
- 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
Cost of Diabetes

- 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.

Cost of DM in the Military

- 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.

Diabetes Prevention Program

- Eligible Participants
  - Randomized
  - Standard Lifestyle Recommendations

  - 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

10-yr F/U of Diabetes Incidence and Weight Loss in the DPPOS

- 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

<table>
<thead>
<tr>
<th></th>
<th>ILS group</th>
<th>Metformin group</th>
<th>Placebo group</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPP (2 yrs)</td>
<td>6.8 (5.5-8.2)</td>
<td>7.8 (6.8-8.8)</td>
<td>11.2 (9.8-12.6)</td>
</tr>
<tr>
<td>End of lifestyle intervention (2-5 yrs)</td>
<td>5.6 (4.3-7.0)</td>
<td>7.0 (6.0-8.0)</td>
<td>10.8 (8.7-12.9)</td>
</tr>
<tr>
<td>Bridge period</td>
<td>7.1 (5.9-8.9)</td>
<td>7.5 (6.5-8.5)</td>
<td>8.0 (6.6-9.4)</td>
</tr>
<tr>
<td>Combined incidence</td>
<td>5.5 (4.2-6.8)</td>
<td>6.5 (5.0-7.8)</td>
<td>7.8 (7.0-8.8)</td>
</tr>
</tbody>
</table>

Data are incidence rates (95% CI). The bridge period began Aug 1, 2001, and 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.

![Graph showing mean weight change and cumulative incidence of diabetes over time with risk reduction data.]

- Risk Reduction: 31% by metformin, 58% by lifestyle.
Translating the Diabetes Prevention Program Into an Urban Medically Underserved Community

A nonrandomized prospective intervention study

Morgan M. Toure, MD, MPH
Kathleen J. Dugan, MD
Stacy A. Perz, MD

OBJECTIVE: The objective of this study was to determine if a community-based modified Diabetes Prevention Program (DPP) diabetes (GLB) intervention, for individuals at risk for diabetes, was effective in decreasing risk for type 2 diabetes and undiagnosed diabetes (T2D) in urban medically underserved community, and ultimately reducing or delaying diabetes in the community.

RESEARCH DESIGN AND METHODS: This nonrandomized prospective intervention study used a parallel design to test the effectiveness of a community-based (GLB) modified DPP among adults (≥18 years old) who are at risk for T2D, with pairs of participants matched for age, race, gender, BMI, and baseline glycemic status.

RESULTS: A total of 120 individuals (average age 48 years, BMI 34.5) were enrolled. The treatment group (n=60) received the DPP intervention, while the control group (n=60) did not. The intervention group showed a statistically significant reduction in weight (6.0 kg vs 0.2 kg, p<0.001) and HbA1c (0.8% vs 0.4%, p=0.001) compared to the control group. The intervention group also showed a significant decrease in systolic blood pressure (SBP) (10.1 mmHg vs 0.6 mmHg, p<0.001) and diastolic blood pressure (DBP) (5.8 mmHg vs 1.1 mmHg, p=0.008).

CONCLUSIONS: The results of this study suggest that a community-based modified DPP diabetes intervention can be effective in reducing risk for T2D in urban medically underserved communities, with reductions in weight, glycemic control, and blood pressure. Further research is needed to evaluate the long-term sustainability and effectiveness of the intervention in this population.
Pilot Study of A DPP in A Military Community

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.

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.

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 10 mmHg in systolic blood pressure (p = 0.07)
- Glucose decreased by 3mg/dL, but was not statistically significant (p >0.05)
- 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.
Pilot Study for A Media-Based Diabetes Prevention Program in A Military Community
Lisa Strickland, Capt, USAF, MC
Joseph Pollard, MPH

Acknowledgments: 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).

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 10 lbs
- 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
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

- 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
Translating What We Know

- 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!

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

- 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 ≥ 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

Summary

- 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

Questions?

