Memorandum

Date: March 26, 2001

From: Roy M. Fleming, Sc.D., Director, Research Grants Program RMF
Office of Extramural Programs, NIOSH, D30

Subject: Final Report Submitted for Entry into NTIS for Grant 5 R01 OH003198-04.

To: William D. Bennett
Data Systems Team, Information Resources Branch, EID, NIOSH, P03/C18

The attached final report has been received from the principal investigator on the subject NIOSH grant. If this document is forwarded to the National Technical Information Service, please let us know when a document number is known so that we can inform anyone who inquires about this final report.

Any publications that are included with this report are highlighted on the list below.

Attachment
cc: Sherri Diana, EID, P03/C13

List of Publications

Murphy S, Beaton R, Pike K: Occupational stressors, stress responses and alcohol consumption among professional fire fighters: A prospective, longitudinal analysis. International Journal of Stress Management 6: 179-196, 1999

Corneil W, Beaton R, Murphy S, Johnson C, and Pike K: Exposure to Traumatic Incidents and Prevalence of Posttraurnatic Stress Symptornatology in Urban Fire Fighters in Two Countries. Journal of Occqpational Health Psychology 4:131-141, 1999

Beaton R, Murphy S, Johnson C, Pike K, and Corneil W: Cognitive/behavioral coping strategies in urban firefighters and paramedics. Journal of Traumatic Stress 12: 293-308, 1999

Beaton R, Murphy S, Johnson C, Pike K, Corneil W: Exposure to duty-related incident stressors in urban fire fighters & paramedics. Journal of Traumatic Stress 11: 821-828, 1998

Title: Psychosocial Risk Factors in Fire Fighter Stress
Investigator: Randal D. Beaton, Ph.D.
Affiliation: University of Washington
City & State: Seattle, WA
Telephone: (206) 543-8551
Award Number: 5 R01 OH003198-04
Start & End Date: 9/30/1994–9/29/1999
Total Project Cost: $465,232
Program Area: Not NORA
Key Words:

Abstract:
The aims of this study were: (1) to document baseline prevalence and incidence (new cases) of post-traumatic, other stress related symptomatology, and alcohol use in urban fire fighters over a three-year time frame; (2) to describe and document the frequency and intensity of urban fire fighters' exposure to duty-related trauma, i.e. medical, fire and other incidents (e.g. hazardous materials), by reviewing and objectively assessing Fire Department emergency medical and fire incident reports; (3) to determine the effect of traumatic incident exposures on the incidence of post-traumatic, symptornatology, and alcohol use in urban fire fighters over a three-year time frame; (4) to determine the interrelationships of appraised sources of non-traumatic occupation and non-work stressors in fire fighters with duty-related exposure to traumatic events across time in terms of specified adverse health outcomes; and (5) to identify pre-existing moderator and mediating variables that affect the relationships between predictor exposure and appraisal variables and the specified adverse (secondary traumatic stress) health outcomes across time.

Perhaps one of the most significant findings of this surveillance investigation of stress-related disorders in urban firefighters was the documented elevated prevalence(s) of post-traumatic stress disorder (PTSD). The prevalence of PTSD, based on a caseness criteria derived from a valid, reliable self-report inventory, was in excess of 20% in the sample of U.S. firefighters who participated in this investigation. Thus, the study sample PTSD prevalence rate was approximately 15-20 times that of a comparison male community sample, and these community
comparison data were also collected in North America in the 1990's. The PTSD rate documented for this sample was even greater than that reported for wounded Vietnam combat veterans, and higher than published prevalence rates reported for any other occupational groups. The annual incidence (new cases) of PTSD in this sample was also quite high (>10%). A number of distinctive patterns of PTSD were also observed in the U.S. firefighter sample (over an 18 month time frame) including long-term chronic (>1 year), mid-range chronic (>6months<1 year), "cyclers," acute (and acute-resolved). Based on the firefighter sample participants, it seems likely that a majority of U.S. urban firefighters currently have, or will experience at sometime during their career, clinically significant post-traumatic stress symptomatology.

There were elevated prevalences of other somatic, behavioral, emotional, and cognitive stress-related symptomatology in urban firefighters relative to a sample of healthy males. Summarizing data obtained from nearly 90% of the fire service personnel from the larger of the two participating fire departments, the number and frequency of a wide variety of somatic, behavioral, emotional, and cognitive symptomatology, based on self-reports on the Symptoms of Stress (SOS) inventory, was approximately one to two standard deviations above the "healthy" norm, with a few notable exceptions. Based on data obtained during year 1, nearly 60% of the entire sample of the firefighter participants had at least one SOS subscale t-score >70. (This was the "caseness" criterion employed.) It is also worth noting that officers (or supervisors) in this urban fire service sample had stress symptom profiles that were generally elevated relative to their line counterpart in the same department. - This comprised another significant finding-that is, in this high risk occupation, fire service supervisors tended to be at an even greater risk for certain stress-related symptoms, including PTSD. Based on year 1 data (and essentially replicated in subsequent years) the annual incidences of new cases of stress-related disorders (based on scores on any of the SOS inventory scales >2 standard deviations above the Beaton et al. [1991] healthy male norms) was 28.4%. Additionally, the documented prevalence of problem drinking in this sample of urban U.S. firefighters was approximately 30%. Though this latter finding did replicate the results of a prior investigation, it is still a significant finding since alcohol problems in firefighters could affect job performance, result in chronic health problems, affect health costs, and even influence their health status following retirement.

Based on the objective coding of the participating departments' emergency medical and fire incident reports was the higher-than-expected frequency of the firefighter participants' exposures to various types of duty-related stressful incidents. Indeed, in terms of the most stressful exposures, also documented for a Canadian metropolitan sample of firefighters, the operationally-defined "traumatic" incident exposures for the U.S. firefighters were nearly double that reported by a comparison sample of Canadian urban firefighters. However, even though U.S. firefighters were clearly capable of rating the relative stressfulness of actual and hypothetical categories of incident exposures, we were unable to show an increased risk of post-traumatic stress symptomatology due to actual incident exposures in the U.S. sample of firefighters. Furthermore, while we did not find a relationship between incident exposures and alcohol use per se.

Our surveillance research program identified a variety of risk and protective factors for various specific firefighter health outcomes. We had already identified rank in the fire service as a risk factor for PTSD, but also found that years of service and rank interacted in our sample, i.e. relatively inexperienced officers in the fire service reported the most post-traumatic symptoms. Prior counseling as well as recent on-the-job injury were also identified as separate, significant risk factors for PTSD caseness in our sample of firefighters. Also identified in this research investigation were a number of protective factors, including high levels of social support at work and at home, that appeared to partially mitigate the inherently stressful duties and tasks of the urban firefighters. We also found that leadership ratings (as assessed by their subordinates) and their level of physical fitness (as self-reported) showed a dose-response relationship to post-traumatic

stress symptomatology and other strain indices. That such leadership ratings could be significantly improved with a brief intervention for fire service officers has already been documented in an approved supplemental pilot intervention study with one of the participating fire departments.

Publications

Murphy S, Beaton R, Pike K: Occupational stressors, stress responses and alcohol consumption among professional fire fighters: A prospective, longitudinal analysis. International Journal of Stress Management 6: 179-196, 1999

Corneil W, Beaton R, Murphy S, Johnson C, and Pike K: Exposure to Traumatic Incidents and Prevalence of Posttraurnatic Stress Symptornatology in Urban Fire Fighters in Two Countries. Journal of Occqpational Health Psychology 4:131-141, 1999

Beaton R, Murphy S, Johnson C, Pike K, and Corneil W: Cognitive/behavioral coping strategies in urban firefighters and paramedics. Journal of Traumatic Stress 12: 293-308, 1999

Beaton R, Murphy S, Johnson C, Pike K, Corneil W: Exposure to duty-related incident stressors in urban fire fighters & paramedics. Journal of Traumatic Stress 11: 821-828, 1998

UNIVERSITY OF WASHINGTON
SCHOOL OF NURSING

December 20, 1999

Centers for Disease Control & Prevention (CDC)
Grants Management Branch
ATTN: Closeout Desk
2920 Brandywine Road, Suite 3000, Mail Stop E-13
Atlanta, GA 30341-4146

To Whom It May Concern:

Enclosed please find the original and three (3) copies of the Final Performance Report for Research Grant No. 5R01 OHO3198-04: *Psychosocial Risk Factors in Fire Fighter Stress*.

This grant expired on September 29, 1999, and required documentation has been submitted or will be forwarded to your office within 90 days of the above date.

Regards,

Randal D. Beaton, Ph.D.

Randal D. Beaton, PhD
Principal Investigator & Research Professor

encs.

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FINAL REPORT

"Psychosocial Risk Factors in Fire Fighter Stress"
Grant Number OHO3198
Total Project Period: 09/30/94 through 09/29/99

Randal D. Beaton, Principal Investigator
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Organizational Component to Receive Credit for Biomedical Research Support Grant:
09 School of Nursing

OPTION 2: SUMMARY REPORT

A. SPECIFIC AIMS

1. To document baseline prevalence and incidence (new cases) of post-traumatic, other stress-related symptomatology, and alcohol use in urban fire fighters over a three-year time frame.

2. To describe and document the frequency and intensity of urban fire fighters' exposure to duty-related trauma, i.e. medical, fire and other incidents (e.g. hazardous materials), by reviewing and objectively assessing Fire Department emergency medical and fire incident reports.

3. To determine the effect of traumatic incident exposures on the incidence of post-traumatic, symptomatology, and alcohol use in urban fire fighters over a three-year time frame.

