2015

Manpower System Analysis Thesis Day Brief / Class of March 2015

Monterey, California, Naval Postgraduate School

http://hdl.handle.net/10945/44884
Welcome
Naval Postgraduate School
Thesis Day
Improving the Signal for U.S. Navy Officer Productivity

LCDR Josh Ellison
(MBA Financial Management)

Advisors: Dr. Jesse Cunha
Dr. Marigee Bacolod
How should the U.S. Navy performance appraisal system be used to **optimally** identify officer productivity?

Answers Manpower and FM questions:
- Talent Management
- Improve Retention
- Increase Human Capital
- Reducing Costs
Literature Review
• 10 performance appraisal topics
• 2 incentive structure topics

Case Study
• USN & USMC Fitness Reports

Research Method
• Quantitative vs. Qualitative

Results
• Signal could be improved
  • Differentiation of Talent
  • Rating Accuracy
  • Metric Development
Navy FITREP could be improved by better measuring differences between individual’s performance.

Relative vs. Absolute Performance Comparison

1. Rankings
   - “Authorized” not required
2. Promotion Recommendations (EP, MP, P)
   - Forced Distribution
   - “Consistent” with Performance Trait grades
3. Performance Traits
   - 7 traits with scale options (most between 3.0 and 5.0)
   - 15 trait average possibilities from 3.0 to 5.0
Analysis suggests that FITREP ratings are likely manipulated

**Performance Appraisal Components**
- Rating Instrument
- Procedure
- Rater (Reporting Senior)

**Purpose Alignment**
- Short Term vs. Long Term
  - Merit based

| Positive Rater's Motive | - Improve motivation
  - Maximize merit pay increase
  - Avoid a record that might damage the employee’s career
  - Reward recent performance
  - Assist employee with a personal problem
  - Reward effort
  - Liking the subordinate |
|-------------------------|---------------------------------------------------------------|
| Negative Rater's Motive | - Avoid hanging dirty laundry
  - Make themselves look good
  - Avoid conflict/confrontation.
  - Promote a problem employee up and out. |
| Inflated Ratings | - Punish an employee
  - Encourage an employee to quit
  - Minimize merit pay increase
  - Comply with an organizational guidance to keep ratings low |
| Deflated Ratings | - Scare better performance out of an employee to prevent termination
  - Build a strong case against an employee who is destined to be terminated. |
Recommendations

• **Differentiation of Talent**
  – Require Rankings
    • Relative Comparison
    • Complete Summary Group

• **Rating Accuracy**
  – Ensure Alignment between Reporting Senior and Manpower Objectives
    • Merit Based
    • Leadership Messaging
    • Eliminate Implicit Incentives to Manipulate Ratings

• **Metric Development**
  – Use Inputs from above recommendations to develop a metric
Cumulative Productivity Metric (CPM)

- Calculate numerical value
  - Rankings (i.e. 2 of 13)
  - Normalize (Mean = 50)
  - Weight results based on length of observation

<table>
<thead>
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<th>Centile(P)</th>
<th>Normalized(N)</th>
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<td>2</td>
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Normalize Ranking of Summary Group

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<td>36.5</td>
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<tr>
<td>85.6</td>
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</table>

CPM = 62.4
Summary

- Differentiation of Talent
- Rating Accuracy
- Metric Development
Comparing the Performance of the Resident to Distance Learning Student Navy Officers at Naval Postgraduate School

LCDR Kyle Alcock
(MS Operations Research)

Advisors: Dr. Samuel Buttrey
Dr. Marigee Bacolod
• Research Questions

1. Is the NPS Academic Profile Code (APC) a valid predictor of student success in both DL and resident programs?

2. Do graduate students achieve a higher level of student performance in a resident education or in a distance learning education?

3. What student attributes lead to success in distance learning versus resident learning (and vice versa) and where do they differ?
Methodology/Approach

- Quantitative Analysis of Navy Officers Only (N=2633)
  - Continuous Response
    - Linear Models
    - Recursive Partition Regression Trees
  - Binary Response
    - Logit Models
    - Recursive Partition Classification Trees
Predictors

• Distance Learning status
• Academic Profile Code (APC) Delta
• Military Pay Grade
• Navy Officer Community
• Academic Year Started at NPS
• Years Since Undergraduate Degree
• USNA Graduate
• NPS School Name
• Class Retake
• Refresher Quarter
• Define student success?
  – Total Quality Point Rating (TQPR)
    • Graduation Eligible
    • Graduating With Distinction

• Student failure?
  – TQPR of Disenrolled Students
Total Quality Point Rating (TQPR)