Lisa.Strickland.1@us.af.mil
References

As cited on slides, additionally:
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.
Introduction

- Background
- Methods
- Results
- Conclusion

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

Background

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

- 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
H₁: Blood glucose levels will be significantly decreased during HBO2

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

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

<table>
<thead>
<tr>
<th>Patient ID</th>
<th>No. of Patients</th>
<th>Pre-Med (mg/dL)</th>
<th>Post-Med (mg/dL)</th>
<th>Pre-Blood (mg/dL)</th>
<th>Post-Blood (mg/dL)</th>
<th>Pre-Urine (mg/dL)</th>
<th>Post-Urine (mg/dL)</th>
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<td>448.1</td>
<td>447.0</td>
<td>449.0</td>
<td>448.2</td>
<td>449.1</td>
</tr>
</tbody>
</table>

| Results |
|----------|---------------|-----------------|------------------|------------------|------------------|------------------|
| Totals   |               | Pre-Med (mg/dL) | Post-Med (mg/dL) | Pre-Blood (mg/dL) | Post-Blood (mg/dL) | Pre-Urine (mg/dL) | Post-Urine (mg/dL) |
| A        |               | 104.7           | 107.5            | 112.5            | 115.0            | 113.2            | 115.1            |
| B        |               | 146.1           | 149.7            | 152.5            | 155.0            | 154.2            | 156.1            |
| C        |               | 208.7           | 212.5            | 213.5            | 215.0            | 214.2            | 216.1            |
| D        |               | 236.2           | 239.1            | 240.0            | 242.0            | 241.2            | 243.1            |
| E        |               | 274.3           | 278.1            | 279.2            | 281.0            | 280.2            | 282.1            |
| F        |               | 27.7            | 29.7              | 30.4             | 30.5             | 30.4             | 30.5             |
| G        |               | 207.1           | 209.7            | 210.1            | 211.0            | 210.2            | 211.1            |
| H        |               | 207.7           | 209.5            | 210.1            | 211.0            | 210.2            | 211.1            |
| I        |               | 249.4           | 252.0            | 252.5            | 254.0            | 253.2            | 254.1            |
| J        |               | 267.1           | 269.9            | 270.0            | 272.0            | 271.2            | 272.1            |
| K        |               | 339.1           | 342.5            | 343.2            | 345.0            | 344.2            | 345.1            |
| L        |               | 446.3           | 448.1            | 447.0            | 449.0            | 448.2            | 449.1            |

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Discussion

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

<table>
<thead>
<tr>
<th>Study</th>
<th>Mean Decrease in Glucose [mg/dL]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delamora: Non-DM</td>
<td>13.2</td>
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<tr>
<td>Delamora: DM (IDDM+HIDDM)</td>
<td>23.2</td>
</tr>
<tr>
<td>Springer: IDDM</td>
<td>51</td>
</tr>
<tr>
<td>USAFSAM: Metformin only</td>
<td>31.1</td>
</tr>
</tbody>
</table>

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

Discussion

- EHR has shortfalls
  - No documentation of interventions
  - Unable to pull demographics

- USAFSAM screening validated
  - No clinical hypoglycemia
  - Continue with current protocol

Questions?
References


Distribution Statement A
Approved for public release; distribution is unlimited. 314 ARMN No. 10-915, 13 Aug 90

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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
Team-Based Approach to Diabetes Care

Mark W. True, Lt Col, USAF, MC
Nina A. Watson, RN, MSN, CDE
Joseph Puttard, MPH
Linda Simeone, RN, PhD, CDE
Kristine Ruppert, DPh

Disclosure Slide

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.