4. To determine the interrelationships of appraised sources of non-traumatic occupation and non-work stressors in fire fighters with duty-related exposure to traumatic events across time in terms of specified adverse health outcomes.

5. To identify pre-existing moderator and mediating variables that affect the relationships between predictor exposure and appraisal variables and the specified adverse (secondary traumatic stress) health outcomes across time.

B. SIGNIFICANT FINDINGS

In this section of the summary report we will review and briefly describe our most significant research findings. Although it was somewhat difficult to cull these "most significant" findings from our many research results, we felt that four of our findings were of particular import and relevance for the occupational group studied: urban fire service personnel. These four significant findings, the foci of many of our publications and described in more detail below, included the following:

(1) elevated prevalences of posttraumatic stress symptomatology and posttraumatic stress disorder (PTSD) "caseness;"

(2) elevated prevalences of other somatic, behavioral, emotional, and cognitive "stress-related" symptomatology in urban firefighters (including problem drinking);

(3) high rates of exposures to various types of duty-related, stressful incidents; and

(4) the identification of a variety of risk and protective factors for various specific firefighter health outcomes.

1. Elevated Prevalences of Posttraumatic Stress Symptomatology & PTSD "Caseness"

Perhaps one of the most significant findings of this surveillance investigation of stress-related disorders in urban firefighters was the documented *elevated prevalence(s) of post-traumatic stress disorder (PTSD).* As shown in Figure 1 (from Corneil, Beaton, Murphy, Johnson, & Pike, 1999), the prevalence of PTSD, based on a caseness criteria derived from a valid, reliable self-report inventory, was in excess of 20% in the sample of U.S. firefighters who participated in this investigation. Thus, the study sample PTSD prevalence rate was approximately 15-20 times that of a comparison male community sample, and these community

comparison data were also collected in North America in the 1990's. The PTSD rate documented for this sample was even greater than that reported for wounded Vietnam combat veterans, and higher than published prevalence rates reported for any other occupational groups. The annual incidence (new cases) of PTSD in this sample was also quite high (>10%) as initially reported in 1996 (Beaton & Murphy, 1996), but as reported in 1997 (Beaton, Murphy, Pike, & Corneil, 1997), a number of distinctive *patterns of PTSD* were also observed in the U.S. firefighter sample (over an 18 month time frame) including long-term chronic (>1 year), mid-range chronic (>6months<1year), "cyclers," acute (and acute-resolved). Based on the firefighter sample participants, it seems likely that a *majority of U.S. urban firefighters currently have, or will experience at sometime during their career, clinically significant post-traumatic stress symptomatology.* One of the implications of this finding is to formulate a policy that recognizes the "general presumption" of risk of PTSD in urban firefighters as recommended at a Northwest health policy forum in 1997 (Beaton, Murphy, & Salazar, 1997).

2. ***Elevated Prevalences of Other Somatic, Behavioral, Emotional, & Cognitive "Stress-Related" Symptomatology***

Another significant finding from this investigation were *elevated prevalences of other somatic, behavioral, emotional, and cognitive stress-related symptomatology in urban firefighters* relative to a sample of healthy males (Beaton, Johnson, Bond, Murphy, & Hurrell, in review). As shown in Figure 2, summarizing data obtained from nearly 90% of the fire service personnel from the larger of the two participating fire departments, the number and frequency of a wide variety of somatic, behavioral, emotional, and cognitive symptomatology, based on self-reports on the Symptoms of Stress (SOS) inventory, was approximately one to two standard

deviations above the "healthy" norm, with a few notable exceptions. Based on data obtained during Year 01, nearly 60% of the entire sample of the firefighter participants had at least one SOS subscale t-score >70 (Beaton & Murphy, 1996). (This was the "caseness" criterion employed.) It is also worth noting that officers (or supervisors) in this urban fire service sample had stress symptom profiles that were generally elevated relative to their line counterpart in the same department (Beaton, *et al.,* in review). This comprised *another significant finding*—that is, *in this high risk occupation, fire service supervisors tended to be at an even greater risk for certain stress-related symptoms, including PTSD* (Corneil, *et al.,* 1999). Based on Year 01 data (and essentially replicated in subsequent years) the annual incidences of *new cases of stress-related disorders* (based on scores on *any* of the SOS inventory scales ≥2 standard deviations above the Beaton *et al.* (1991) healthy male norms) was 28.4% (Beaton & Murphy, 1996). Additionally, the documented prevalence of problem drinking in this sample of urban U.S. firefighters was approximately 30%—essentially the same rate of problem drinking as had been previously reported by Boxer & Wild (1993) (see Murphy, Beaton, & Pike, 1999). Though this latter finding did replicate the results of a prior investigation, it is still a significant finding since alcohol problems in firefighters could affect job performance, result in chronic health problems, affect health costs, and even influence their health status following retirement (Murphy, *et al.,* 1999).

3. High Rates of Exposures to Duty-Related Stressful Incidents

Another significant finding, based on the objective coding of the participating departments' emergency medical and fire incident reports was the *higher-than-expected frequency of the firefighter participants' exposures to various types of duty-related stressful*

incidents. (See Tables 1 and 2 for types, numbers, and percentages of annual exposures from the records of the participating fire departments.) (Corneil, Murphy, Beaton, & McGill, 1997)) Indeed, in terms of the *most stressful exposures*, also documented for a Canadian metropolitan sample of firefighters, the operationally-defined "traumatic" incident exposures for the U.S. firefighters were nearly double that reported by a comparison sample of Canadian urban firefighters (Corneil, *et al.,* 1999). However, even though U.S. firefighters were clearly capable of rating the relative stressfulness of actual and hypothetical categories of incident exposures (see Beaton, Murphy, Johnson, Pike, & Corneil, 1998), *we were unable to show an increased risk of post-traumatic stress symptomatology due to actual incident exposures in the U.S. sample of fire fighters* (Corneil, *et al.,* 1999). Furthermore, while we did not find a relationship between incident exposures and alcohol use *per se*, Murphy, *et al.,* (1999) found that PTSD ("Trauma Caseness") *was* a significant predictor of *future* drinking behavior (at two year follow-up) and the reported number of drinks per week was a more robust predictor of future drinking problems (at two yar follow-up) than current self-reported drinking problems. (See Table 3 from Murphy, *et al.,* 1999).

4. Identification of Risk & Protective Factors for Specific Health Outcomes

Another significant finding from our surveillance research program was *the identification of a variety of risk and protective factors for various specific firefighter health outcomes.* Table 4 identifies the various risk & protective factors that have been identified in our surveillance investigation to predict (or to have a statistically significant concurrent correlation) with various health indices in our sample of urban U.S. fire service personnel. We had already identified rank in the fire service as a risk factor for PTSD, but also found that *years of service*

and rank interacted in our sample, i.e. relatively inexperienced officers in the fire service reported the most post-traumatic symptoms (see Figure 3 from Beaton, *et al.,* in review). *Prior counseling* as well as *recent on-the-job injury* were also identified as separate, significant risk factors for PTSD caseness in our sample of firefighters (Corneil, *et al.,* 1999). Also identified in this research investigation were a number of *protective factors,* including *high levels of social support at work and at home,* that appeared to partially mitigate the inherently stressful duties and tasks of the urban firefighters (Corneil, *et al.,* 1999) (see Table 4). We also found that *leadership ratings* (as assessed by their subordinates) and their *level of physical fitness* (as self-reported) showed a dose-response relationship to post-traumatic stress symptomatology (see Figures 4 and 5) and other strain indices. That such leadership ratings could be significantly improved with a brief intervention for fire service officers has already been documented in an approved supplemental pilot intervention study with one of the participating fire departments (Beaton, Infield, Ollis, & Bond, in review).

C. USEFULNESS/APPLICABILITY OF FINDINGS:

The study findings clearly documented a high prevalence of PTSD and other stress-related disorders in a sample of urban firefighters. These findings have *major implications for policy formulation*, such as the provision of both remedial and preventive mental health benefits (e.g. stress management programs) and the recognition of potential "stress-related" (mental health) problems in this occupational group. Our survey findings also suggested that interventions focused on incident exposure(s) *per se*, such as critical incident stress debriefings, evidently did not remedy nor prevent post-trauma symptomatology in our sample of firefighters (see Figure 6). Such incident-based interventions also have the potential to overlook the

multiple, potentially malleable risk and protective factors identified in this epidemiologic investigation. Unfortunately, we did not and could not identify optimal cognitive-behavioral coping styles that could be taught to individual firefighters (see Beaton, Murphy, Johnson, Pike, & Corneil, 1999). Instead, we *were* able to identify a host of *organizational variables,* such as rank and leadership, that appeared to be significant correlates and predictors of subsequent strain. Importantly, these findings also provided the bases for a *needs assessment* culminating in the *development of a tailored multi-component intervention* focused on ranking officers in the fire service. This intervention is based on the assumption that relaxed, more competent fire officers will produce a systemic decrease in stress-related disorders in the participating department, including a reduction in on-the-job injuries. At this juncture, a NIOSH-funded Demonstration Project, awarded to the PI in 1998, is evaluating a multi-component leadership training program for fire service officers which has recently been implemented. *Such organizational interventions, if effective, might also be generalized and form the core curriculum for training with other high strain occupational groups such as emergency dispatchers* (Beaton, 1999).

