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14. ABSTRACT Purpose: Posttraumatic stress disorder (PTSD) is common, often chronic, and has been associated with greater risk of postoperative mortality in veterans. The purpose of this study was to determine if elective outpatient surgery had a persistent and deleterious effect on the physical or mental health of veterans, and also to explore factors that contributed to health change after outpatient elective surgery in veterans with PTSD. Design: A longitudinal, mixed method, quasi-experimental, nonequivalent control group study was conducted. Methods and Sample: Physical and mental health, depressive symptom severity, posttraumatic symptom severity, and pain severity were measured in 29 veterans with PTSD preoperatively, and 1, 4, and 12 weeks after outpatient elective surgery. For comparison, parallel data were collected from a control group of 31 veterans with PTSD at enrollment, and 1, 4, and 12 weeks after enrollment. Subjects who displayed clinically significant or distressing changes in health status after surgery were interviewed to identify factors associated with postoperative health change. Analysis: Quantitative data were analyzed using a random coefficients regression model approach. Qualitative data were analyzed using a qualitative descriptive method. Findings: Subjects in the surgical group reported significant declines in subjective physical and mental health at one week, but not one or three months, after outpatient elective surgery. Depressive symptom severity and posttraumatic symptom severity were unchanged after surgery. Subjects reported that this physical and mental distress was driven by acute postoperative pain, but that underlying chronic pain remained influential throughout their postoperative course. Implications for Military Nursing: On average, outpatient elective surgery was associated with transient but significant declines in mental and physical health in the first week after surgery. Substantial opportunities exist to improve the perioperative care of veterans with chronic PTSD with respect to post discharge pain management, resource coordination, and family support.					
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Abstract

Purpose: Posttraumatic stress disorder (PTSD) is common, often chronic, and has been associated with greater risk of postoperative mortality in veterans. The purpose of this study was to determine if elective outpatient surgery had a persistent and deleterious effect on the physical or mental health of veterans, and also to explore factors that contributed to health change after outpatient elective surgery in veterans with PTSD.

Design: A longitudinal, mixed method, quasi-experimental, nonequivalent control group study was conducted.

Methods and Sample: Physical and mental health, depressive symptom severity, posttraumatic symptom severity, and pain severity were measured in 29 veterans with PTSD preoperatively, and 1, 4, and 12 weeks after outpatient elective surgery. For comparison, parallel data were collected from a control group of 31 veterans with PTSD at enrollment, and 1, 4, and 12 weeks after enrollment. Subjects who displayed clinically significant or distressing changes in health status after surgery were interviewed to identify factors associated with postoperative health change.

Analysis: Quantitative data were analyzed using a random coefficients regression model approach. Qualitative data were analyzed using a qualitative descriptive method.

Findings: Subjects in the surgical group reported significant declines in subjective physical and mental health at one week, but not one or three months, after outpatient elective surgery. Depressive symptom severity and posttraumatic symptom severity were unchanged after surgery. Subjects reported that this physical and mental distress was driven by acute postoperative pain, but that underlying chronic pain remained influential throughout their postoperative course.

Implications for Military Nursing: On average, outpatient elective surgery was associated with transient but significant declines in mental and physical health in the first week after surgery. Substantial opportunities exist to improve the perioperative care of veterans with chronic PTSD with respect to post discharge pain management, resource coordination, and family support.

TSNRP Research Priorities that Study or Project Addresses**Primary Priority**

Force Health Protection:	<input checked="" type="checkbox"/> Fit and ready force <input type="checkbox"/> Deploy with and care for the warrior <input checked="" type="checkbox"/> Care for all entrusted to our care
Nursing Competencies and Practice:	<input checked="" type="checkbox"/> Patient outcomes <input type="checkbox"/> Quality and safety <input type="checkbox"/> Translate research into practice/evidence-based practice <input type="checkbox"/> Clinical excellence <input type="checkbox"/> Knowledge management <input type="checkbox"/> Education and training
Leadership, Ethics, and Mentoring:	<input type="checkbox"/> Health policy <input type="checkbox"/> Recruitment and retention <input type="checkbox"/> Preparing tomorrow's leaders <input type="checkbox"/> Care of the caregiver
Other:	<input type="checkbox"/>

Progress Towards Achievement of Specific Aims of the Study or Project

The study has concluded, with data collected from 29 surgical group subjects and 31 control group subjects. We were successfully able to address specific aims 1 and 3 as written in the grant proposal; however, we were unable to adequately address specific aim 2 for reasons that we will detail in the discussion of findings.

A total of 174 patients were screened for participation in the study, 91 for participation in the surgical group and 83 in the control group. A total of 29 patients provided informed consent and completed baseline assessment for participation in the surgical group. All 29 subjects went on to have surgical procedures as scheduled. The most common type of surgical procedure was orthopedic ($n = 9$), with the remainder evenly divided between general ($n = 4$), gynecology and urology ($n = 4$), plastic ($n = 4$), neurosurgery ($n = 4$), and oromaxillofacial/otolaryngology ($n = 4$). A total of 32 patients provided informed consent for participation in the control group; however, one subject disclosed misrepresenting exclusion criteria immediately after providing consent and was therefore dropped from the study before completing baseline assessment. Therefore, 31 control group subjects completed baseline assessment.

Of the 60 analyzable subjects, 58 (96.6%) provided data at 1 week, 55 (91.6%) provided data at 4 weeks, and 53 (88.3%) provided data at 12 weeks. A total of 7 (11.7%) participants withdrew or were lost to follow-up prior to completing 12-week assessment. The frequency of attrition was not significantly different between the surgical and control groups at 1 week (Fisher's exact test; $p = .49$), 4 weeks (Fisher's exact test; $p = .35$) or 12 weeks of study participation (Fisher's exact test, $p = .43$). Subjects who were lost to follow up were not significantly different from subjects who remained in the study with respect to age (WS = 230; $n_1 = 53$, $n_2 = 7$; $p = .71$), gender (Fisher's exact test; $p = .99$), years of education (WS = 171.5;

n1 = 53, n2 = 7; p = .31), or baseline PCS, (WS = 198; n1 = 53, n2 = 7; p = .74), MCS (WS = 218; n1 = 53, n2 = 7; p = .93), GDS (WS = 252; n1 = 53, n2 = 7; p = .35), or CAPS severity score (WS = 252; n1 = 53, n2 = 7; p = .15), indicating that missing data were missing at random. Screening, enrollment and retention in the surgical and control groups are graphically depicted in Figures 1 and 2, respectively.