Overview

- 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

Diabetes Epidemiology

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

IDC: National Diabetes Fact Sheet, 2007
Source: 2009–2008 National Health and Nutrition Examination Survey estimates of total prevalence (both diagnosed and undiagnosed) were projected to year 2007.
Diabetes Complications

- Heart disease \(\rightarrow\) 2-4x more likely
- Stroke \(\rightarrow\) 2-4x more likely
- Blindness \(\rightarrow\) 12-14k new cases each year
- Kidney failure/dialysis \(\rightarrow\) 48k new cases yearly
- Nervous system disease \(\rightarrow\) amputations \(\rightarrow\) 71k/yr

**Why should AFMS care about diabetes?**

- \"It\’s mostly a problem of retirees…right?\"
- FY 06 -- TRICARE treatment costs for its 622,000 diabetic beneficiaries \(\rightarrow\) 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?**

- Focus of AFMS research should be on wartime priorities first, 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

**Defining the problem**

- 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
Comprehensive Diabetes Visit

Failure to Meet Goals

- 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

Diabetes Center of Excellence Inception

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

Best Practice 1: Team-Based Appt Model

1. Prior to scheduled appt
   - Lab work gets done 1-2 weeks prior to appt
   - Pts instructed to record BG 4x/daily for 7 days

2. Check-in process
   - Completed by clinic support staff
   - Download glucose meter
   - Vitals sign/foot exam
   - Review of symptoms, medications, prevention screening (ophthalmology, microalbumin, etc.)
   - All data on a shared spreadsheet application
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

Team-based model

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

Best practice #2: IT tool to promote teamwork

• 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)
  • Promotes and enforces standards of care
  • Standardizes gathering/storing of information and documentation

DCOE Spreadsheet highlights
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 finger stick blood sugar.

If your morning finger stick 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)

---

**SUPPLEMENTAL Sliding Scale Insulin**

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

Check your fasting blood sugar 4 times a day and record the results. Do not eat food until you get a reading.

**Blood sugar readings**:
- **Action**
  - Do not change dose
  - Input 1 extra units
  - Input 2 extra units
  - Input 3 extra units
  - Input 4 extra units
  - Input 5 extra units

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**DCOE Patient Visits**

Providing Great Care…Building Warrior Males

Others (EO, CDC, counselor)

107
DCOE Impacts on DM2

- Jan 09 to Dec 09 impact on Hgb A1C

<table>
<thead>
<tr>
<th>Initial A1C</th>
<th>Number of patients w/ at least one follow-up</th>
<th>Average A1C drop at follow-up visit</th>
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<tbody>
<tr>
<td>&gt;8.0%</td>
<td>372</td>
<td>0.87%</td>
</tr>
<tr>
<td>&gt;7.0%</td>
<td>323</td>
<td>0.94%</td>
</tr>
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<td>&gt;6.0%</td>
<td>233</td>
<td>1.11%</td>
</tr>
<tr>
<td>&gt;5.0%</td>
<td>134</td>
<td>1.62%</td>
</tr>
</tbody>
</table>

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

--

DCOE Impacts on DM2

- Jan 09 to Dec 09

<table>
<thead>
<tr>
<th>Initial A1C</th>
<th>Number of patients w/ at least one follow-up</th>
<th>Average A1C drop at follow-up visit</th>
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<tr>
<td>6 – 7 %</td>
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<td>0.32%</td>
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<tr>
<td>7 – 8 %</td>
<td>88</td>
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<td>8 – 9 %</td>
<td>133</td>
<td>0.39%</td>
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<td>1.62%</td>
</tr>
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</table>

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

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A1C < 7% Target in Question

Effects of Intensive Glucose Outcomes in Patients

<table>
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<th>Glucose Control and Vascular Complications in Veterans with Type 2 Diabetes</th>
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<tr>
<td></td>
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<tr>
<td>Study size (n)</td>
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<tr>
<td>BMI</td>
</tr>
<tr>
<td>Years of DM</td>
</tr>
<tr>
<td>Baseline A1c</td>
</tr>
<tr>
<td>Prior CVD</td>
</tr>
<tr>
<td>A1C (%) (Intensive vs Control)</td>
</tr>
<tr>
<td>Nonfatal MI (%)</td>
</tr>
<tr>
<td>CV Death (%)</td>
</tr>
<tr>
<td>Microvascular</td>
</tr>
</tbody>
</table>