1. Submariner or LDO?
   - YES
     - N=2633
     - TQPR=3.54
     - 2. *Distance Learning Student?
       - N=293
       - TQPR=3.02
     - 3. *GSEAS or *GSOIS?
       - N=170
       - TQPR=2.51
         - N=140
         - TQPR = 2.24
         - N=30
         - TQPR=3.73
   - NO
     - N=2340
     - TQPR=3.60

140 Submariners or LDOs taking DL courses in the GSEAS or GSOIS had an average TQPR of 2.24

*Denotes strong significance in the corresponding LM
Graduation Eligible

1. Submariner or LDO?
   - YES
     - N=2633
     - Prob=94.2%
   - NO

2. *Distance Learning Student?
   - YES
     - N=293
     - Prob=79.5%
   - NO
     - N=2340
     - Prob=96.0%

3. GSEAS or *GSOIS?
   - YES
     - N=170
     - Prob=65.9%
   - NO
     - N=123
     - Prob=98.4%

4. O-3, O-4, O-5?
   - YES
     - N=93
     - Prob=52.7%
   - NO
     - N=47
     - Prob=83.0%

O-3s, O-4s, and O-5s in the group identified by the previous Regression Tree have a Graduation Eligible probability of 52.7%.

*Denotes strong significance in the corresponding logit GLM.
USNA grads with less than 14 years after undergraduate studies and a better APC have a **87.3% probability of graduating With Distinction.**

*Denotes strong significance in the corresponding logit GLM*
141 DL students in the GSEAS or GSOIS were disenrolled with an average TQPR of 1.63.

*Denotes strong significance in the corresponding LM
Conclusions

• Research Question Answers

1. The APC is a valid predictor of student success

2. Student performance is equal between DL and resident students in GSBPP but not GSEAS and GSOIS

3. Success is achievable by 9 in 10 Navy Officer students with very few distinguishable characteristics
Conclusions

Follow On Opportunities

1. Similar study can be done for all other services, DoD civilians, and international students

2. More in depth analysis:
   - APC digits seperately
   - Curricula comparisons
   - Undergraduate Schools / Majors
   - Longitudinal study to analyze post-NPS performance
Conclusions

• Too soon to determine why some students perform poorly in identified DL programs:
  – Academic readiness?
  – Lifestyle integration?
  – Material presentation?
  – Technical rigor?
  – Career implications of disenrollment?
Questions?
Analysis of Suicide Behaviors in the Navy Active Duty and Reserve Component Population

LCDR Serena Blankenship
LCDR Kristin Shepherd
(MSM Manpower Systems Analysis)

Advisors: Dr. Yu-Chu Shen & Dr. Jesse Cunha

Sponsor: OPNAV Suicide Prevention Branch, N171
Area of Research

• Background:
  – Navy suicide behavior has increased over the past decade and peaked in CY 2012.
  – Tracking and prevalence of suicide death while on Active Duty is common, however incidence within the non-activated Reserve population is only gaining recent attention.
  – The tracking of self inflicted injuries only became mandated in 2009.
Research Questions

• Research Questions

1. What non-demographic, service-specific factors (e.g. sailor rating, warfare platform, combat zone deployment, command type, transition state) and pre-screening factors (e.g. AFQT, substance abuse, medical or legal waivers) are associated with the occurrence of suicide attempts and death by suicide?

2. How have suicide behavior trends (suicide attempts and deaths) differed between the active duty and reserve component Navy officer and enlisted populations.

3. In both the active duty and the reserve components, how do risk factors change between attempting and committing suicide?
Methodology

• Performed logistic regression analysis
  – Measured odds ratio for two outcomes, suicide attempt and death, given demographic, service-specific, and mental health characteristics
  – Analyzed enlisted active duty, enlisted reserve component, and officer active duty personnel separately
Data Sources

• Utilized pre-collected records
  – Defense Manpower Data Center: demographics, career information, reserve component indicator
  – Armed Forces Medical Examiner System: identified suicide death for Active Duty
    • 2,206 unique death observations CY2002-CY2012
  – National Death Index: identified suicide death for those not on Active Duty
    • 6,244 unique death observations CY2002-CY2012
  – Tricare: clinical diagnoses based on ICD-9 codes
• Created a yearly and aggregate sample
• Data Samples CY2002-CY2011
  – Enlisted: 3,219,849 total observations
    • 667,336 unique Sailors: 485,956 AC, 181,369 RC
  – Officer: 561,795 total observations
    • 94,617 unique Sailors: 62,998 AC, 31,618 RC
• Outcome variables:
  – Suicide Attempt
  – Suicide Death
• Explanatory Variables:
  – Demographics: gender, age, race/ethnicity, marital status, dependents, AFQT
  – Service-specific: paygrade, demotion, rate/designator, primary platform, combat zone deployment
  – Mental Health: diagnosed suicide attempt, PTSD, depression, substance use
Enlisted: Suicide Statistics