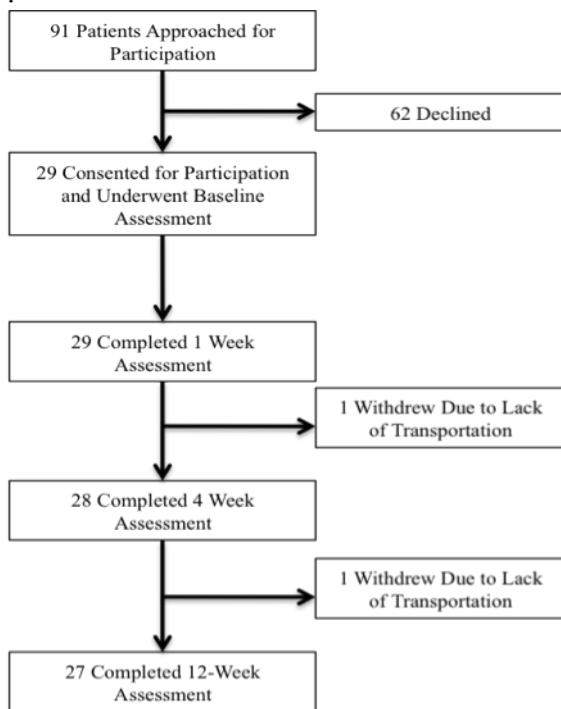


Figure 1. Subject flow through surgical group over 12 weeks

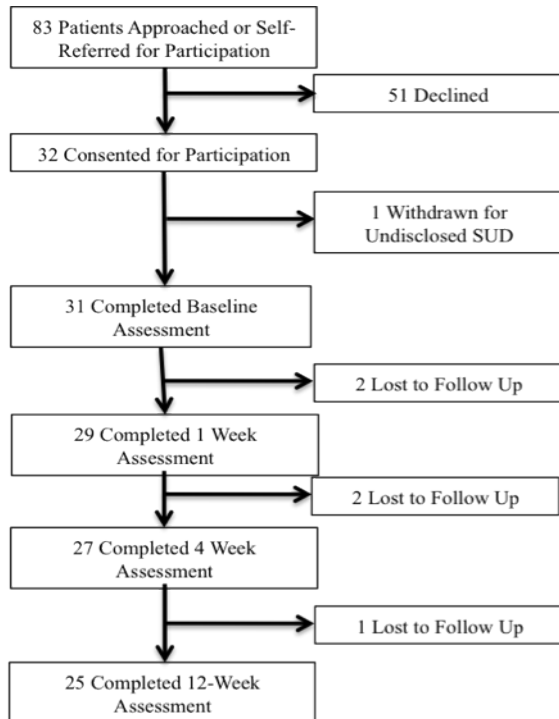


Figure 2. Subject flow through control group over 12 weeks

Demographics and comorbidities (Table 1) and psychoactive medication use (Table 2) were similar between surgical and control patients, with the exception that control patients were older, had suffered from posttraumatic symptoms for longer periods of time, and were more likely to be taking tricyclic or tetracyclic antidepressants. Age was already included as a covariate in all analyses to control for its effect on physical and mental health status. Although not significant, the current use of tricyclic or tetracyclic antidepressants was considered as a potential covariate in subsequent analyses. At baseline there were no significant differences between surgical and control subjects in mean MCS, PCS, GDS, or CAPS severity scores (Table 3).

Table 1. Baseline sociodemographics and comorbidities

Variable	Surgical (n = 29)	Control (n = 31)	<i>p</i>
Age	51.8 ± 2.3	59.4 ± 1.5	< .01*
Education	13.2 ± 0.3	13.8 ± 0.4	.24
Duration of PTSD symptoms (in years)	24.8 ± 3.1	36.4 ± 1.9	< .01*
Male gender	25 (86 %)	27 (87 %)	.91
Ethnicity			.14
White	15 (52 %)	10 (32 %)	
African-American	13 (45 %)	21 (68 %)	
Pacific Islander	1 (3 %)		
Married	20 (70 %)	17 (55 %)	.26
Depression	18 (62 %)	25 (81 %)	.11
Bipolar disorder	1 (4 %)	1 (3 %)	.96
Other anxiety disorder	6 (21 %)	6 (19 %)	.90
Hypertension	18 (62 %)	24 (81 %)	.11
Myocardial infarction	2 (7 %)	2 (7 %)	.95
Arrhythmia	1 (4 %)	1 (3 %)	.96
Chronic obstructive pulmonary disease	3 (10 %)	2 (6 %)	.61
Asthma	6 (21 %)	2 (6 %)	.11
Chronic bronchitis	4 (14 %)	3 (10 %)	.62
Obstructive sleep apnea	9 (31 %)	7 (23 %)	.46
Gastroesophageal reflux	12 (41 %)	13 (42 %)	.95

Table 1. Baseline sociodemographics and comorbidities

Variable	Surgical (n = 29)	Control (n = 31)	<i>p</i>
disease			
Cirrhosis	0 (0 %)	1 (3 %)	.33
Smoking (hx)	18 (32 %)	21 (67 %)	.65
Smoking (current)	10 (34 %)	9 (29 %)	.65
Ethanol abuse (hx)	15 (52 %)	19 (61 %)	.45
Ethanol abuse (current)	6 (21 %)	7 (23 %)	.86
Obesity	14 (48 %)	18 (58 %)	.45
Illicit substance use (hx)	5 (17 %)	11 (35 %)	.11
Type I diabetes	1 (3 %)	4 (13 %)	.19
Type II diabetes	5 (17 %)	4 (.13 %)	.64
Chronic pain	21 (72 %)	23 (74 %)	.88
Transient ischemic attack/cerebrovascular accident without sequelae	1 (3 %)	4 (13 %)	.19
PTSD at baseline ^a	24 (83 %)	26 (81 %)	.91

Note: Data are described as mean \pm standard error of the mean or number (percent); PTSD = Posttraumatic Stress Disorder; hx = history

^a Indicates the number (percent) of subjects meeting full diagnostic criteria for PTSD on the Clinician Administered PTSD Scale using the ‘frequency \geq 1, intensity \geq 2’ assessment criteria set forth in Weathers, Ruscio, and Keane (1999)

* Significant at $p < .05$.

Table 2. Psychoactive medication use

Medication	Surgical (n = 29)	Control (n = 31)	<i>p</i>
Selective serotonin reuptake inhibitors	11 (38 %)	15 (48 %)	.41
Tricyclic/tetracyclic Antidepressants	5 (17 %)	12 (39 %)	.06*
Anticonvulsants	4 (14 %)	4 (13 %)	.92
Benzodiazepine/sedative Hypnotic	7 (24 %)	4 (13 %)	.26
Atypical antipsychotic	7 (24 %)	4 (13 %)	.26
Other antidepressant	10 (34 %)	13 (42 %)	.55
Antihistamine	3 (10 %)	1 (3 %)	.27
Alpha antagonist	8 (28 %)	9 (29 %)	.90

Note: Data are described as number (percent)

* $p < .10$.

Table 3. Mean scores by group at baseline

Measure	Surgical (n = 29)	Control (n =31)	<i>t</i>	<i>df</i>	<i>p</i>
VR-36 Physical Component Summary (PCS) score	37.2 ± 1.5	37.7 ± 1.7	.25	58	.81
VR-36 Mental Component Summary (MCS) score	37.6 ± 2.1	34.3 ± 1.9	1.19	58	.24
Geriatric Depression Scale (GDS) score	18.3 ± 1.7	19.6 ± 1.4	.63	58	.53
Clinician Administered PTSD Scale (CAPS) severity score	69.6 ± 5.0	74.3 ± 4.0	.74	58	.46
State-Trait Anxiety Inventory, State (STAI-S) scale score	47.9 ± 2.9	47.3 ± 2.3	.87	58	.87
Visual Analog Scale for Pain (VASP) score	56.0 ± 5.2	46.9 ± 5.3	1.23	58	.22

Note; Data are described as mean ± standard error of the mean; VR-36 = Veterans Rand 36-Item Health Survey; PTSD = Posttraumatic Stress Disorder

Findings related to each specific aim, research or study questions, and/or hypothesis:

Table 4 depicts the mean adjusted PCS, MCS, GDS, and CAPS severity scores (\pm standard error of the mean) at baseline, 1 week, 4 weeks, and 12 weeks after surgery or enrollment, respectively, in the surgical and control groups. Scores were adjusted for the fixed and random effects described in each data analysis. Table 4 also depicts Cohen's *d* effect sizes for the between-group difference in mean adjusted scores at each time point.