Take home: j risk MIs, but j risk death in intensive arm, Choose control has no impact on CV events, but j Microvascular risk, Choose control has no impact on CV events
Future Directions

- 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

Lessons Learned

- 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
    - Those disease managers should develop team-based models of care within their MTFs based upon DCOE practices
    - Nurse contact between provider visits is beneficial

IT can help

- 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

Diabetes IT System

- Key capabilities leveraged in a Diabetes IT System
  - Computerized information support system that accurately tracks outpatient diabetes 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
    - Populated 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 EHR note
  - Note that a chronic disease management platform for diabetes would also work for any other chronic disease
Progress towards a Diabetes IT solution

- Requirements for a Diabetes IT System (DITS) were validated at the Air Force SCORCC 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

Summary

- 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 scheduled to facilitate team interaction
  - IT tools can help facilitate team interaction, and reinforce standards
  - Use of trained nursing staff for visits for insulin titration
- Need for broader IT development to bridge projected resource gaps

Questions?
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.
The Prevalence of Secretive Behaviors in USAF Special Duty Subpopulations

Mary T. Braggstrom, MG, MPH
USAF, 9/09, 4/09

Introduction

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

Secretive Behaviors
- Suicidality
- Family Maltreatment
- Substance Abuse

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

Team Aerospace Begins Here!
**Introduction**

Community Assessment Survey
- Measures community risk and protective factors and prevalence of secretive behaviors

**Suicidality**
- CDC tool
- Suicidal thoughts
- Suicidal behavior

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

**Alcohol Use**
- WHO AUDIT tool
- Alcohol consumption
- Alcohol problems

**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

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

**Behavioral health treatment seeking patterns**
- Study #1 (Rowan, 1996)
  - SDP had higher rates of self-referral
  - SDP had higher rates of negative career impact by avoiding or delaying professional assistance
  - SDP was 65% TS-SCI on intelligence training base
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 (6%)
  - Aircrew had higher peer directed referral (50%) than TS-SCI (14%)
  - PRP not adequately represented

- 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%

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

Methods

<table>
<thead>
<tr>
<th>Site</th>
<th>% ELY</th>
<th>% PRP</th>
<th>% SCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base 1</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Base 2</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Base 3</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Base 4</td>
<td>1%</td>
<td>0%</td>
<td>99%</td>
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<tr>
<td>Base 5</td>
<td>2%</td>
<td>0%</td>
<td>98%</td>
</tr>
<tr>
<td>Base 6</td>
<td>2%</td>
<td>0%</td>
<td>97%</td>
</tr>
<tr>
<td>Base 7</td>
<td>3%</td>
<td>0%</td>
<td>97%</td>
</tr>
<tr>
<td>Base 8</td>
<td>1%</td>
<td>2%</td>
<td>97%</td>
</tr>
<tr>
<td>Base 9</td>
<td>4%</td>
<td>0%</td>
<td>96%</td>
</tr>
<tr>
<td>Base 10</td>
<td>7%</td>
<td>0%</td>
<td>95%</td>
</tr>
<tr>
<td>Base 11</td>
<td>7%</td>
<td>0%</td>
<td>95%</td>
</tr>
<tr>
<td>Base 12</td>
<td>7%</td>
<td>0%</td>
<td>95%</td>
</tr>
<tr>
<td>Base 13</td>
<td>8%</td>
<td>0%</td>
<td>92%</td>
</tr>
<tr>
<td>Base 14</td>
<td>9%</td>
<td>0%</td>
<td>91%</td>
</tr>
</tbody>
</table>

114
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 *

Results: Demographics

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI</td>
<td>120</td>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>FLY</td>
<td>150</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>180</td>
<td>450</td>
</tr>
</tbody>
</table>