D. HOW GRANT PUBLICATIONS AND PAPER PRESENTATIONS RELATE TO THE SPECIFIC AIMS OF THE PROJECT

The publication by Corneil, *et al.* (1999) clearly addresses Aims 1, 2, and 3 of this investigation by identifying the prevalence of PTSD in a sample of urban firefighters, by documenting the frequencies/types of stressful incident exposures experienced and also by documenting the (lack of significant) effect of such duty-related incident exposures on subsequent post-traumatic stress symptomatology. A paper presentation by Beaton and Murphy (1996) also addressed Aim 1 by documenting the prevalences and incidences of PTSD, other

stress-related symptomatology, and problem drinking. The paper presentation by Beaton, Murphy, Pike, and Corneil (1997) also addressed Aim 1 by documenting the prevalence and patterns of PTSD in urban fire personnel. The paper presentation by Corneil, Beaton, Murphy, and McGill (1997) addressed Aim 2 by examining the types and frequencies of actual incident exposures in the participating departments. The publication by Murphy, Beaton, Pike, & Johnson (1999) addressed Aims 4 and 5 by examining the prevalence(s) of post-traumatic, other stress-related symptomatology, and alcohol use in urban firefighters over a two-year time frame. (The impact of actual incident exposures was not examined in this paper since prior research had shown they were *not* predictive of adverse health outcomes.) The publication by Murphy, *et al.* (1999) also examined the inter-relationships of sources of non-traumatic and non-work stressors across time in terms of specific adverse outcomes, including problem drinking, stress-related symptomatolgy, and PTSD ("trauma") caseness, as well as the roles that moderator and mediating variables played in terms of specified adverse health outcomes (at two year follow up). The publication by Beaton, Murphy, Johnson, Pike, and Corneil (1999) also addressed Aim 5 by identifying pre-existing moderator/mediating variables (namely, cognitive-behavioral coping strategies) that predicted changes in post-traumatic stress symptomatology in urban firefighter participants across time (at six-month follow-up).

E. PUBLICATIONS & PRESENTATION ABSTRACTS FROM FUNDED R0-1 PROJECT/GRANT NUMBER OHO3198[1]:

Publications

Beaton, R., Murphy, S., Johnson, C., Pike, K. & Corneil, W. (1998). Exposure to duty-related incident stressors in urban fire fighters & paramedics. Journal of Traumatic Stress, 11, 821-828.

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[1]Copies of each of these above-cited publications and presentation abstracts, except for those "in progress" are attached as part of this Final Performance Report.

Beaton, R., Murphy, S., Johnson, C., Pike, K. and Corneil, W. (1999). Cognitive/behavioral coping strategies in urban firefighters and paramedics. Journal of Traumatic Stress,12, 293-308.

Corneil, W., Beaton, R., Murphy, S., Johnson, C., and Pike, K. (1999). Exposure to Traumatic Incidents and Prevalence of Posttraumatic Stress Symptomatology in Urban Fire Fighters in Two Countries. Journal of Occupational Health Psychology.4.131-141.

Murphy, S., Beaton, R., & Pike, K. (1999). Occupational stressors, stress responses and alcohol consumption among professional fire fighters: A prospective, longitudinal analysis. International Journal of Stress Management, 6, 179-196.

Beaton, R., Infield, S., Ollis, T., & Bond, G. (in review). Outcomes of a leadership intervention for a metropolitan fire department. Manuscript submitted to Psychological Reports.

Beaton, R., Johnson, C., Bond, G., Murphy, S., & Hurrell, J. (in review). Rank years of service, sources of occupational stress & self-reported health outcomes in urban fire service personnel. Manuscript submitted to Journal of Occupational Health Psychology.

Johnson, L. C., Beaton, R., Murphy, S., & Pike, K. (in review). Methodological approaches to sampling and response biases in health surveys. Manuscript submitted to the International Journal of Stress Management.

Paper Presentations

Beaton, R. & Murphy, S. "Pre-disaster baselines of the prevalence and incidence of stress-related disorders in urban firefighters & paramedic first responders." Poster presentation at the 21st Annual Hazards Research & Applications Workshops, Denver, Colorado, July 1996

Beaton, R., Murphy, S. & Corneil, W. "Prevalence of post-traumatic stress disorder symptomatology in professional urban firefighters in two countries." Accepted for oral presentation at International Congress on Occupational Health '96 in Stockholm, Sweden, September 1996.

Beaton, R., Murphy, S. & Salazar, M. "The general presumption of risk of post-traumatic stress disorder in urban firefighters." Paper accepted for presentation at the 1997 Northwest Health Policy Research Conference, Seattle, Washington, June 23, 1997.

Beaton, R., "Psychosocial Risk Factors in Firefighter Stress." Plenary session presentation at IAFF Redmond Symposium, Toronto, Quebec, Canada, August 1997

Corneil, W., Beaton, R., Murphy, S. & McGill, S. "Objective indices of trauma exposures in urban fire service personnel." Paper accepted for presentation at the 1997 International Society for Traumatic Stress Studies, Montreal, Quebec, November 1997.

Pike, K., Beaton, R., Murphy, S. & Corneil, W. "Gastrointestinal symptoms of fire service personnel with Post-traumatic Stress Disorder." Paper accepted for presentation at the 1997 International Society for Traumatic Stress Studies, Montreal, Quebec, November 1997.

Beaton, R., Murphy, S., Pike, K. & Corneil, W. "The prevalence and patterns of post-trauma symptomatology in urban firefighters & paramedics." Paper accepted for oral presentation at the 1997 International Society for Traumatic Stress Studies, Montreal, Quebec, November 1997.

Beaton, R., Salazar, M. and Robinson, J. Barriers to Implementing Personal Protective Equipment Policies Pertaining to Infection Control in Washington State Fire Service Personnel. Accepted for oral presentation at the 1998 Northwest Health Policy Research Conference, Seattle, Washington, May 1998.

Beaton, R., Fiedler, F., Infield, S. and Ollis, T. Outcomes Of A Leadership Intervention For A Metropolitan Fire Department. Accepted for oral presentation at NIOSH/APA Conference: Work, Stress and Health '99: Organization of Work in a Global Economy, Baltimore, Maryland, March 1999.

Johnson, C., Beaton, R., Murphy, S. and Pike, K. Methodological Approaches to Sampling and Response Biases in Health Surveys. Accepted for poster presentation at NIOSH/APA Conference: Work, Stress and Health '99: Organization of Work in a Global Economy, Baltimore, Maryland, March 1999.

Salazar, M. and Beaton, R. An Ecological Model of Occupational Stress. Accepted for poster presentation at NIOSH/APA Conference: Work, Stress and Health '99: Organization of Work in a Global Economy, Baltimore, Maryland, March 1999.

Beaton, R. Emergency Dispatchers: An Under-Researched and Underserved High Strain Occupation. Accepted for oral symposium (on "Emergency Workers") presentation at NIOSH/APA Conference: Work, Stress and Health '99: Organization of Work in a Global Economy, Baltimore, Maryland, March 1999.

Other Educational Publications

Beaton, R. (1997). Psychosocial Risk Factors for Fire Service Stress. Agenda of Occupational Health and Hazards of the Fire Service: 14th John Redmond Symposium, p. 19.

Beaton, R. (1997, Fall). Stress Symptoms Prevalent in Urban Fire Fighters. In Washington State Council Newsletter.

Beaton, R., Salazar, M. & Robinson, J. (1998). Barriers to Implementing Personal Protective Equipment Policies Pertaining to Infection Control in Washington State Fire Service Personnel. Proceedings of Northwest Health Policy Research Conference, p. 22.

Manuscripts in Progress

Beaton, R., Johnson, C., Bond, G., Salazar, M., & Murphy, S., (in preparation). The relationship between age, years of service, and on-the-job injuries in urban fire service personnel. For submission to the Journal of Emergency Medical Services.

Murphy, S., Bond, G., Beaton, R., Murphy, J., & Johnson., L. (in preparation). Lifestyle behaviors, leisure activities and their relationship to job stress, job satisfaction, and health outcomes among urban firefighters. For submission to the Amer. J. Health Promotion.

F. ADDITIONAL CLOSEOUT REQUIREMENTS

As requested as part of the Centers for Disease's award closeout requirements, this final performance report submission includes:

(1) an Equipment Inventory Form (attached as Appendix 1) indicating that no equipment was purchased on this grant costing $5,000 or more, and

(2) a Final Invention Statement (attached as Appendix 2) indicating that no inventions were made under this grant award.

The final Financial Status Report (attached as Appendix 3) will be forwarded to your office directly by the University of Washington Grant and Contract Accounting Office upon closeout of this award. Please see attached email message.