Table 4. Mean adjusted scores by group over 12 weeks after enrollment

Measure	Group	Mean adjusted score (\pm SE)			
		Baseline	Week 1	Week 4	Week 12
VR-36 Physical Component Summary (PCS) score	Surgical	37.0 \pm 1.2	33.5 \pm 1.2	35.0 \pm 1.2	37.4 \pm 1.5
	Control	37.7 \pm 1.3	37.3 \pm 1.0	37.1 \pm 1.1	36.8 \pm 1.5
	Cohen's <i>d</i>	-.10	-.63	-.35	.07
VR-36 Mental Component Summary (MCS) score	Surgical	36.4 \pm 1.6	33.6 \pm 1.9	34.8 \pm 1.8	36.7 \pm 2.1
	Control	35.2 \pm 1.4	36.5 \pm 1.6	35.3 \pm 1.5	33.3 \pm 2.0
	Cohen's <i>d</i>	.15	-.40	-.08	.36
Geriatric Depression Scale (GDS) score	Surgical	17.9 \pm 1.5	-	18.8 \pm 1.5	18.5 \pm 1.5
	Control	19.0 \pm 1.1	-	19.2 \pm 1.2	19.2 \pm 1.2
	Cohen's <i>d</i>	-.05	-	-.07	-.02
Clinician Administered	Surgical	71.5 \pm 4.1	-	71.5 \pm 4.3	68.8 \pm 4.6

PTSD Scale (CAPS) severity score	Control	72.9 ± 3.3	-	71.8 ± 4.0	70.6 ± 4.8
	Cohen's <i>d</i>	-.07	-	-.01	-.07

Note: Data are described as mean adjusted score ± standard error of the mean adjusted score; means are for predicted individual scores that have been adjusted for both fixed (surgical intervention, time, age, and gender) and random (subject) effects derived from the random coefficients regression model; mean MCS scores were also adjusted for fixed effect of season; SE = standard error of the mean; VR-36 = Veterans Rand 36-Item Health Survey; PTSD = Posttraumatic Stress Disorder; “-“ indicates data were not collected for this outcome at this time point

Specific Aim 1: Evaluate the effect of elective outpatient surgery on the primary outcome of functional health and the secondary outcomes of PTSD severity and depressive symptom severity in a sample of veterans with preexisting PTSD.

Hypothesis 1a: Over a three-month period, veterans with preexisting PTSD who undergo elective outpatient surgery will demonstrate greater decline in functional health (defined as score on the Veterans Rand 36-item Health Survey) than a sample of veterans with preexisting PTSD who do not undergo elective surgery.

Analysis and Findings Related to Hypothesis 1a

The Veterans Rand 36-item Health Survey yields two summary scores, the Physical Component Summary score (PCS) and Mental Component Summary score (MCS), that reflect the physical and mental subjective health status of the respondent, respectively. Prior to constructing the random coefficients regression model of longitudinal PCS and MCS scores, mean scores were graphed over time to visually examine the temporal pattern of change within each group over the course of data collection. These graphs indicated that the temporal pattern change on mean PCS and MCS scores over time was non-linear in the surgical group and non-existent in the control group. Specifically, a graph of mean PCS and MCS scores by group over

time suggested that surgical group participants demonstrated an abrupt shift in both the level and rate of change on PCS and MCS scores following surgery, while control group participants demonstrated little to no change on PCS and MCS scores from baseline to 12 weeks after enrollment. Quadratic, cubic, and square root polynomial effects of time were tested and either found not significant or demonstrated convergence issues, likely due to the small number of subjects.

After review of the relevant literature about the analysis of such discontinuous phenomena, it was decided to apply techniques described by Singer and Willett (2003). Specifically, surgical intervention was coded as a time-varying covariate that occurred between baseline and one week only to subjects in the surgical group. Therefore, the analytic model of longitudinal PCS scores included the following fixed effects: surgical intervention (exposed to surgery or not), time, the surgical intervention-by-time interaction, and two covariates (age and gender). The analytic model of longitudinal MCS scores included the following fixed effects: surgical intervention (exposed to surgery or not), time, the surgical intervention-by-time interaction, and three covariates (age, gender, and season). Random effects for both analyses were subject and subject-by-time; intercepts and slopes were set to random. It was hypothesized that the two groups would have significantly different trajectories over time as evidenced by a significant group-by-time interaction. *A priori* contrasts of the trajectories generated by the model were conducted at one week, four weeks, and twelve weeks to test for significant differences in the groups at those time points.

Based on a review of the literature, it was expected that the surgical group would demonstrate lower PCS and MCS scores at baseline compared to the control group and would demonstrate a non-linear trend in PCS and MCS scores over time (Wellwood et al. 1998, Burney

and Jones 2002, Busija et al. 2008, Langenbach et al. 2008, Shi et al. 2009). Subjective health scores would likely be lower in subjects scheduled to receive elective surgery, as such surgery is performed to improve physical health and preoperative anxiety should adversely impact mental health. Previous studies of physical and mental subjective health change after outpatient elective surgery using the PCS and MCS demonstrated a transient decrease in physical and mental subjective health status at four weeks after surgery due to pain and functional limitation, followed by a return to baseline by twelve weeks after surgery (Wellwood et al. 1998, Burney and Jones 2002, Busija et al. 2008, Langenbach et al. 2008, Shi et al. 2009). In contrast, subjects in the control group should demonstrate stable or very slow change on PCS and MCS scores across the twelve-week study period. If PTSD did not have an adverse effect on subjective physical or mental health recovery after surgery, then the surgical and control groups should differ significantly at baseline on PCS scores, but converge at 3 months as early declines in subjective health between baseline and four weeks were offset by subjective health improvement between four and twelve weeks due to healing and the beneficial effects of the surgery. This was the expected trend after elective surgery. However, if elective surgery exerted a persistent adverse effect on the subjective physical or mental health of the veteran with chronic PTSD, then surgical and control groups would differ significantly at baseline on PCS and MCS scores, and not converge at twelve weeks.

Random coefficients regression analyses on longitudinal PCS scores identified a statistically significant effect of age ($F = 5.20$; $df = 1,60.6$; $p = .03$), surgical intervention ($F = 14.01$; $df = 1,141$; $p < .00$) and the surgical intervention-by-time interaction ($F = 5.45$; $df = 1,58.8$; $p = .02$), but not time ($F = 3.30$; $df = 1,55.8$; $p = .07$) or gender ($F = 0.94$; $df = 1,56.9$; $p = .34$). As part of the random coefficients regression method, between-group contrasts were

performed to compare the surgical and control participants at each scheduled assessment point along the predicted trajectories across time. Results indicated a statistically significant difference in which the PCS scale scores of the surgical group were significantly lower than those of the control group at 1 week ($F = 14.01$; $df = 1,142$; $p < .00$), but not 4 weeks ($F = 3.41$; $df = 1,132$; $p = .07$) or 12 weeks ($F = 0.13$; $df = 1,50.8$; $p = .72$) after surgery or enrollment, respectively. Mean adjusted PCS scores over time are depicted graphically in Figure 3. The intraclass correlation of the PCS score averaged .94 in surgical group subjects and .94 in control group subjects across the four scheduled assessments (baseline, 1 week, 4 weeks, and 12 weeks).

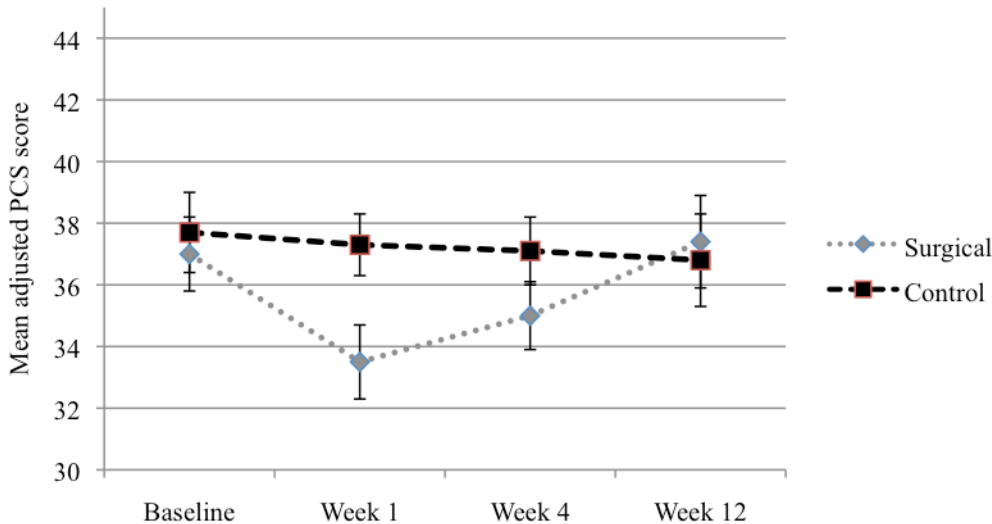


Figure 3. Mean adjusted VR-36 Physical Component Summary (PCS) scores over time

Random coefficients regression analyses on longitudinal MCS scores identified a statistically significant effect of age ($F = 20.64$; $df = 1,57.6$; $p < .00$), season ($F = 2.82$; $df = 3,136$; $p = .04$), surgical intervention ($F = 6.42$; $df = 1,138$; $p = .01$) and the surgical intervention-by-time interaction ($F = 7.07$; $df = 1,62.7$; $p < .00$), but not time ($F = 0.00$; $df = 1,48.5$; $p = .96$) or gender ($F = 0.35$; $df = 1,53.9$; $p = .56$). As the surgical intervention-by-time interaction was significant, between-group contrasts were performed to compare the surgical and control