Results: Suicidality

<table>
<thead>
<tr>
<th>Special Duty Subpopulation</th>
<th>Suicidal Thoughts</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>CI (95%)</td>
</tr>
<tr>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>PRP vs. SCI</td>
<td>1.39</td>
</tr>
<tr>
<td>PRP vs. FLY</td>
<td>2.33</td>
</tr>
<tr>
<td>SCI vs. FLY</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Results: Alcohol Use

<table>
<thead>
<tr>
<th>Special Duty Subpopulation</th>
<th>Alcohol Consumption (g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>CI (95%)</td>
</tr>
<tr>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>PRP vs. SCI</td>
<td>2.26</td>
</tr>
<tr>
<td>FLY vs. SCI</td>
<td>1.61</td>
</tr>
<tr>
<td>PRP vs. FLY</td>
<td>1.18</td>
</tr>
</tbody>
</table>

* Significant at p < 0.05
Results: Partner Abuse

<table>
<thead>
<tr>
<th>Special Duty Subpopulation</th>
<th>Partner Emotional Abuse</th>
<th>Partner Physical Abuse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>CI</td>
</tr>
<tr>
<td>SCI vs. PRP</td>
<td>1.34</td>
<td>1.01 - 1.79</td>
</tr>
<tr>
<td>SCI vs. FLY</td>
<td>1.77</td>
<td>1.19 - 2.58</td>
</tr>
<tr>
<td>PRP vs. FLY</td>
<td>1.32</td>
<td>0.85 - 2.04</td>
</tr>
</tbody>
</table>

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

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

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
**Total Suicide Event Rate: AF vs AF ISR Agency**

SUEs per 100,000 AD members

**Discussion: Other Evidence**

Positive screening responses

<table>
<thead>
<tr>
<th>AF/ISR Evaluation</th>
<th>AF/ISR Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening</td>
<td>Screening</td>
</tr>
<tr>
<td>% in Squadron</td>
<td>% in Squadron</td>
</tr>
<tr>
<td>MHC</td>
<td>MHC</td>
</tr>
<tr>
<td>Rate</td>
<td>Rate</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>8.3%</td>
<td>41.7%</td>
</tr>
<tr>
<td>8.3%</td>
<td>33.3%</td>
</tr>
<tr>
<td>8.3%</td>
<td>50.0%</td>
</tr>
<tr>
<td>25.0%</td>
<td>41.7%</td>
</tr>
</tbody>
</table>

**Special Duty Demographics**

<table>
<thead>
<tr>
<th>Population</th>
<th>Total</th>
<th>% AD/SD</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total AF</td>
<td>8,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special Duty</td>
<td>6,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>4,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRF</td>
<td>2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fly</td>
<td>1,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes of Interest:**
- Special Duty falls applies to approximately 1/3 of the Air Force.
- SCI personnel are 1/5 of the entire AF.
- PRF are only 1/5 of the entire AF.
- SCI personnel currently are a little more numerous than PRF personnel.
- PRF only constitute 4% of the AF (about half of the Fly).
Personnel Trends

Non Physical Effects of Warfare

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

Welcome to the Future

- "Tele-WARFARE"
- Telecommuting to the war zone
- "The NEW COMBAT ZONE!"

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
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

Questions

RAM 2010
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.
**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

**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)

**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): $4.29 (CDC, 2006)
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)

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)

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)

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).
Proceedings of the 2010 AFMS Medical Research Symposium
Volume 2  Operational & Medical

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 (Brestau, Novak, and Kessler 2004)
  - Major depression, anxiety disorders, and substance use disorders

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 (Mihalescu and Drucker-Colin, 2000)

Methods

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

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
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”.

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, Heapska, Meyers, Rumpf, Johana 2004) included:
  - impulsivity, alcohol use, and exercise have been shown to affect cigarette smoking.