Table 1
Frequency of Exposures Across Departments
(From October 1994 to November 1995)

CATEGORY	SUBTYPES	# OF STRESSFUL EXPOSURES	% OF EXPOSURES
Suicides		**0**	**0.0%**
Dead on Arrival		**198**	**12.8%**
	Alcohol/Drug	8	.5%
	Gun Shot Wound	11	.7%
	Cardiopulmonary Resuscitation/Medical	101	6.5%
	Motor Vehicle Accidents	5	.3%
	Strangulation/Suffocation	6	.4%
	Other (incl. "natural causes")	70	4.5%
Crimes		**272**	**17.7%**
	Gun Shot Wounds	77	5.0%
	Stabbings	32	2.1%
	Sexual Assaults	16	1.0%
	Assaults (w/o weapons)	140	9.1%
	Assaults (w/blunt instrument)	7	.5%
Serious Injury Accidents		**394**	**25.6%**
	Auto/Child (incl. pedestrian/vehicle)	17	1.0%
	Other Child Accidents	72	4.7%
	Serious Motor Vehicle Accidents (incl. motorcycles & pedestrian/vehicle)	207	13.4%
	Industrial	6	.4%
	Electric Shock	3	.2%
	Adult Falls/Other Accidents/Injuries	89	5.8%
Medical Aid to Children & Infants (non-trauma)		**120**	**7.8%**
	Sudden Infant Death Syndrome	3	.2%
	Other Child Deaths	10	.6%
Hazardous Materials		**6**	**.4%**
	Drug Labs	4	.3%
Fire Fatalities		**1**	**.1%**
	Child	1	.1%
Fire Incident Injuries/Burns		**39**	**2.5%**
	Fire Fighters	23	1.5%
	Citizens	16	1.0%
Other Usual Events		**7**	**.5%**
	Multiple Alarm Fire	5	.3%
	Explosion of Unknown Origin	2	.1%
Other Stressful Incidents (not listed above)		**298**	**19.0%**

Table 2
Frequency of Exposures Across Departments
(From October 1, 1995 to September 30, 1996)

CATEGORY	SUBTYPES	# OF STRESSFUL EXPOSURES	% OF EXPOSURES
Suicides		**0**	**0.0%**
Dead on Arrival		**414**	**19.1%**
	Alcohol/Drug	10	.5%
	Gun Shot Wound	33	1.5%
	Cardiopulmonary Resuscitation/Medical	225	10.4%
	Motor Vehicle Accidents	5	.2%
	Strangulation/Suffocation	8	.4%
	Other (incl. "natural causes")	133	6.1%
Crimes		**424**	**19.6%**
	Gun Shot Wounds	168	7.8%
	Stabbings	101	4.7%
	Sexual Assaults	24	1.1%
	Assaults (w/o weapons)	113	5.2%
	Assaults (w/blunt instrument)	18	.8%
Serious Injury Accidents		**571**	**26.4%**
	Auto/Child (incl. pedestrian/vehicle)	97	4.5%
	Other Child Accidents	80	3.7%
	Serious Motor Vehicle Accidents (incl. motorcycles & pedestrian/vehicle)	242	11.2%
	Industrial	17	.8%
	Electric Shock	10	.5%
	Adult Falls/Other Accidents/Injuries	125	5.8%
Medical Aid to Children & Infants		**76**	**3.5%**
	Medical Aid (non-Trauma)	44	2.0%
	Sudden Infant Death Syndrome	30	1.4%
	Other Child Deaths	2	.1%
Fire Fatalities		**18**	**.8%**
Fire Incident Injuries/Burns		**198**	**9.1%**
	Fire Fighters	80	3.7%
	Citizens	118	5.4%
Other Usual Events		**83**	**3.8%**
	Multiple Alarm Fire	80	3.7%
	Explosion of Unknown Origin	3	.1%
Other Stressful Incidents (not listed above)		**382**	**17.6%**
Total		**2166**	**100.0%**

Table 3
Pearson Product Moment Correlations Among Occupational Stressors, Trauma, Symptoms of Stress, and Alcohol Use For Professional Fire Fighters By Time Comparisons

Variables (Baseline ↓) / (2 Yr Follow up →)	1	2	3	4	5	6
1. Job Stressors	.63***	.41***	.45***	.17*	.28***	.19**
2. Trauma Caseness	.44***	.46***	.38***	-.004	.17*	.13
3. Symptoms of Stress	.56***	.45***	.74***	.12	.15	.15
4. Reported # of Drinks Per Week	.15*	.24***	.18**	.70***	.48***	.31***
5. Self-Reported Drinking Problem	.10	.32***	.04	.25***	.35***	.26***
6. Alcohol "Caseness"	.11	.24***	.13	.26***	.29***	.46***

Note. Data shown were provided by 188 respondents who provided data at baseline and at two year follow up. Shaded region shows test-retest correlations.

*p=<.05 **p=<.01 ***p=<.001

Table 4
Risk & Protective Factors Identified from Surveillance Research Program for Various Firefighter Health Outcomes (with reference citations)

RISK FACTORS	PROTECTIVE FACTORS
Individual cognitive avoidance & numbing coping[1] (Beaton *et al.*, 1999)	Work social support[1] (Corneil *et al.*, 1999)
Employment as urban firefighter[1] (Corneil *et al.*, 1999)	Family social support[1] (Corneil *et al.*, 1999) Supervisor leadership ratings "The best"[4]
Single (marital status)[1] (Corneil *et al.*, 1999)	Married (martial status)[1]
Officer rank[1,2] (Corneil *et al.*, 1999; Beaton *et al.*, in review)	Line firefighter[1,2] (Corneil *et al.*, 1999; Beaton *et al.*, in review)
10-15 Years of service (and officer)[3] (Beaton *et al.*, in review)	Self-perception of fitness "good"[4] Low levels of overall work strain[1] (Corneil *et al.*, 1999)
Serious on-the-job injury[1] (Corneil *et al.*, 1999)	
Prior (mental health) help seeking[1] (Corneil *et al.*, 1999)	
High reported levels of job stress[5] (Murphy *et al.*, 1999)	Reported alcohol consumption moderate (to abstinence)[10]
PTSD caseness[6,7] (Murphy *et al.*, 1999; Pike *et al.*, 1997)	
Age[8] (Beaton *et al.*, in preparation)	Non-ED (field Fire Service personnel)[9] (Beaton, 1999)

[1] For future post-traumatic symptomatology or PTSD caseness.
[2] For interpersonal sources of occupational stress and certain physical strain symptoms.
[3] Interacted with rank in predicting post-traumatic symptomatology.
[4] See Figures 4 & 5 from Final Report.
[5] Predicted future (two year follow-up) "PTSD Caseness."
[6] Predicted future (two year follow-up) symptoms of stress & problem drinking.
[7] Associated with elevated prevalences of gastrointestinal symptomatology.
[8] Predicted higher on-the-job injury rates & delayed recovery from injury.
[9] ED associated with elevated post-trauma & other strain indices (Beaton, 1999).
[10] Predicted future (at two year) appraisals of job stress.

FIGURE LEGENDS

Figure 1. From Corneil *et al.*, 1999.
Prevalence of posttraumatic stress disorder in samples of Canadian and U.S. firefighters (based on total Impact of Events Scale scores ≥26). Also shown are contemporary comparative community norms obtained from Canadian men, U.S. crime victims, and Vietnam veterans. PTSD = posttraumatic stress disorder.

Figure 2. From Beaton *et al.*, (in review).
Mean Total and subscale T-scores for firefighter line personnel and all officers on the Symptoms of Stress Inventory.

Figure 3 From Beaton *et al.*, (1999).
Smoothed curve plots of the mean total of the Impact of Events Scale for line firefighter personnel and all supervisors as a function of years of service.

Figure 4 Impact of Event total scores as a function of supervisory ratings (by group).

Figure 5 Impact of Event total scores as a function of self-rated fitness (by group).

Figure 6 Impact of Event total scores for subsamples of firefighters who had (Yes) or had not (No) participated in a critical incident stress debriefing (within the prior six months).

Figure 1: Prevalence of PTSD

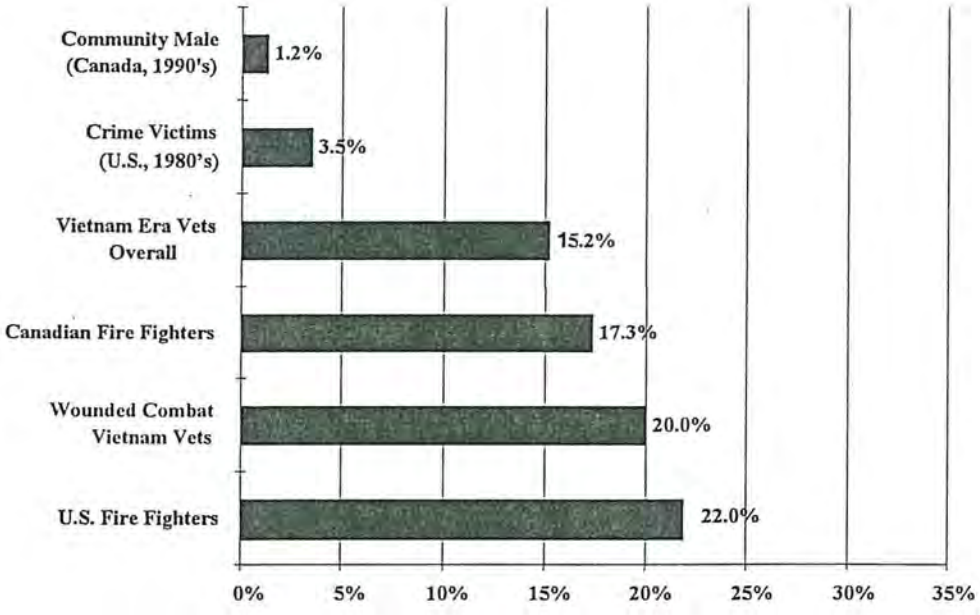


Figure 2:
Profiles of SOS (Total and Sub-scales)
Using Healthy Males as the Normative Group