participants at each scheduled assessment point along the predicted trajectories across time. Results indicated a statistically significant difference in which mean adjusted PCS scores of the surgical group were significantly lower than those of the control group at 1 week ($F = 5.06$; $df = 1,138$; $p = .03$), but not 4 weeks ($F = .15$; $df = 1,134$; $p = .70$) or 12 weeks ($F = 2.12$; $df = 1,50.3$; $p = .15$) after surgery or enrollment, respectively. The mean adjusted MCS scores over time are depicted graphically in Figure 4. The intraclass correlation of the MCS score averaged .94 in surgical group subjects and .92 in control group subjects across the four scheduled assessments (baseline, 1 week, 4 weeks, and 12 weeks).

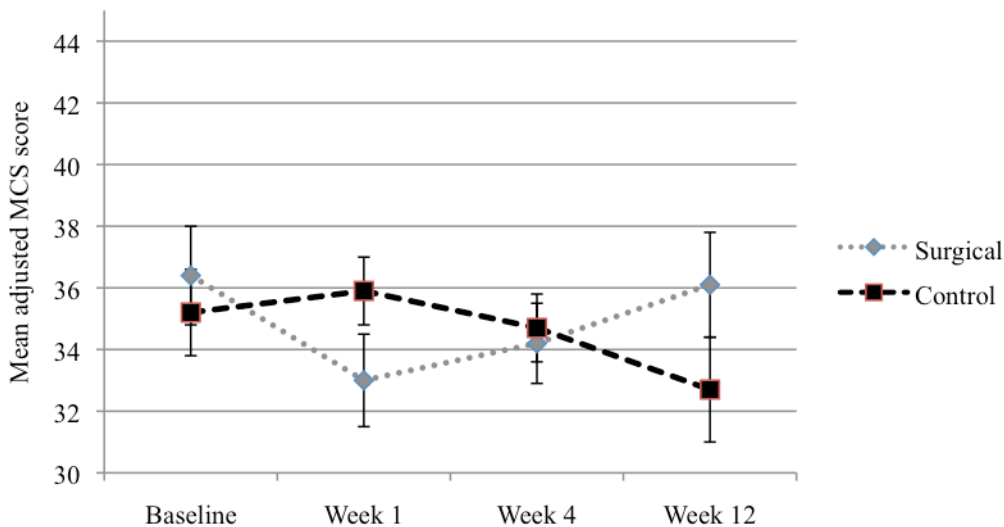


Figure 4. Mean adjusted VR-36 Mental Component Summary (MCS) scores over time

The findings of this study suggest that surgery has a significant but short-lived adverse impact on the physical and mental subjective health status of veterans with chronic PTSD. This adverse impact peaks shortly after surgery, but resolves for the majority of patients within one month. Therefore, **we found no evidence to support rejecting the null hypothesis for Hypothesis 1a, and we conclude that outpatient elective surgery did not demonstrate a sustained and adverse effect on the health of veterans with chronic PTSD.**

***Hypothesis 1b & 1c:** Over a three-month period, veterans with preexisting PTSD will demonstrate greater increase in PTSD severity (defined as severity score on the Clinician Administered PTSD Scale) and depressive symptom severity (defined as total score on the Geriatric Depression Scale) after undergoing elective outpatient surgery than veterans with preexisting PTSD who do not undergo elective surgery.*

Analyses and Findings Related to Hypothesis 1b & 1c

A series of random coefficients regression models were also used to test for differences in trajectories of change on CAPS severity scores and GDS scores. The random coefficients regression models of CAPS severity scores and GDS scores included assessments at baseline, four weeks, and twelve weeks in the two groups. Prior to constructing each random coefficients regression model, the dependent variable (CAPS severity scores or GDS scores) was graphed over time to visually examine the temporal pattern of change within each group.

Graphs of GDS scores and CAPS severity scores demonstrated little change over time regardless of surgical intervention. Separate random coefficients regression models were used to test for differences in trajectories of change in GDS scores and CAPS severity scores at baseline, four weeks, and 12 weeks after surgery or enrollment. Linear, quadratic, cubic, and square root polynomial effects of time were tested and found not significant. In each model, surgical intervention was coded as a time-varying covariate that occurred between baseline and one month only to subjects in the surgical group.

Therefore, each analytic model of longitudinal GDS scores or CAPS severity scores included the following fixed effects: surgical intervention (i.e., exposed to surgery or not), time,

the surgical intervention-by-time interaction, and two covariates (age and gender). Random effects were subject and subject-by-time; intercepts and slopes were set to random. It was hypothesized that the two groups would have significantly different trajectories over time as evidenced by a significant surgical intervention-by-time interaction. In the event of a significant surgical intervention-by-time interaction, contrasts of the trajectories generated by each model would be conducted at each time point to test for significant differences in the groups on GDS scores or CAPS severity scores.

Random coefficients regression analyses on longitudinal CAPS severity scores identified a statistically significant effect of age ($F = 19.18$; $df = 1,59.7$ $p < .00$), but not time ($F = 0.57$; $df = 1,73.7$; $p = .45$), surgical intervention ($F = 0.16$; $df = 1,69.1$; $p = .69$) or surgical intervention-by-time interaction ($F = 0.09$; $df = 1,77.2$; $p = .76$). As the omnibus test of the surgical intervention-by-time interaction was not significant, no further analyses were performed on CAPS severity scores. The mean adjusted CAPS severity scores over time are depicted graphically in Figure 5. The intraclass correlation of CAPS severity scores averaged .93 in surgical group subjects and .92 in control group subjects across the three scheduled assessments (baseline, 4 weeks, and 12 weeks).

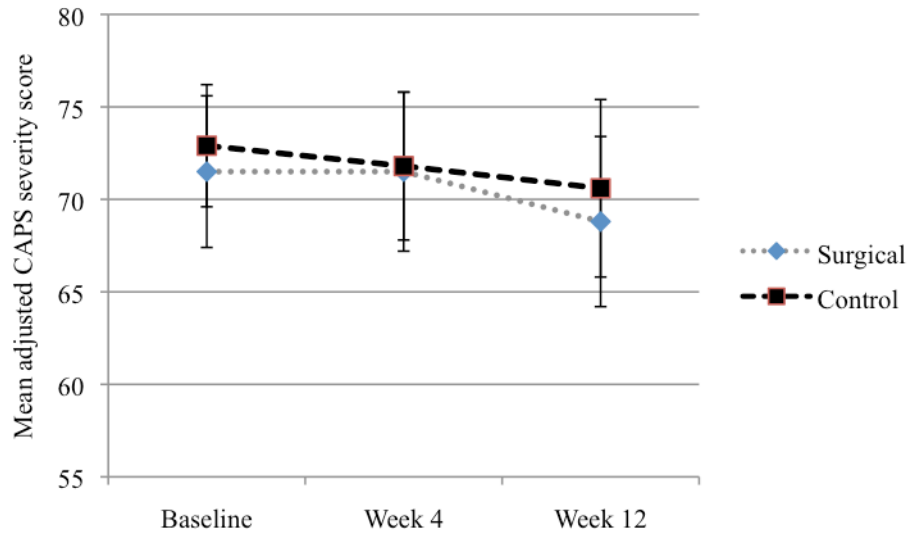


Figure 5. Mean adjusted Clinician-Administered PTSD Scale (CAPS) severity scores over time