Enlisted Suicide Attempts

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<th>Year</th>
<th>AC Enlisted</th>
<th>RC Enlisted</th>
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<td>2010</td>
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Enlisted Suicide Deaths

<table>
<thead>
<tr>
<th>Year</th>
<th>AC Enlisted</th>
<th>RC Enlisted</th>
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<td>2010</td>
<td>48</td>
<td>9</td>
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<tr>
<td>2011</td>
<td>33</td>
<td>3</td>
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Officer: Suicide Statistics

Officer Suicide Attempts

- **AC Officer**
  - 2002: 32
  - 2003: 33
  - 2004: 34
  - 2005: 37
  - 2006: 37
  - 2007: 41
  - 2008: 42
  - 2009: 34
  - 2010: 33

- **RC Officer**
  - 2002: 13
  - 2003: 16
  - 2004: 18
  - 2005: 17
  - 2006: 17
  - 2007: 15
  - 2008: 20
  - 2009: 17
  - 2010: 14

Calendar Year

Officer Suicide Deaths

- **AC Officer**
  - 2002: 5
  - 2003: 7
  - 2004: 2
  - 2005: 7
  - 2006: 3
  - 2007: 5
  - 2008: 3
  - 2009: 1
  - 2010: 3
  - 2011: 2

- **RC Officer**
  - 2002: 0
  - 2003: 1
  - 2004: 0
  - 2005: 3
  - 2006: 0
  - 2007: 2
  - 2008: 0
  - 2009: 0
  - 2010: 1
  - 2011: 2

Calendar Year
Suicide Behavior Snapshot

- Total Number of Suicide Attempts: 15,864
- Total Number of Suicide Deaths: 866 (5.46%)
- Total Number of Suicide Deaths with a Previous Suicide Attempt Diagnosis: 41 (4.73%)
Results: Suicide Attempt

Mental Health Conditions

- Active Officer
- Active Enlisted
- Reserve Enlisted

Odds Ratio

- PTSD
- Depression
- Substance Use
Results: Suicide Death

Mental Health Conditions

- Odds Ratio
- Active Officer
- Active Enlisted
- Reserve Enlisted

- PTSD
- Depression
- Substance Use
- Previous Suicide Attempt
Results: Suicide Attempt

Service-Specific Factors

- Demotion
- Deployed to Combat Zone
- Paygrade ≥E5

Small and Large Platforms

AC  RC
Results: Suicide Death

Service-Specific Factors

- Demotion
- Deployed to Combat Zone
- Paygrade ≥E5
- Small Plat & CVN
- Other & Major Waivers

AC
RC

36
Recommendations

• Align DON Suicide Prevention Programs with behavioral health initiatives based on current research findings.
• Separate analysis for the method used to attempt/complete suicide
• Conduct additional research on demotion
• Conduct additional research on the environment and culture of surface combatants.
Questions?
Pre-Accession Factors in the Performance and Retention of Hispanic Navy Enlistees

LTJG Ryan Bowers
(MSM Manpower Systems Analysis)

Advisors: Dr. Stephen Mehay
Dr. Simona Tick
• Talent Management

• Propensity & Representation

• Basic Enlistment Eligibility Requirements
Primary:

• What are the attrition, retention, and promotion rates for different demographic groups of Navy enlistees?

• What pre-enlistment characteristics can explain such differences?
Methodology

• Quantitative Analysis on FY 01-09 Navy enlisted, followed over their career through FY 13 or separation.
• Model Definitions.
• Source: PRIDE & DMDC.
  • 348,033 enlistees, 18.5% Hispanic.

FY12 CNA Population Representation in the Military Service

- Endstrength
  - Hispanic civilians

- Accessions
  - Hispanic civilians

Percentage

- Army
- Navy
- Marine Corps
- Air Force
• Hispanics are less likely to attrite.

• Hispanic (ethnicity) increases reenlistments and extensions.

• Hispanics promote to E5 slower.
Results of Regression Analysis

• Hispanics are more likely to acquire dependents by three years of service.
  – increases retention and promotion probability.

• Unexpectedly, enlistees with an alcohol or drug waiver are less likely to attrite, more likely to retain, and promote faster.

• Longer time in DEP reduces first-term attrition, and increases retention.

• Completing the DEP PQS reduces first-term attrition and increases fast-track promotion to E5.
  – Enlistees who promote quickly have higher retention levels.
Secondary:

- Does citizenship or quality of education at enlistment affect career outcome?
- What is the effect of accessing with an advanced pay grade?
- Does occupational assignment differ by demographic group?
Results of Regression Analysis

Does citizenship or quality of education at enlistment affect first-term attrition, promotion, or retention?

• Non-citizens have lower first-term attrition, higher retention, and higher promotion rates.