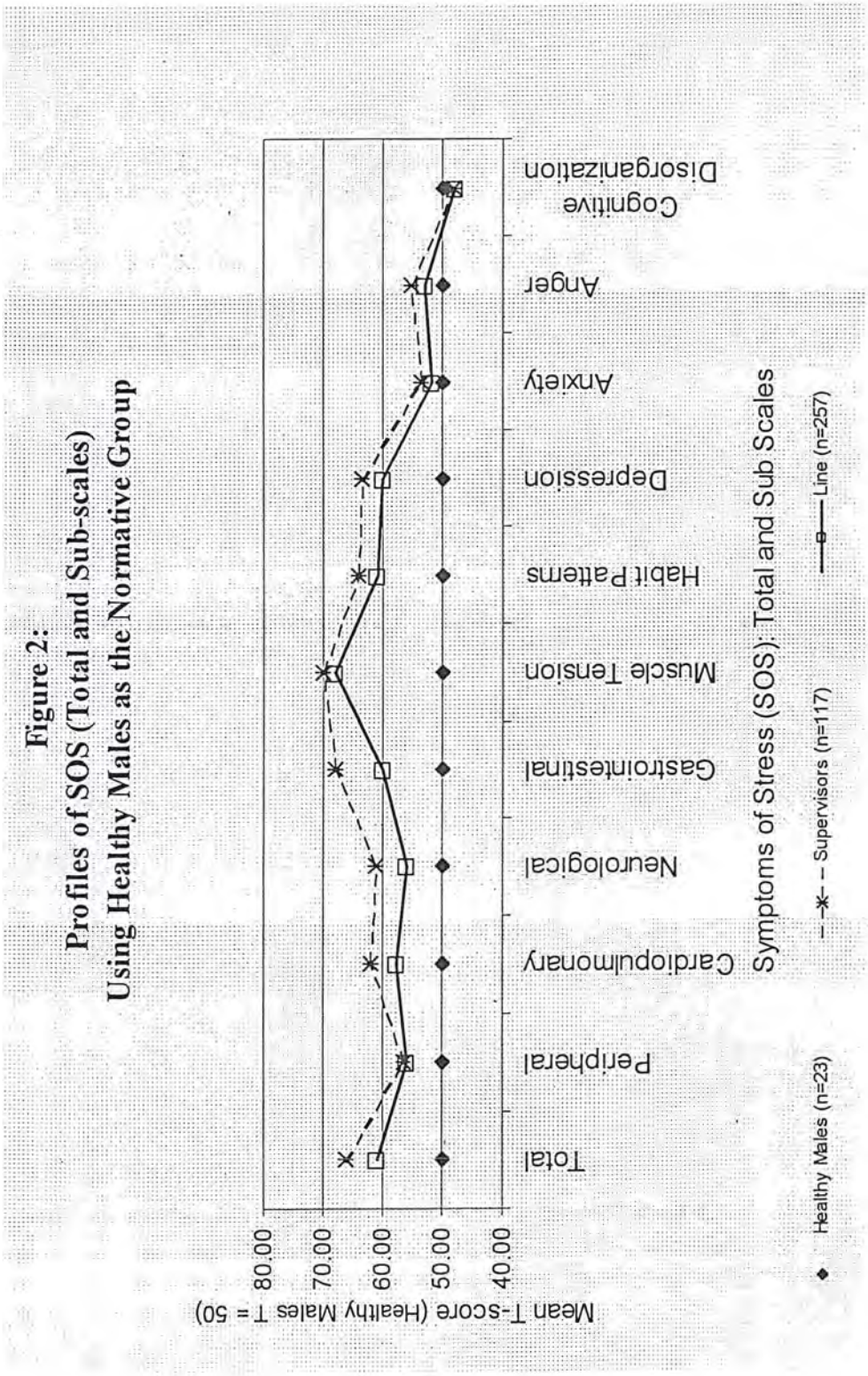


Figure 3:
Smoothed Curve Plots of the Mean Total of the Impact of Events Scale for Line Firefighter Personnel and All Supervisors as a Function of Years of Service.

Figure 4: Impact of Events: Tacoma FF (mid 1990's)

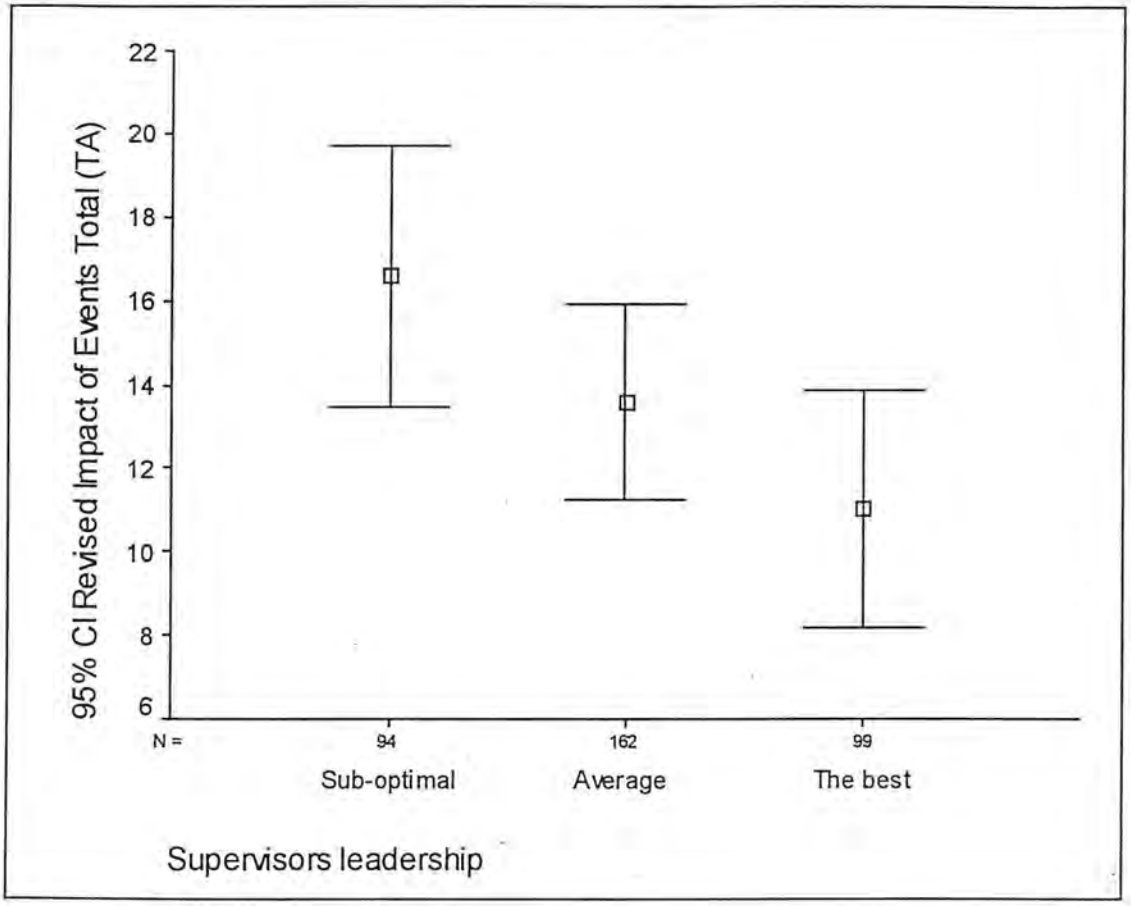


Figure 5: Impact of Events: Tacoma FF (mid 1990's)

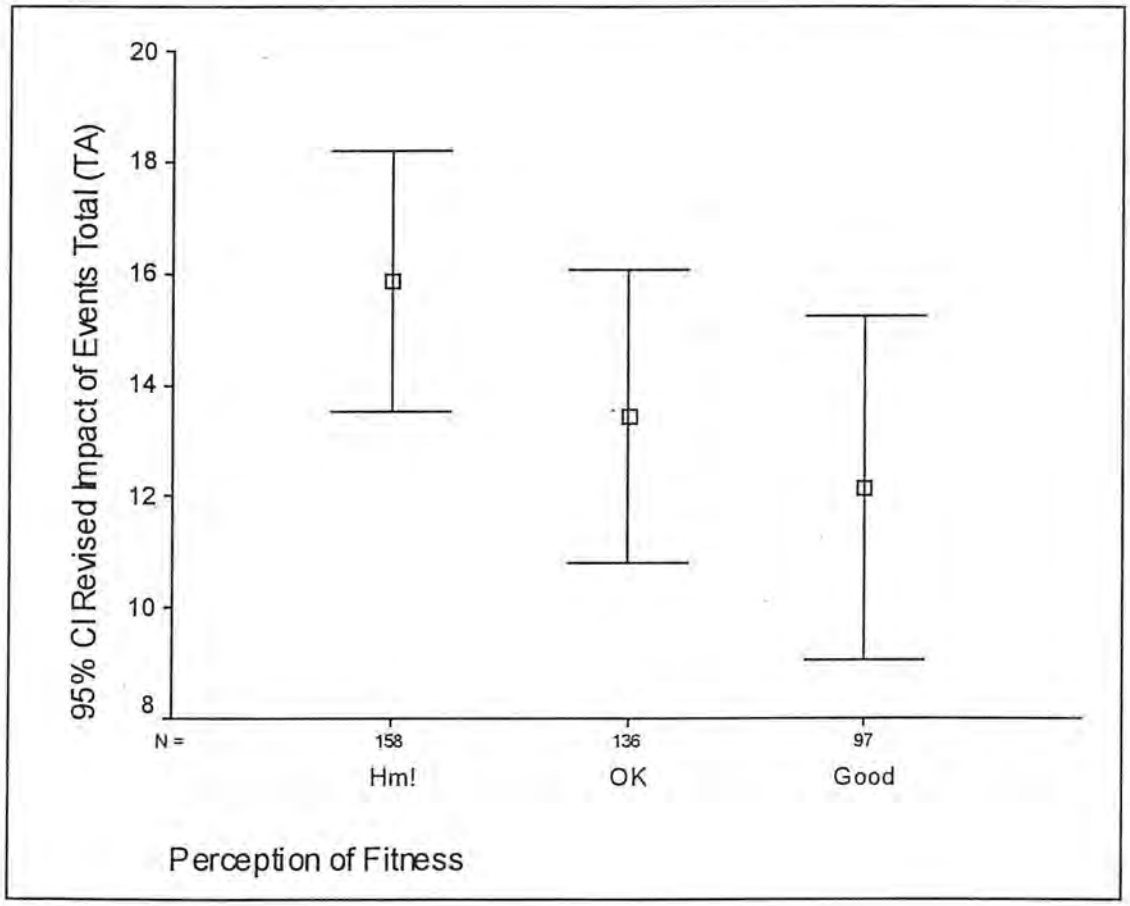


Figure 6: Impact of Events: Tacoma FF (mid 1990's)