Random coefficients regression analyses on longitudinal GDS scores identified a statistically significant effect of age ($F = 25.27$; $df = 1,60.7$; $p < .00$), but not time ($F = 0.17$; $df = 1,67.5$; $p = .49$), surgical intervention ($F = .96$; $df = 1,69.5$; $p = .33$) or the surgical intervention-by-time interaction ($F = .13$; $df = 1,70.4$; $p = .72$). As the omnibus test of the surgical intervention-by-time interaction was not significant, no further analyses were performed on GDS score. The mean adjusted GDS scores over time are depicted graphically in Figure 6. The intraclass correlation of GDS scores averaged .95 in surgical group subjects and .90 in control group subjects across the three scheduled assessments (baseline, 4 weeks, and 12 weeks).

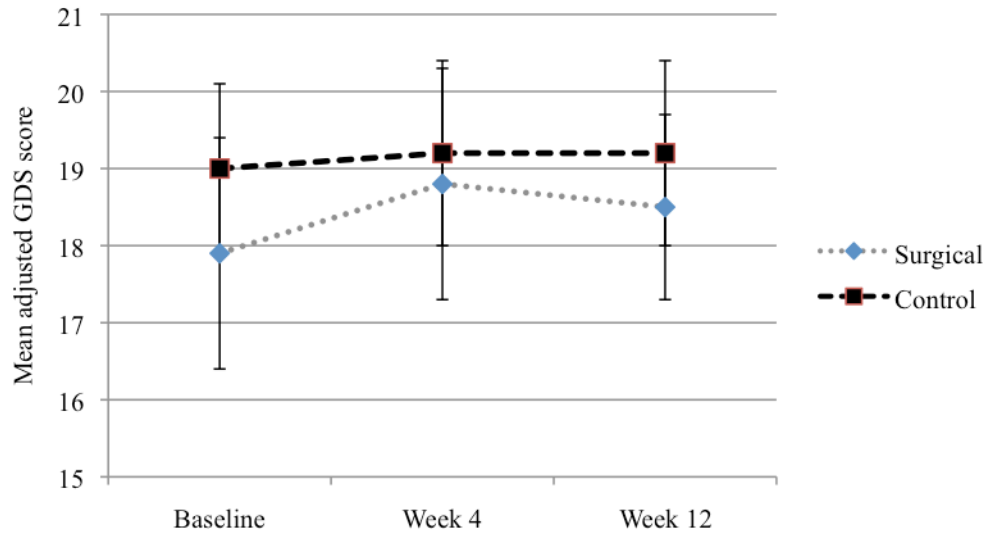


Figure 6. Mean adjusted Geriatric Depression Scale (GDS) scores over time

The findings of this study suggest that surgery did not adversely impact posttraumatic or depressive symptom severity in veterans with chronic PTSD. Therefore, we found **no evidence to support rejecting the null hypotheses for Hypotheses 1b and 1c, and we conclude that outpatient elective surgery did not have a sustained adverse effect on posttraumatic symptom severity or depressive symptom severity in veterans with chronic PTSD.**

Specific Aim 2: Evaluate the influence of baseline PTSD severity, depressive symptom severity, situational anxiety severity, and postoperative pain severity on functional health after elective outpatient surgery in a sample of veterans with preexisting PTSD.

Hypotheses Related to Specific Aim 2:

Hypothesis 2a. Baseline PTSD severity (defined as total score on the Clinician Administered PTSD Scale) will be a significant predictor of functional health change (defined as change in

total score on the Veterans Rand 36-item Health Survey) over a three-month period after elective outpatient surgery in a sample of veterans with pre-existing PTSD.

Hypothesis 2b. *Baseline depressive symptom severity (defined as total score on the Geriatric Depression Scale) will be a significant predictor of functional health change (defined as change in total score on the Veterans Rand 36-item Health Survey) over a three-month period after elective outpatient surgery in a sample of veterans with pre-existing PTSD.*

Hypothesis 2c. *Baseline situational anxiety severity (defined as total score on the State-Trait Anxiety Inventory-State Scale) will be a significant predictor of functional health change (defined as change in total score on the Veterans Rand 36-item Health Survey) over a three-month period after elective outpatient surgery in a sample of veterans with pre-existing PTSD.*

Hypothesis 2d. *Baseline pain severity (defined as total score on the Visual Analog Scale for Pain) will be a significant predictor of functional health change (defined as change in total score on the Veterans Rand 36-item Health Survey) over a three-month period after elective outpatient surgery in a sample of veterans with pre-existing PTSD.*

Analysis and Findings Related to Hypotheses 2a-2d

A series of random coefficients regression models were used to test for the effects of age, gender, baseline GDS scores, baseline CAPS severity scores, baseline VASP scores, or baseline STAI-S scores on trajectory of change on VR-36 PCS or MCS scores in surgical group subjects only. Prior to constructing the random coefficients regression models, mean PCS or MCS scores

were graphed over time to visually examine the temporal pattern of change within only surgical group subjects at baseline, one week, four weeks, and 12 weeks after surgery. These graphs indicated that the temporal pattern of change in both PCS and MCS scores over time was non-linear. Specifically, a graph of mean PCS and MCS scores suggested that surgical group participants demonstrated an abrupt shift in both the level and rate of change of PCS and MCS scores following surgery. Quadratic, cubic, and square root polynomial effects of time were tested and either found not significant or demonstrated convergence issues, likely due to the small number of subjects.

Because these subgroup analyses included only surgical group subjects, a time-varying covariate could not be used to capture the effect of surgery on the level and rate of change in PCS or MCS scores. Therefore, the data were left censored at one week after surgery to result in a linear trajectory of PCS or MCS scores from one week to 12 weeks after surgery, and the random coefficients regression model approach was applied to longitudinal PCS or MCS scores at one week, four weeks, and twelve weeks in the surgical group only. Quadratic, cubic, and square root polynomial effects of time were tested again and either found not significant or demonstrated convergence issues.

Next, a set of random coefficients regression models of the PCS or MCS trajectory were applied to PCS or MCS scores at one week, four weeks, and twelve weeks in the surgical group only. Each analytic model included the following fixed effects: time, baseline PCS or MCS scores, and one of the candidate predictor variables (age, gender, baseline CAPS severity score, baseline GDS score, baseline VASP scores, or baseline STAI-S score). Random effects were subject and subject-by-time for all models. Any baseline predictor variable that was significant at the 0.10 level would be retained for further testing.

Next, all retained baseline measures were entered into the model simultaneously to examine the influence of each after controlling for all other explanatory variables in the models. The independent variables included in these models were examined for multicollinearity and influential outliers. The final model included: (a) the fixed effects of time since surgery and baseline PCS or MCS score; (b) the random effects of subject and subject-by-time, and; (c) the main effects of baseline covariates that were significant at the 0.05 level after controlling for all other variables in the model and eliminating multicollinear variables.

Random coefficients regression analyses of longitudinal PCS scores in the surgical group only at 1 week, 4 weeks, and 12 weeks after surgery identified a statistically significant effect of day ($F = 5.67$; $df = 21.9$; $p = .03$) and baseline PCS score ($F = 65.55$; $df = 1,26.3$; $p < .00$). None of the six covariates evaluated individually (age, gender, baseline GDS score, baseline CAPS severity score, baseline VASP score, or baseline STAI-S score) were significant at $p < .10$ after controlling for baseline PCS score.