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≤0.25)
- Second, covariates could not be highly correlated with each other
  - Education and paygrade

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

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Unweighted sample</th>
<th>Weighted sample</th>
<th>Weighted %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any smoking in the past 30 days</td>
<td>Yes</td>
<td>323</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>2,603</td>
<td>42.2</td>
</tr>
<tr>
<td>Mental health related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needed further depression counseling (Yes)</td>
<td>2,223</td>
<td>130,743</td>
<td>22.8</td>
</tr>
<tr>
<td>Needed mental health counseling (Yes)</td>
<td>2,217</td>
<td>134,715</td>
<td>16.9</td>
</tr>
<tr>
<td>Depression or anxiety persisting (Yes)</td>
<td>754</td>
<td>30,181</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Results: Sample Characteristics of Covariates

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Unweighted sample</th>
<th>Weighted sample</th>
<th>Weighted %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White, non-Hispanic</td>
<td>2,203</td>
<td>131,302</td>
<td>22.9</td>
</tr>
<tr>
<td>Black, non-Hispanic</td>
<td>2,209</td>
<td>130,877</td>
<td>22.8</td>
</tr>
<tr>
<td>Asian</td>
<td>1,608</td>
<td>56,797</td>
<td>9.6</td>
</tr>
<tr>
<td>Native</td>
<td>1,324</td>
<td>30,151</td>
<td>5.1</td>
</tr>
<tr>
<td>Household income level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>3,432</td>
<td>276,712</td>
<td>46.3</td>
</tr>
<tr>
<td>Some college</td>
<td>5,961</td>
<td>296,014</td>
<td>48.8</td>
</tr>
<tr>
<td>College graduate</td>
<td>4,253</td>
<td>197,942</td>
<td>32.3</td>
</tr>
<tr>
<td>National average</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>2,083</td>
<td>215,851</td>
<td>44.6</td>
</tr>
<tr>
<td>Military dummy</td>
<td>2,916</td>
<td>35,385</td>
<td>5.6</td>
</tr>
<tr>
<td>Medical dummy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted sample count</td>
<td>7,314</td>
<td>413,657</td>
<td>66.9</td>
</tr>
</tbody>
</table>
### Results: Sample Characteristics of Covariates - continued

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted odds ratio (OR)</th>
<th>95% CI</th>
<th>Adjusted odds ratio (OR)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (male)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Results: Association Between Predictors and Outcome

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted odds ratio (OR)</th>
<th>95% CI</th>
<th>Adjusted odds ratio (OR)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service (Army)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specialty</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deployment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table: Time association between mental health problems and re-exposure to violence during deployment

<table>
<thead>
<tr>
<th>Year</th>
<th>Unadjusted OR</th>
<th>95% CI</th>
<th>Adjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

---

*Results are based on data collected from a national survey of veterans who have served in Iraq or Afghanistan. The study was conducted by the Department of Veterans Affairs and is ongoing.*

*The data used in this analysis are proprietary and are subject to confidentiality agreements. Further information can be obtained by contacting the Department of Veterans Affairs.*
Results: Association Between Covariates and Outcome - continued

Discussion: Results Summary

- 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

Discussion: Covariates of Interest

- 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

Discussion: Military Impact

- 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
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.

Discussion: Strengths

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

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

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
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

Acknowledgements

- Mr. Billy Thompson (USAFSAM)
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- Ms. Sandy Kawano (USAFSAM)
- Ms. Gin Maupin (USAFSAM)
- Ms. Jane Marquardt (USAFSAM)

Questions?
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

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Resident in Occupational Medicine
USAF-SAM/FEER

OVERVIEW

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

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

Background

- Objectives include:
  - Mental health
  - Hypertension
Mental Health & Hypertension

- 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

MH and HPT in the Military

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

Public Health Significance

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

Hypothesis

- 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
**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

**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

**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”

**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)
**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)

**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)

**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

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

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

RESULTS: Descriptive Characteristics

- 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%

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

RESULTS: Descriptive Characteristics

- 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
Unadjusted analysis

- 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)

Multivariate adjustment

- 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: 25% ↑ HPT Rx (OR=1.26; CI=1.08-1.48; p=0.005)
  - Received mental health counseling: 50% ↑ HPT Rx (OR=1.50; CI=1.26-1.78; p<0.0005)
  - Used medications for MH reasons: 44% ↑ HPT Rx (OR=1.44; CI=1.09-1.91; p=0.0012)

Multivariate adjustment

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

Multivariate adjustment

- 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
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.