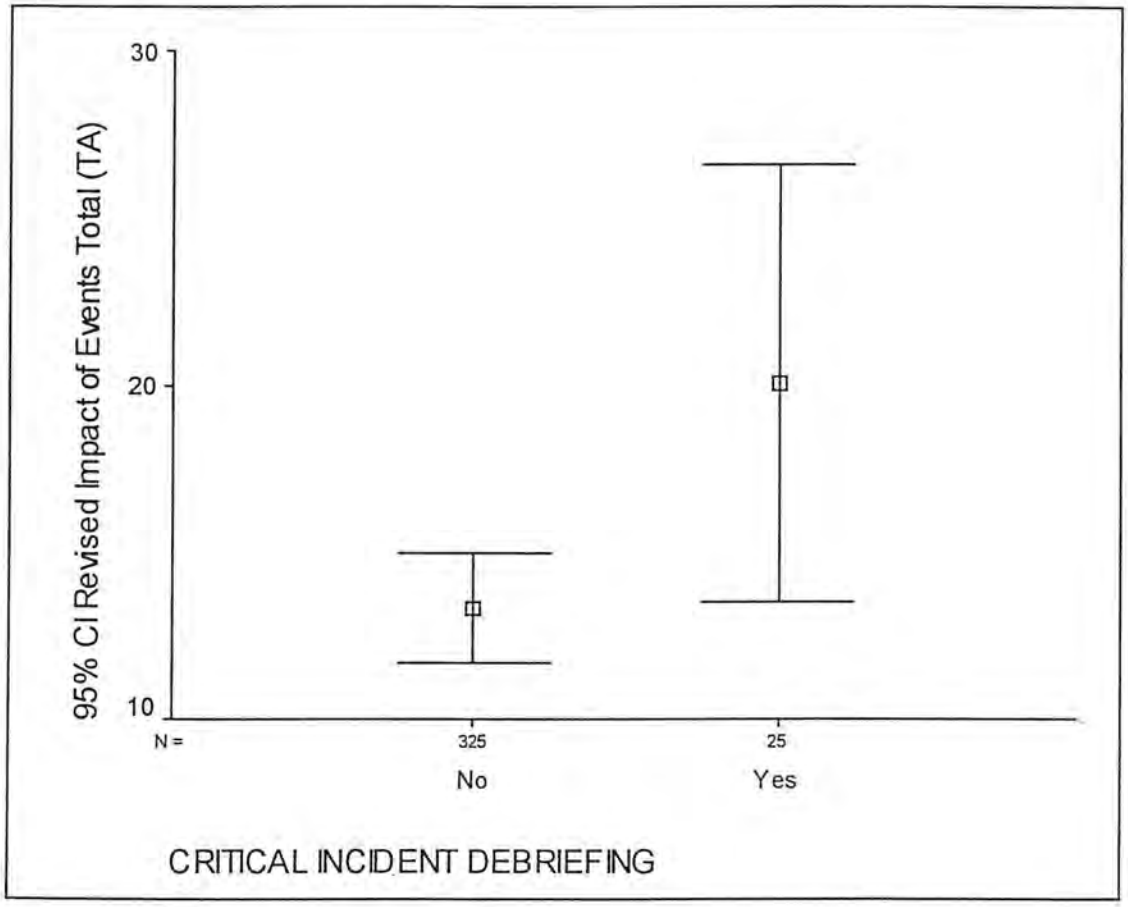


Figure 1: Prevalence of PTSD

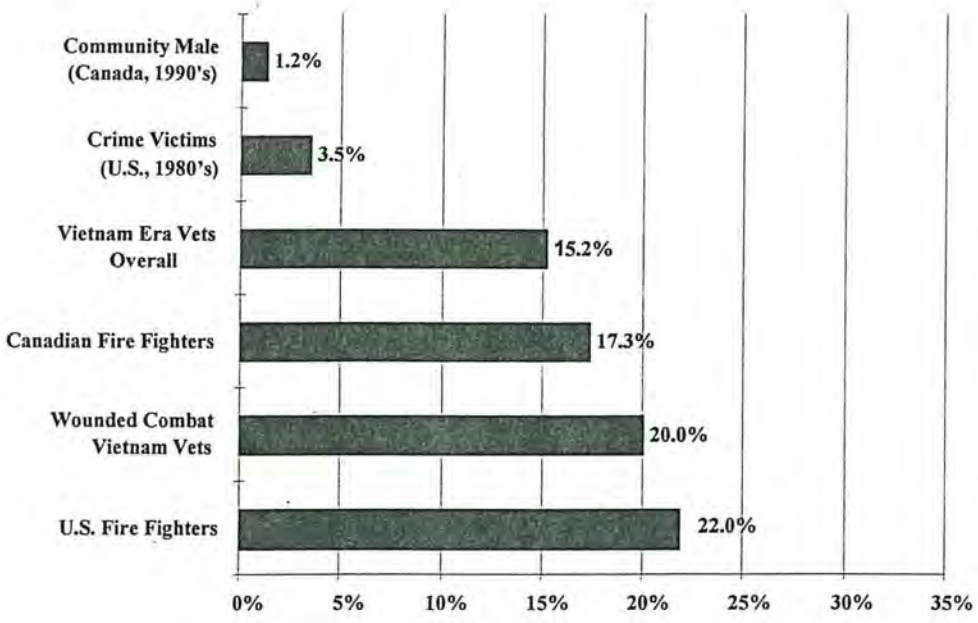
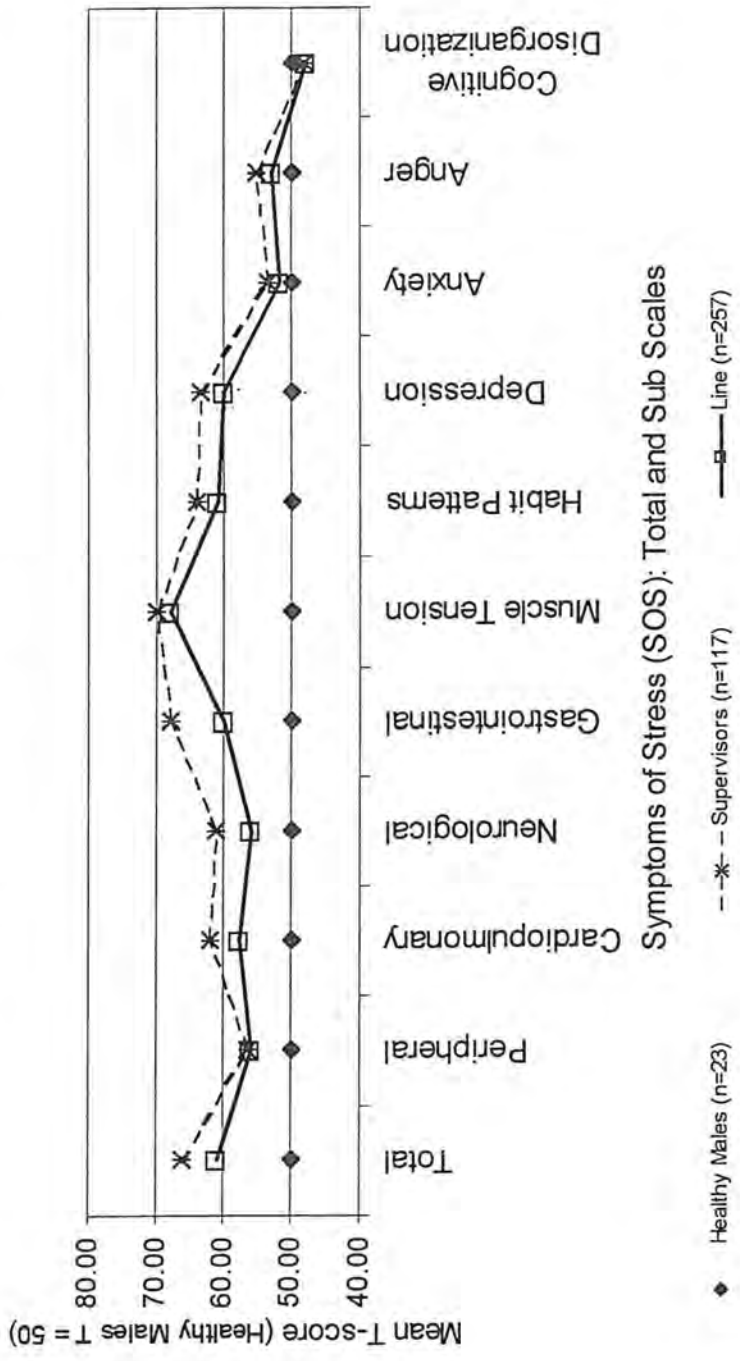


Figure 2:
Profiles of SOS (Total and Sub-scales)
Using Healthy Males as the Normative Group