Random coefficients regression analyses of longitudinal MCS scores in the surgical group only at 1 week, 4 weeks, and 12 weeks after surgery identified a statistically significant effect of baseline MCS score ($F = 20.44$; $df = 1,26.2$; $p < .00$). Time was not statistically significant ($F = 1.21$; $df = 16.4$; $p = .29$) after controlling for baseline MCS score. Of the six covariates evaluated individually (age, gender, baseline GDS score, baseline CAPS severity score, baseline VASP score, or baseline STAI-S score), only baseline GDS score was statistically significant ($F = 4.51$; $df = 1,25.8$; $p = .04$) after controlling for baseline MCS score. However, significant multicollinearity existed between baseline GDS score and baseline MCS score (mean variance inflation > 2). Therefore, baseline GDS score was eliminated from further consideration.

Specific Aim 3: Describe additional factors that influence functional health after elective surgery using qualitative interview methods in a subgroup of veterans with PTSD.

Analysis and Findings Related to Specific Aim 3

Unstructured, interactive interviews (Richards and Morse 2007) were used to allow subjects with PTSD to describe factors associated with mental and physical health improvement and/or decline over time after elective outpatient surgery. Subjects were recruited using purposive deviant case sampling (Teddlie and Yu 2007). As part of a larger, longitudinal quasi-experimental study measuring the effect of elective outpatient surgery on the mental and physical health of patients with PTSD at a large Veterans Affairs Medical Center (VAMC), subjects who demonstrated ≥ 10 points of improvement or decline from baseline in subjective health status were asked to participate in an unstructured, interactive interview. For the purposes of this study, subjective health status was defined as the participant's Mental Component Summary (MCS) or Physical Component Summary (PCS) scores on the Veterans Rand 36-item Health Survey (VR-36), a population specific variant of the Medical Outcomes Study 36-Item Health Survey. The criterion of ≥ 10 points was selected because a previous study in veteran outpatients demonstrated that this degree of change in PCS and/or MCS scores was associated with greater risk of 1-year mortality. During the course of the study several patients were noted to have very low MCS or PCS scores at baseline due to preexisting chronic mental and/or physical illness; because these patients had no room to demonstrate further decline in their health, the decision was made to interview them if they endorsed a particularly distressing subjective change in mental or physical health so that their experiences would not be lost from the study. For

example, one participant was interviewed because of suicidal ideation culminating in a suicidal gesture, while another was interviewed who suffered a severe flashback in the recovery room. Participants who met these criteria were interviewed at one week, one month, and/or three months after surgery. Interviews were repeated whenever participants demonstrated ≥ 10 points of change in MCS and/or PCS scores, so long as the subject was available and willing to participate. This use of deviant case sampling to obtain a sample for qualitative analysis allowed us to evaluate the effects of different levels of a known quantitative predictor (that is, MCS and/or PCS scores) with a more flexible qualitative research method, with the goal of explaining or describing the factors that contributed to the case becoming an outlier (Creswell 2009).

Each interview began with the question: “Starting with the day you had surgery, tell me what has happened that made your health better or worse.” Additional prompts were added and used as needed. All interviews were conducted in a quiet, private office at the Durham VAMC. Interviews were digitally audio-recorded, transcribed verbatim, and redacted for identifying information by replacing named persons and locations with pseudonyms. After ensuring transcription accuracy, each interview was read and the topics described by the participant were identified, and an abstract of each topic was written. Within each topic the events, situations, thoughts, and feelings described by the participants were examined. These events, situations, thoughts, and feelings were compared within the same interview and across interviews with other subjects to arrive at codes or categories that were sufficient to encompass very similar topics but distinct from other topics. The thought process used to arrive at those codes was documented, and additional codes were created as necessary to encompass new topics described by participants (Sandelowski 1995). Ideally, each code could be distinctively depicted by quoting verbatim a statement from a participant in the context that participant intended (Sandelowski

1994). A researcher with extensive research in qualitative data analysis (JB) audited all analyses. The guiding principal of this data analysis was to construct a thorough description of the factors that subjects believe contributed to health change after elective surgery. Enrollment continued so long as patients were available and consented to participate in interviews. After analysis of all interviews, the findings were summarized in lay language and mailed to participants as a member check to elicit their opinions (Carlson 2010). Participant responses to this member check were incorporated into the findings presented here.

Sample. The sample consisted of 2 women and 12 men; 5 were African-American, 1 was a Pacific Islander, and 8 were Caucasian. All had at least a high school education, and half had attended between 1 and 4 years of college. Two participants were aged 30-39 years, 5 were aged 40-49 years, 1 was aged 50-59 years, and 6 were aged 60-69 years. Twelve participants lived with their spouse or significant other; 2 primarily lived alone but had children who resided with them on a part-time basis. As to employment status at the time of the study, 9 participants were either fully retired or medically disabled, three remained employed full- or part-time, and two were full-time students working toward college degrees. Additionally, all participants received varying amounts of disability pension compensation from the Veterans Administration or military retirement pay from the Department of Defense. The amount of time that had elapsed since participants experienced their traumatic event ranged from 4 and 45 years, with a mean of 24.4 years. Twelve of the 14 participants were diagnosed with some source of chronic pain at enrollment, but only 2 of the 14 participants sustained injuries during their traumatic experiences.

Interviews occurred 1-3 times per participant and lasted between 4 and 24 minutes. Although not an end point of enrollment, saturation occurred after analyzing the first interview

of the twelfth participant, after which an additional two additional participants were interviewed to ensure that no new categories would emerge. Participants identified four major categories of factors that influenced their physical and mental health during and after undergoing elective outpatient surgery: (a) preexisting chronic pain and disability; (b) the elective surgery itself; (c) the health care system, and; (d) friends and family.

Preexisting Chronic Pain and Disability. Almost all participants identified chronic pain and disability as factors that influenced their physical and mental health during recovery. This pain and disability predated the elective surgery and may or may not have been related to the purpose of the surgery. Regardless of its relationship to the reason for the patient electing to have surgery, this chronic pain continued to exert an independent, adverse effect on the health of participants as they recovered. One phenomenon observed in this sample was a shift in the content of the interviews over time: Among participants interviewed multiple times, content describing the impact of chronic pain and disability tended to appear in later interviews. Participants described living with and managing back, neck, knee, and shoulder pain, as well as migraines. Regardless of the source, this chronic pain and disability adversely affected patient's mental and physical health throughout the process of recovering from surgery. One participant described living with chronic back pain and the accompanying disability:

It's like there's no flow to my life, it's a bunch of stutter steps with feeling, the pain's good, and the pain's okay, and the pain's gone, oh no, the pain's bad.... I never know how it's going to be. It's the craziest thing. I mean, I can lay in my bed one day and get up feeling great, and lay in my bed another day, in the same position, but get up and feel like I was laying on rocks.

Managing this preexisting chronic pain and disability consumed a great deal of participants' attention and energy. Participants had developed highly individualized paradigms for managing this chronic pain and the accompanying disability by taking both prescribed and over-the-counter medications; using non-pharmacological remedies like heat, cold, and pressure; and by seeking further care from their health care providers. Participants reported varying degrees of success in managing their chronic pain and disability. One participant described successfully using prescribed opiates for his chronic knee and leg pain:

...for the past 30 years I have always managed my pain well, because I deal with the knee pain, and the gunshot wounds in my legs. I take 5 milligrams of Percocet a day....I haven't abused any drugs, or the pain medicine. I feel like whatever I'm doing is working and it's been well for me.

Another participant described his intentions to seek further care because his efforts to manage his chronic back pain using a combination of prescription medications and heat were unsuccessful:

I'm going to have to talk to my primary care about changing something...he said once my body's adjusted to the meds, then it may take something else, like some morphine pills or something. I took Percocet twice yesterday just trying to get out of my recliner, and I could hardly get out of bed this morning. It was hard to make it here today...if it weren't for the heated seats in my truck, I wouldn't have made it.