• Tier 2 and Tier 3 enlistees promote slower and are more likely to attrite than (traditional) Tier 1 enlistees.
  – Tier 2 and Tier 3 Hispanics perform better than their non-Hispanic peers with alternative credentials.
Results of Regression Analysis

What is the effect of accessing with an advanced pay grade?

• Enlisting with an advanced pay grade decreases first-term attrition, increases retention, and increases fast-track promotion.

Does occupational assignment differ by demographic group?

• Hispanics are more likely to enlist in slower promoting ratings.
  – (Hospital Corpsman, undesignated)

• Hispanics are less likely to enlist in faster promoting ratings.
  – (Nuclear field, Intelligence and Cryptology ratings)
• Make DEP PQS completion a requirement for Tier 2 enlistees.

• Approval authority for all alcohol and marijuana use waivers for self-disclosing non-dependent applicants with no current dependency to be at the CO NRD level.
Questions?
Evaluation of Aviation Career Continuation Pay Incentives Among the Naval Aviation Enterprise Utilizing Auction Mechanisms

LCDR Brett Williams (MSM Manpower Systems Analysis)

Advisors: Dr. Noah Myung
Dr. William Gates
Establishing Bonus Amounts

Aviator Retention

Bonus Required

$180,000

$160,000

$140,000

$120,000

$100,000

$80,000

$60,000

$40,000

$20,000

$-

Number of Aviators

0 10 20 30 40 50 60 70 80 90 100

Reservation Price

Not Retainable
Establishing Bonus Amounts

Aviator Retention

- Reservation Price
- Not Retainable

Bonus Required

$180,000
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$-

Number of Aviators

0 10 20 30 40 50 60 70 80 90 100

$85,000

53
Establishing Bonus Amounts

Aviator Retention

- Bonus Required
- Number of Aviators

Reservation Price
Not Retainable

$125,000
$85,000
$100,000
$120,000
$140,000
$160,000
$180,000
Establishing Bonus Amounts

Aviator Retention

- Reservation Price
- Not Retainable
- Insufficient/Excessive Retention

Bonus Required

$180,000
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$-

Number of Aviators

0 10 20 30 40 50 60 70 80 90 100

$125,000
$85,000

35
53
75
• Primary:
  – What alternative mechanisms could be implemented to correct inefficiencies in the current Aviation Career Continuation Pay (ACCP) program?
  – What is the correct price for ACCP in order to retain the correct number and quality of officer among the various Type / Model / Series?
  – What are the appropriate metrics for deciding the quality of officers among naval aviation in order to maintain high quality for retention?
  – What efficiency gain and loss can we expect with a market-based compensation?

• Secondary:
  – What are some of the factors that influence staying in Naval Aviation?
Establishing Bonus Amounts

Aviator Retention

- Reservation Price
- Not Retainable
- Insufficient/Excessive Retention

Number of Aviators

Bonus Required

- $125,000
- $120,000
- $110,000
- $100,000
- $90,000
- $80,000
- $70,000
- $60,000
- $50,000
- $40,000
- $30,000
- $20,000
- $10,000
- $0

35
53
75

Establishing Bonus Amounts

Aviator Retention

- Bonus Required
- Number of Aviators
- Reservation Price
- Not Retainable
- Optimal Bonus

$125,000
$120,000
$110,000
$85,000
$80,000
$60,000
$40,000
$20,000
$0

35
53
75
Uniform Price Auction

Aviator Retention

Number of Aviators

Bonus Required

$180,000
$160,000
$140,000
$120,000
$125,000
$120,000
$110,000
$100,000
$85,000
$80,000
$60,000
$40,000
$20,000
$-

Reservation Price
Not Retainable
Optimal Bonus

35
53
75

75
80
90
100
Methodology

- Designed survey
  - Reservation price (bids up to $175,000)
  - Value of non-monetary incentives (NMI)
  - Quality factors
  - Perceptions among participants

- Survey was sent out to 9,588 aviators and NFOs
  - 2,141 completed the survey (effective response rate of 22.3%)

- Conducted simulations of auction mechanisms
  - Uniform-price
  - Quality Adjusted Discount (QUAD)
  - Combinatorial Retention Auction Mechanism (CRAM)
Quantity of Aviators

Percent Error In Take Rates

-30.0%
-20.0%
-10.0%
0.0%
10.0%
20.0%
30.0%
40.0%
50.0%
60.0%

Percent Error

Current System
Uniform Price
QUAD Model

VP
VAW
Quality of Aviators

Average Quality Score

- **Uniform-Price**
- **QUAD model**

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<th>VAW</th>
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<tr>
<td>10.00</td>
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Quality Score Comparison:
- **VP**: Uniform-Price = 6.00, QUAD model = 10.00
- **VAW**: Uniform-Price = 10.00, QUAD model = 6.00
## Recommendations

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Questions?
Naval Postgraduate School