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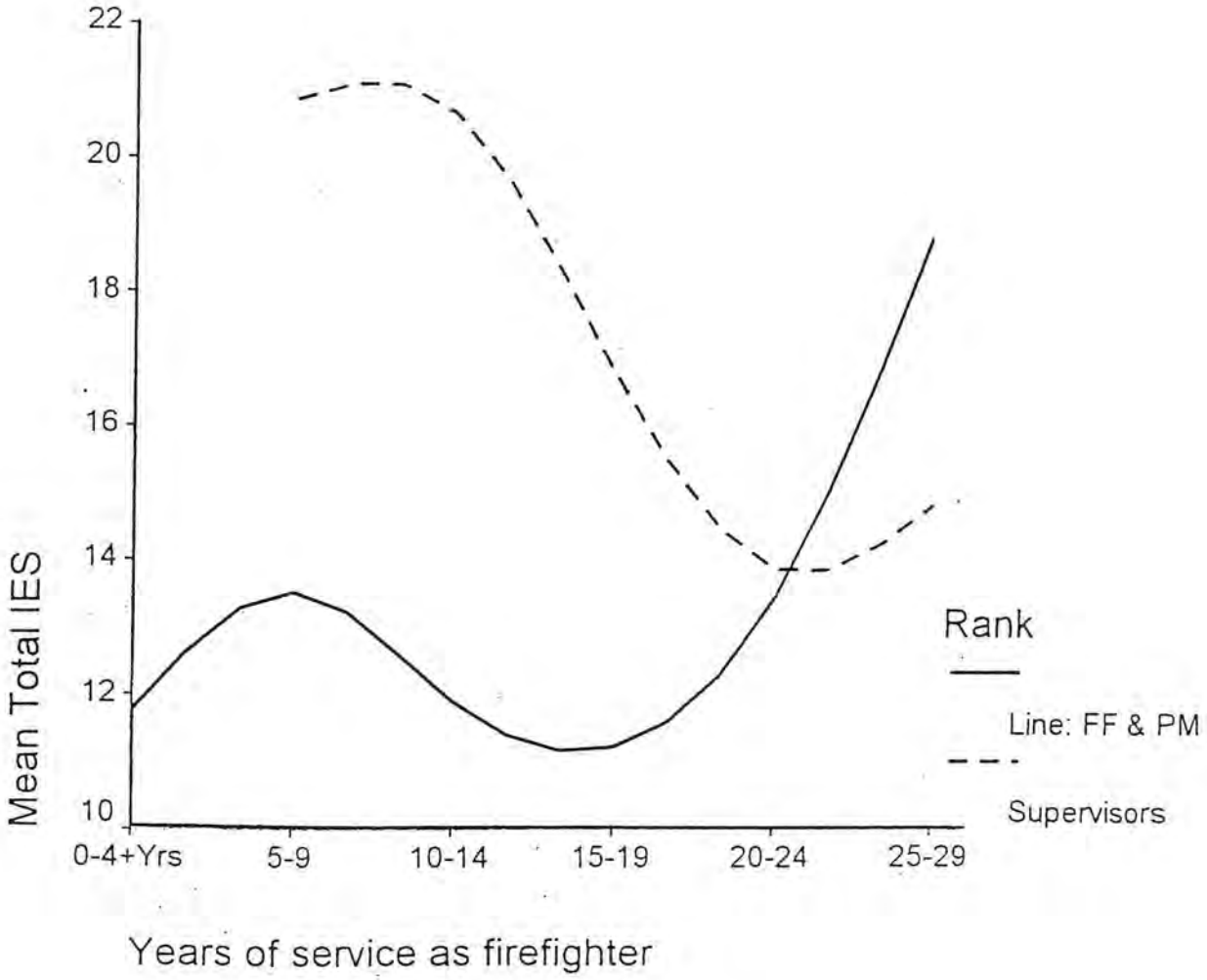

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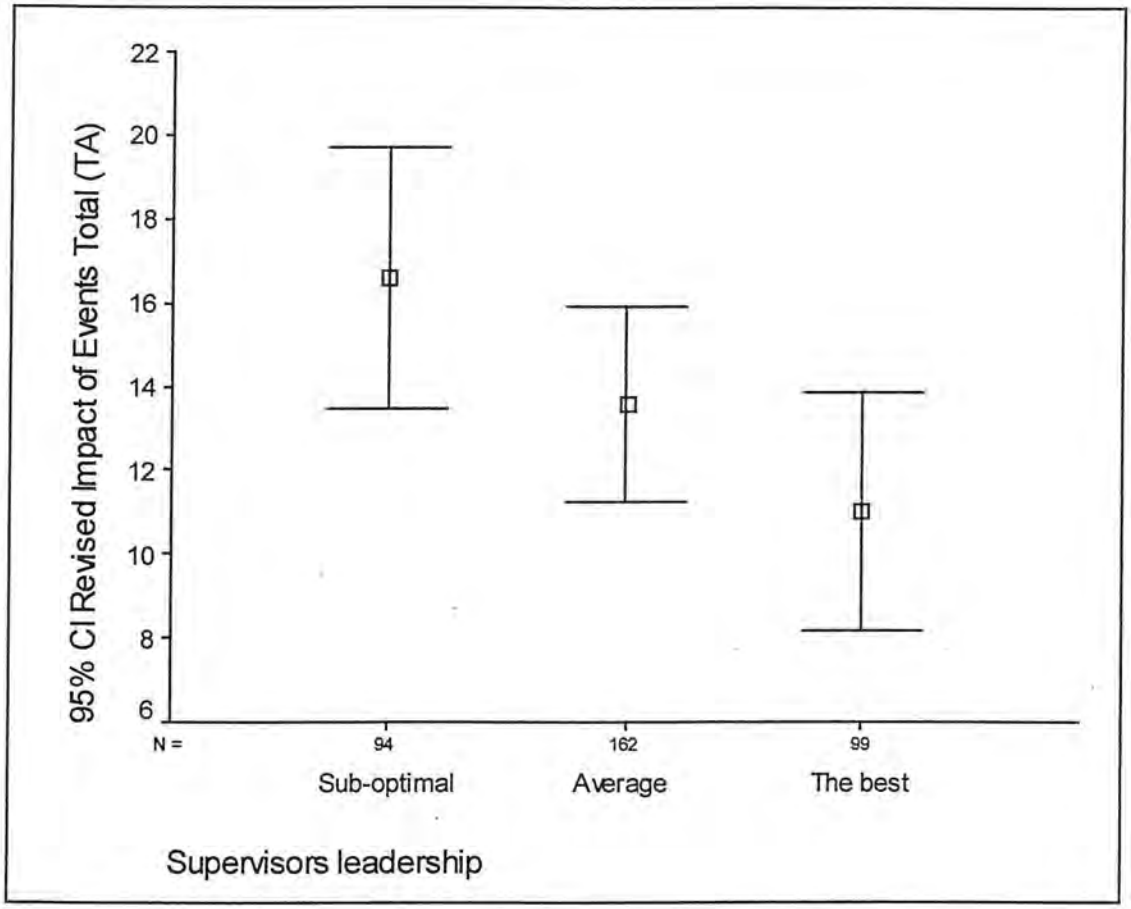


Figure 5: Impact of Events: Tacoma FF (mid 1990's)