Elective Surgery. Participants identified two main factors associated with the surgery that influenced their mental and physical health. These factors included the short-term acute pain and disability caused by the surgery and long-term impact of the surgery on their total burden of mental and physical distress.

All participants described acute pain and disability from the surgery as adversely impacting their physical and/or mental health in the days and weeks after surgery. Among participants interviewed multiple times, content describing the impact of acute pain and disability tended to appear in earlier interviews. Participants reported forming expectations about the degree of pain they expected to suffer based on prior experiences with surgery and information provided by their health care providers, but these expectations did not make the acute pain any less distressing. One participant said:

There's been a lot of pain, an excessive amount compared to the left shoulder rotator cuff surgery I had three years ago, but there was much more extensive work done on this right one. Cutting a tendon, releasing it, working on the arthritis, and a rotator cuff repair. So, much more extensive than the last one. Very painful.

In addition, participants reported being unprepared for the duration of pain and disability after these comparatively 'minor' procedures. One participant described her experiences:

It's only been two weeks, but I feel like my healing is going too slow. I want to just go ahead and heal, so I can get back to being myself and so that I can go back to doing everything that I feel that I need to do, or that I want to do.

Participants reported that this acute pain exacerbated their posttraumatic symptoms, causing them to experience flashbacks, intrusive memories, and irritability. Of note is that

participants who discussed these experiences presented them in an order that indicated that pain preceded these acute changes in their mental health. In some cases participants attributed this experience to the similarity between their postoperative pain and their traumatic experiences.

After foot surgery one participant described his experiences:

Well, I've woken up in the night with the foot hurting so bad that it would place me in a bad situation...back in Vietnam, my feet would hurt so bad because I could never get them dry, you know...and lately I would wake up in the middle of the night with that falling off the shelf and taking me back... the pain brings on a lot, it tips the shelf and everything falls off...and I don't care what veteran with PTSD you talk to, he's lying if he says pain don't bring back memories.

In other cases, the relationship between pain and posttraumatic symptoms was less specific. The most common and distressing symptom associated with acute pain was irritability.

One participant describes irritability associated with pain after surgery:

After surgery I was hard, and I was sharp with everybody. I didn't want to be bothered, I didn't want nobody around me...I was in so damned much pain. And, I ain't going to lie to you, I've hurt before, but never this much.

In addition to acute pain, most participants reported suffering from acute disability in the days shortly after surgery. One participant described his acute disability in the days shortly after surgery:

...All of a sudden I was dependent on others to help me do things...Simple things like taking a shower, because I really couldn't move my left arm to do much, so I had to have somebody help me to scrub places that I couldn't reach. I was in bed

for the first three days...I mean, I was getting up as much as I could, but I couldn't make lunch for myself, or make dinner for myself.

For many participants this acute disability precipitated or worsened depressive and/or posttraumatic symptoms. Participants reported being distressed by feelings of helplessness, blue mood, intrusive memories, and hypervigilance during the days immediately following surgery. Participants also described a relationship between acute physical disability and feelings of helplessness or hypervigilance. One participant described her feelings of helplessness shortly after surgery:

I've been scared a lot... I feel vulnerable. I feel like if something happens, I can't take care of myself, I can't take care of my family...so, I'm not sleeping as well as I used to...because I'm so concerned about someone breaking into the house...you know, just anything could happen, and I'm defenseless.

Participants also described a relationship between acute pain and disability and intrusive memories. Participants reported being more distressed by intrusive memories because they were unable to participate in activities that they normally used to distract themselves from this symptom. One participant who normally spent the majority of his day caring for his farm described his experiences shortly after surgery:

I would be sitting around and in pain, and popping those pain pills and everything, and I would just start thinking about what I went through, and it just kind of stayed in my head, you know...it was like (reliving) everything I've been through in the 'Nam.

Participants coped with acute exacerbations in posttraumatic and depressive symptoms primarily by spending time with family members and pets, discussing their symptoms with their mental health provider at their next scheduled appointment, and resuming their normal activities as tolerated. Regardless of the amount of psychological distress they experienced, no participant reported using emergency mental health services in the days and weeks following surgery.

Much like chronic pain and disability, participants managed acute pain and disability by taking both prescribed and over-the-counter medications; using non-pharmacological remedies like heat, cold, and pressure, self-limiting their physical activity; and by seeking further care from their health care providers. Regardless of how distressing it was, this acute pain and disability typically abated with time with a commensurate improvement in psychological distress.

As acute pain and disability resolved, participants began to describe the ultimate impact of the surgery on their physical and mental health. Participants were motivated to have surgery to decrease pain and disability, improve their cosmetic appearance, and/or set their mind at ease by getting a definitive diagnosis, and judged the effect of surgery on their health according to whether or not it accomplished their particular goals.

Participants for whom the surgery addressed a major source of chronic pain and disability were effusive about the positive benefit of surgery on their mental and physical health. One patient described the impact of an occipital nerve stimulator on his health:

But the surgery has taken away...I would say it's up to 70-80% of the pain. I can go to sleep without the pain, you know, it don't wake me up...it's hard to explain.

After 40-something years of the head pain, and suddenly it's gone... you can't describe it. I wish I could have done it a long time ago.

In contrast, patients for whom the surgery introduced a new source of chronic pain felt that the surgery had negatively impacted their health. One patient with new chronic pain after hernia surgery described the impact on his health:

...and I'm wondering, now, if this is something that's just going to keep on going, if it's something that I'm going to have to live with, this pain in my abdomen.
(Before surgery) I didn't have any pain on my right side, and now that's where it's all concentrated...I think, in retrospect, if this was something I could've lived with from now on, I wouldn't have had it done.

Participants had many sources of chronic pain and disability and the surgery could typically only address one source at a time; however, participants recognized and accepted any long-term improvements in pain and disability the surgery could provide. One participant who suffered from severe chronic back pain offered the following judgment about the impact of foot surgery on his health:

(I had surgery) to get rid of some of the discomfort, and that has happened. Also to loosen up my foot so I could walk without specialty shoes or depending on the crutch so much...I'm walking better, but I still keep it (the cane) with me just in case I misstep or something.

Health Care System. Participants identified several factors associated with the health care system that influenced their mental and physical health during the process of undergoing and recovering from elective outpatient surgery. These factors included: (a) access to care and resources; (b) the process of providing surgical and postoperative care, and; (c) the way health care staff interacted with participants.

In order to recover patients reported needing access to services and resources. Some patients had no problems getting what they needed from the care system, but other patients reported having a hard time getting things they needed to recover from surgery. Resources that patients reported having a hard time accessing included equipment such as boots, braces, and canes, as well as services such as physical therapy, pain management, and mental health services. The inaccessibility of these services and resources profoundly affected patients' health as they attempted to recover from surgery. A commonly reported experience was difficulty obtaining appropriate pain management services once surgery staff had discharged patients from follow-up. One patient described his experiences:

...the last time I had pain medicine, I took it and I called back for more, the (orthopedic surgeon) said, "We do not give pain medicine after six weeks." My response to that was, "That's not what they told me." I said, "They said they would take care of my pain, and at three months (the pain) should leave me."
...And we had a round about it, and of course he didn't give me the pain medicine.

Other patients described being able to obtain pain medication, but found that the pain medication was inadequate or inappropriate given their history of chronic pain and daily analgesic consumption before surgery. One patient described his experiences:

I've been on hydrocodone (for chronic back pain) since 2006...and to see them prescribe the same medication after the surgery...it should have been stronger. I brought that up to them during the surgery follow-up...and the guy said I needed to take it up with my primary care doctor so far as pain management.

Patients secured access to needed resources and services by calling their primary care manager or another staff member with whom they had a close relationship.