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.

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.

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.
Limitations: Concepts of Causality

• 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.
Psychological Health Stress Screening of RPA Operators

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

BACKGROUND

- Questions & concerns from AF leadership re: impact on psychological health of operators
  - Unit CCs & Flight Docs
  - Operational tempo (manning, hour, shift work)
  - Systemic stressors (voluntary 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 partion w/ domestic life)
- High interest from HAFC/CSAF, AFMOA (PTSD), MAJCOM/SGPs (ACC/AFSOC, ISR/SGP)

STRESS SURVEY

- Concern re: impact of operations on MH of RPA ISR personnel (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)
RPA Operator Occupational Stress Screening

**Mission:**
Combatant command occupational psychological stress screening for RPA drone sensor operators & maintainers, intelligence analysts involved in remote and combat support operations world-wide.

**Objectives:**
- Identification of situational stressors & sources of stress
- Changes in health-related to RPA operations
- Identification & recommendation for occupational & health support

**METHOD**
- 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 by local flight surgeon & MH representatives from USAFAM research team
- Distributed at CCs cell or during operational shifts (by CC preference)
- Anonymous survey placed in pre-addressed envelope sealed by participants given to flight surgeon or research team member
- Non-combatant seniors (senior leaders) from various support & logistic organizations supporting ISR RPA operations were also included from local RPA installations.

**STRESS SURVEY**

- 10 - 15 minutes to complete
- Multiple choice, written 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 services utilization
  - Alcohol usage, relationship changes, job satisfaction

**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 Trameras (2005) in one of the first published studies re: RPA operations & operator fatigue
RESULTS

Pilots, Sensor Operators, and MICs (sources of stress)

- Shift work, schedule changes
  - "Shift changes every month."
  - "Routinely over work 30 days."
  - Strange hours, working weekends, shift changes, all impact family life.

- Long hours & low meaning
  - "Too much to do, not enough people"!
  - "Can’t make plans due to low meaning."
  - "Never ending surge & realted leave"

- Job duties (low interest, cynicism)
  - "A money can do 80% of my job!
  - "Hope I can ever get back to flying."
  - "This job is totally unchallenging."
  - "I didn’t see for this job."

Maintaining relationships w/ family & friends

- "Not being around to do stuff at home."
- "Family care is complicated due to shift work."
- "Always trying to work & not being there."

"Career progression (pilots)

- "Career possibilities are terrible."
  - "I can do the things I need to compete for promotion when delayed by long hours/shift work."

At-Risk Operators

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

RESULTS

% Reporting relationships with family have worsened since their assignment at current location

\begin{align*}
\text{MC-1 Provider} & : 45\% \\
\text{MC-2 Faculty} & : 20\% \\
\text{MC-3 Admin} & : 10\% \\
\text{MC-4 Support} & : 5\% \\
\end{align*}
RECOMMENDATIONS

Pilots, Sensor Operators, MICs (Predator/Reaper)

✓ Operational Tempo
  ✓ "Increase morning to allow for leave/reduction in operational surge."
  ✓ "Longer rotations of aircraft to allow for adjustment."
  ✓ "Switch to a 4on-3off work schedule."
  ✓ "Extend flight medical service hours to overlap with midnight shifts."

✓ Health Oriented
  ✓ "Improve quality, quantity, access to fitness equipment/gym."
  ✓ "Better and more health foods in the commissary."