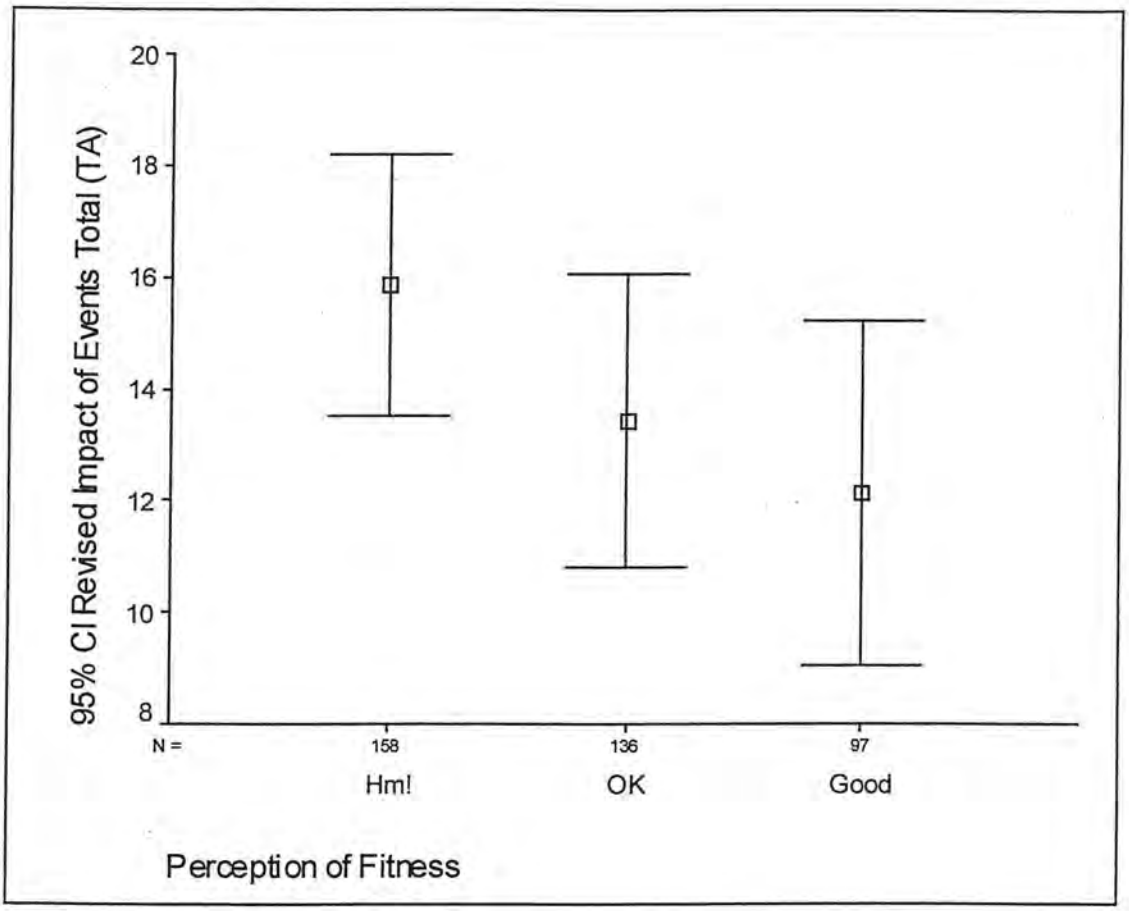
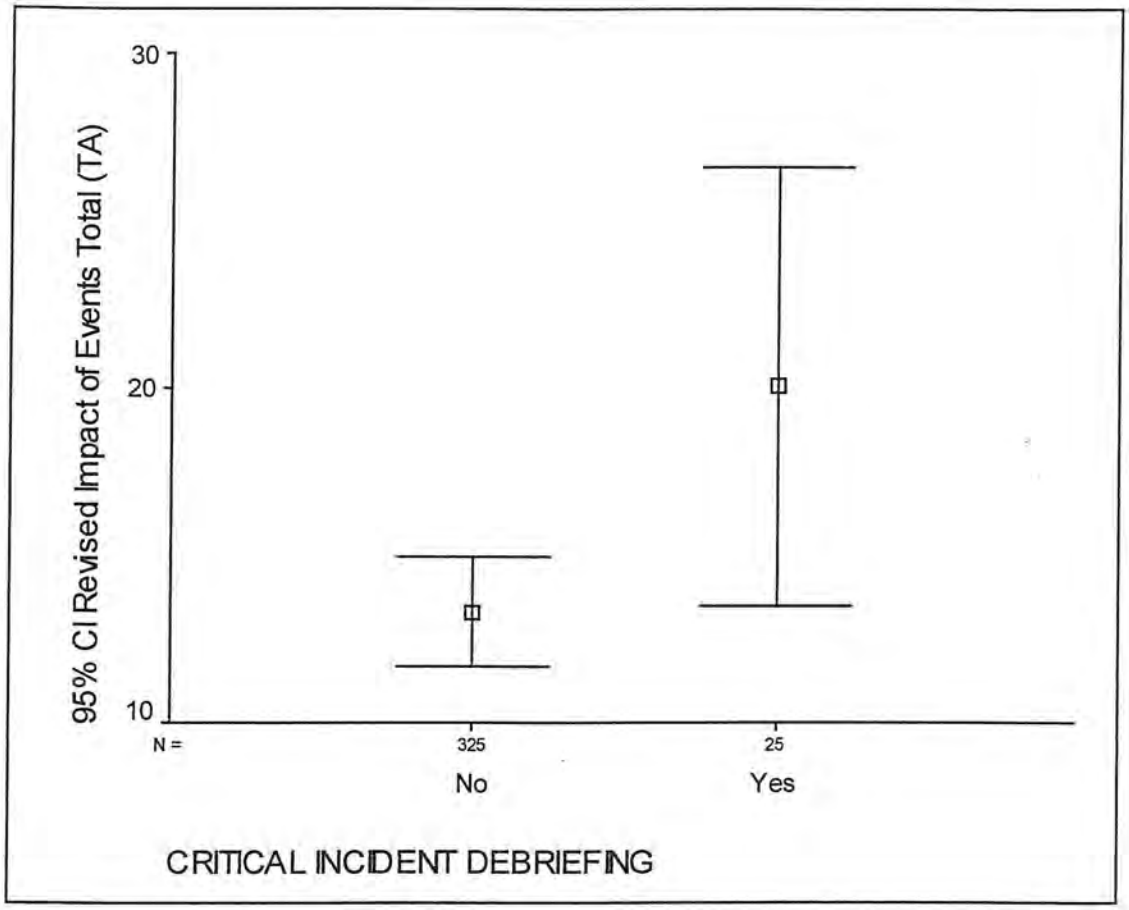


Figure 6: Impact of Events: Tacoma FF (mid 1990's)



Appendix 1

Asset Report Review

OASIS Home Page **Production System** Asset Entry/Inquiry Asset#:

Report ID : nfindley_ADHOC_3610 no data found for the following criteria: (inventory_bgt = "619807") AND (total_cost >= 5000)

Please Enter Review Report ID: nfindley_ADHOC_3610

Output Type	----------Output Destination----------
Web Format	
○	Display Data on Web
Report Format	
○	Email Report nfindley@u.washington.edu
○	Local Printer (Select Print Option Through Browser)
◉	OASIS Printer eilaser2
File Format	Field Delimiter: (default delimiter="|")
○	Email File nfindley@u.washington.edu
○	Select Save Option Through Browser

Get Report | Clear Selection

UNIVERSITY OF WASHINGTON
Equipment Inventory Office
EIO@u.washington.edu
Last Modified 11/1/99

Post-it™ Fax Note 7671 | Date 12/16/99 | # of pages ▶
To Marilyn Barnard | From Nate Findley
Co./Dept. | Co. EIO
Phone # | Phone # 5-4614
Fax # | Fax #

Procedure for Submission of Final Invention Statement and Certification (For Grant or Award) Form HHS 568

A Final Invention Statement and Certification (Form HHS 568) shall be executed and submitted within 90 days following the expiration or termination of a grant or award. The Statement shall include all inventions which were conceived or first actually reduced to practice during the course of work under the grant or award, from the original effective date of support through the date of completion or termination. The Statement shall include any inventions reported previously for the grant or award as part of a non-competing application. This reporting requirement is applicable to grants and awards by Department of Health and Human services in support of research.

The Final Invention Statement and Certification does not in any way relieve the person responsible for the grant or award, or the institution, of the obligation to assure that all inventions are promptly and fully reported directly to the Department of Health and Human Services, as required by terms of the grant or award. Information regarding the reporting of inventions, including the reporting form to be followed, may be obtained from the Office of the General Counsel, Department of Health and Human Services, c/o National Institutes of Health, Bethesda, Maryland 20892.

The original and one copy of the completed Final Invention Statement and Certification is to be returned to the awarding component that funded the grant or award. The entire grant or award number must appear in the designated box on the form. The period covered by the Final Invention Statement is the project period of the grant or award at a particular grantee institution. If no inventions were involved, insert the word "None" in the first block under item Title of Invention. Each Statement requires the signature of: (1) the person responsible for the grant or award concerned, and (2) an institution official authorized to sign on behalf of the institution.

Approved for use through 6/30/94
OMB No. 0925-0001

DEPARTMENT OF HEALTH AND HUMAN SERVICES

FINAL INVENTION STATEMENT AND CERTIFICATION

(FOR GRANT OR AWARD)

DHHS GRANT OR AWARD NO.

A. We hereby certify that, to the best of our knowledge and belief, all inventions are listed below which were conceived and/or first actually reduced to practice during the course of work under the above-referenced DHHS grant or award for the period 9/30/94 (original effective date) through 9/29/99 (date of termination).

B. **INVENTIONS** (Note: If no inventions have been made under the grant or award, insert the word "NONE" under Title below.)

NAME OF INVENTOR	TITLE OF INVENTION	DATE REPORTED TO DHHS
	NONE	
(Use continuation sheet if necessary)		

C. **FIRST SIGNATURE** — The person responsible for the grant or award is required to sign (in ink). Sign in the block opposite the applicable type of grant or award.

TYPE OF GRANT OR AWARD	WHO MUST SIGN (title)	SIGNATURE
Research Grant	Principal Investigator or Project Director	Randal Beeton, Ph.D.
Health Services Grant	Director	
Research Career Program Award	Awardee	
All other types *(specify)*	Responsible Official	

D. **SECOND SIGNATURE** — This block **must** be signed by an official authorized to sign on behalf of the institution.

TITLE: DONALD W. ALLEN, DIRECTOR
GRANT AND CONTRACT SERVICES

TYPED NAME: Sinh Simmons
Grant and Contract Manager
~~Acting for~~
Donald W. Allen

SIGNATURE: S Simmons

DATE: 12/20/99

NAME AND MAILING ADDRESS OF INSTITUTION

GRANT AND CONTRACT SERVICES
3935 UNIVERSITY WAY N.E.
SEATTLE, WASHINGTON 98105-6613

HHS 568 (Rev. 9/91)

Date: Fri, 17 Dec 1999 14:42:47 -0800 (PST)
From: M. Dorschel <mcd@u.washington.edu>
To: Marilyn Barnard <mbarnard@u.washington.edu>
Subject: Budget 61-9807: FSR

Hi Marilyn,

Original signed Financial Status Reports are sent by our office directly to CDC after the budget is closed. When the budget is closed depends on a number of factors. The budget will be closed as soon as all outstanding issues have been resolved.

I appreciate your help,

****
Marcus Dorschel
Research Accountant
Grant & Contract Accounting
E-mail: mcd@u.washington.edu
Phone: (206) 543-2597
Fax: (206) 543-0764

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Box 351122
Seattle, WA 98105-6692
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