✓ Geographic
  ✓ "Relocate to a place closer... commute time ruins family/personal life."
  ✓ "Find a location way more desirable than this."

✓ Career & Veterans Oriented (transitioned veteran)
  ✓ "Provide clear promotional path & incentives for RPA operations."
  ✓ "Allow me to fly SOMETHING, even a Cessna."
  ✓ "Show us some hope that we will go back to flying."

✓ Access to Care
  ✓ Flexible flight medicine hours (care extended to midnight shifts)
  ✓ Implementation of CQHS scenario in flight medi-ces
  ✓ Experienced MH provider co-located within flight medicare
  ✓ Experienced MH provider giving outreach "line-side" briefings to
  ✓ unlife/Sgts: operational & relational stress specific to Creed operations.
  ✓ Prevention based stress inoculation specific training to RPA operations/stressors within training pipeline curriculum for Pilots, Sgts, and MICs.
  ✓ Outreach efforts to families: vs supportive services

QUESTIONS
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 difference 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.
Multivariate Analysis of MAB-II
Neuropsychological Screening in Rated USAF Pilots

Maj Brian Heerman, 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

Background

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

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

Volanti Subvenimus

Volanti Subvenimus
Background

- All indices for both MAB-II and MicroCog
  - Mean = 100
  - Standard deviation = 15

- USAF pilot population compared to general population
  - PSIQ <90th percentile (121)
  - V/Q and P/Q <60th percentiles (118, 120)
  - MicroCog generally the same

- Purpose of this study
  - Does USAF pilot population have same factorial structure as the general population?

Method

- Results from 10,612 pilot candidates included

- Confirmatory factor analyses using structural equation modeling (AMOS 17)
  - Evaluate correlation between variables (subtests)
  - Subtests in general population lead to VIQ and PIQ as well as PSIQ
  - Redundancy test using $\Delta \chi^2$ with $\Delta$ degrees of freedom
    - Evaluated at $p < 0.05$
    - Significant $\Delta$ 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

### Results

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<th>3 Factor</th>
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<td>3 Factor</td>
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<td>.953</td>
<td>.985</td>
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p-value < 0.0001

GFI = "goodness-of-fit index"

CFI = "comparative fit index"

RMSEA = "root mean square error of approximation"
Results

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

Discussion

- Arithmetic (general and numerical reasoning; problem solving) is relatively independent of other verbal aptitudes compared with:
  - Digit 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"
Discussion

- Numerical reasoning may influence, to some degree, performance in areas regarding visual coding and visual-rotation aptitudes and vice versa
- Predictive value or 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

Conclusion

- Pilot population better fits 3-factor model in MAAB-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
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

“Acos”
David M Rogers, MD, MPH
Lt Col, USAF, MC, SFS

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:
• Exposure risk factors?
• Screening dilemmas......
• Prostate CA incidence or mortality reported:
  • 1992 US Commercial Pilots PMR 1.48 (95% CI: 1.08-2.03)
  • 1996 Air Canada Pilots SIR 1.87 (95% 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 AMWTTS 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 registers
  - 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
- Kaplan-Meier Survival Curve
- Cox Proportional Hazards
  - Enables analysis of covariate effects
  - Similar results with Mantel-Haenszel techniques
- Databases merged with SAS 9.1x, Stata analysis with Stata 10.1IC

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**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
  - 56 years (range 36-87)
- Race Demographics for aviators with prostate cancer
  - 96% Caucasian
  - 4% African American
Demographics

- Career flying hours for each group
  - Prostate cancer: 3,039 hrs (±1,384 hrs)
  - No prostate cancer: 3,079 hrs (±1,474 hrs)

Stat significant difference (P<0.001)

Kaplan-Meier survival estimates

Odds Ratios

- Cox Proportional Hazards Model:
  - Odds ratios estimated by Hazard Ratio for prostate cancer
  - Aviators to non-aviators, controlling for age
    - HR: 1.07 (95% CI: 0.85-1.44)
  - 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