Participants reported that their mental health was affected both before and after surgery by the way in which the system provided the surgical benefit and follow-up care. Patients were asked to arrive several hours before surgery, and then waited their turn for the operating room. Although they had an approximate time when their surgery should start, this was subject to change depending on the progression of preceding cases. Therefore, some patients felt 'lost' or 'forgotten' in the process of progressing from the same day surgery unit to the operating room. In some cases, patients became so anxious and distressed by this uncertainty that they threatened to leave without having surgery.

This phenomenon also occurred when receiving postoperative care; patients reported being placed in rooms in the clinic and then being forgotten. In these situations the volume of patients receiving surgical and postoperative care, and the relatively opacity of the traffic control process in the operating room and clinics create a situation in which patients feel lost and overlooked, causing the patient to experience serious but short-lived anxiety. In contrast, patients who received periodic reassurance from a staff member that all was well did not report feeling this way while awaiting surgery or follow-up care.

Some participants also described anxiety when unable to establish and maintain continuity of care. Because of the way in which both surgical and mental health services were

provided, participants reported being unable to establish and maintain trusting relationships with health care providers. One participant describes being unable to meet his surgeon until the morning before surgery:

...I asked him point blank, I said, are you going to be the one that's doing the surgery? And he said, "Maybe, maybe not, I can't say, because when we're scheduled for surgery we don't know who we might be operating on (you)"...So, up till the actual surgery, I didn't know who the physician was.

This finding was not limited to surgical care. As noted, patients did not report using emergency mental health services despite being very distressed by depressive or posttraumatic symptoms. When asked why, one participant stated:

I don't like going (to the emergency mental health clinic). They don't know you, and they don't know what you've been through. I'm okay talking to (my regular psychiatrist) because I've been seeing him for years, but to them in (the emergency mental health clinic) you're just another vet, so I don't like talking to them.

Throughout the process of receiving surgery and postoperative care, patients felt that interactions with staff who appeared interested, caring, unhurried, and informative had a positive effect on their mental health. This feeling was so strong that some patients were not distressed with their overall care even if they had a lot of pain or postoperative complications. Some patients also preferred staff members who made appropriate physical contact when talking with them, such as touching them on the hand when explaining what would happen in surgery. One patient described his experiences after surgery:

I can't complain about what they did because the doctors were concerned, and the nurses were concerned. ...I feel like they have really took an interest, out of the thousands and thousands of the veterans that come in and have surgery, I mean, I'm not the only case, but for them to take an interest in my case, it really made me feel like they had my best interests at hand.

Even small expressions of interest and care on the part of staff members could exert a powerful beneficial effect on patients' mental health. One participant described his feelings when a staff member called after working hours to let him know about the results of a biopsy:

...the (day after surgery) at 5:30 the pathologist called me...he'd just received the results...I thought that was pretty astonishing. I'm not sure what kind of hours they work, but calling me at 5:30 to say "I just got these, and I thought you might want to know"...that brought tears to my eyes.

In contrast, patients reported feeling anxious when forced to interact with staff who seemed distracted, uninterested, unsympathetic and rushed.

Although participants preferred staff members who were forthcoming with information related to their care, the manner in which that information was delivered could result in greater anxiety. One participant describes his interaction with a staff member immediately before surgery:

I went back into OR prep, and the anesthesiologist came back to talk to me. And he told me, "I'm going to take care of this, but right now they don't have the proper instruments in the OR, so we're waiting to put instruments together."
...And, I'm laying there waiting for surgery, and I don't want to hear that these guys don't have their stuff in order.

This quote illustrates how the manner in which information is presented can make a difference in the patients' level of anxiety. The policy at this facility is that the patient cannot be placed under anesthesia until all needed equipment is in the operating room or immediately available.

However, the manner in which this information was conveyed to the participant emphasized that the equipment was not available, rather than emphasizing that protocols were in place and working properly to ensure that the operating room was prepared to care for him.

Although frustrated by unsatisfactory interactions with staff members, some patients reported being afraid to confront staff for fear of being labeled as a 'problem.' Other patients reported setting 'ground rules' about communication when working with a new staff member. One patient described his approach to ensuring staff listened to his needs:

I explain to them, 'I'm very easy to get upset when you don't listen.' I try to hold back, but...I mean, I'm not going to do anything, but once I get upset, then my attitude changes. And then once my attitude changes, why, you get what you get.

However, the most common reaction to unsatisfactory interactions was to rationalize the staff member's behavior. Participants rationalized unsatisfactory interactions by attributing staff responses to high patient volume, differences of personality, or access to knowledge to which the participant was not privy. However, some participants rationalized unsatisfactory interactions by stating that they felt staff members were operating at the limits of their own competence. One participant described this feeling: "I...kind of disagree with him, but I also kind of agree with him, so I really didn't put on a show. I felt like he was doing all that he knew what to do."

In very rare cases, through no fault of their own, staff members who reminded patients of their traumatic experiences could trigger acute posttraumatic symptoms such as flashbacks. One

participant who served in Vietnam described the effect of awakening in the recovery room with two Asian-American nurses standing over him:

...when I come out of the anesthesia, I opened my eyes I seen two (Asian-American) ladies standing beside my bed, and it just freaked me out....they said that I began to go into defense mode, wondering if I was back in Vietnam, wondering if they was trying to hurt me, and wanting to defend everybody. It was like that they were standing there trying to determine what they were going to do with me, or to me. I was thinking that I was waiting for rescue, but the rescue wasn't coming because now they'd captured me.

Friends and family. Participants identified two major factors related to their friends and family members that influenced their physical and mental health after elective surgery: Physical assistance and emotional support.

Family and friends helped patients take care of themselves right after surgery. Friends included both close personal friends and casual acquaintances from church or social clubs; family included spouses, unmarried significant others and children. This type of physical assistance included getting food, drink, and medications; performing personal hygiene tasks; and keeping their residence clean. One patient described receiving assistance with food preparation from his teenaged children in the days following surgery: "I couldn't make lunch for myself, or make dinner for myself...My kids tried to help me out, but that meant we were limited to what they could make, like spaghetti and macaroni and cheese." Patients who found themselves without this support struggled to meet their needs, even when their family members were away for only short periods of time. One patient described his experiences trying to care for himself in his wife's absence shortly after foot surgery:

(Before my wife) went to work...she would lay me out my three oranges and my three apples, and I would have my TV controller, and I would get in my recliner with that foot up in the air...And if I needed anything, I found out that at that point in time crawling along on all fours was a good way to get around. So I did that, crawled along the carpet, for about 4 days...

Patients reported that the presence of emotional support from a friend or family member influenced their mental health after surgery. Interestingly, several patients cited pets as a source of this type of emotional support. Even being temporarily deprived of emotional support could trigger profound feelings of distress. Patients asked about this phenomenon felt that being left alone and in pain gave them too much time to think about their problems. One patient described his mood after his girlfriend had to return to work:

Monday morning my girlfriend had to go do her thing, so I was there by myself. I just couldn't get out of bed...I was just really depressed...I mean, really in a dark place...angry, and pissed off, mostly at myself, for not being able to do the things that I had been doing for myself for the past few years...but I wasn't able to do those, and I really just beat myself up for it. ...You get back to, you know, that military aspect of, if you're not helping, you're hindering...and that's what I felt like, you know?

Participants indicated that family members and spouses remained a consistent source of emotional support throughout the study. Unfortunately, patients in pain were more irritable, which could cause family and/or friends to avoid the patient. In some cases this irritability was imperceptible to the patient until pointed out by someone else. In extreme cases excessive

irritability could lead to friends disengaging from participants completely, triggering profound emotional distress for the participant. One patient described his emotional distress after his fiancé left him over concerns with his irritability and anger:

I never put a lot of stock in that I was being mean until... my fiancé flat out told me, "your PTSD, you have a problem. You need to go get help"... (Since then) my fiancé and I have just been at it. This last week we had a knock down drag out.... it didn't need to get out of control. She tried to back off, and I didn't, and then I tried to back off, and she didn't...and now I think I've lost her. And, I'm hurt, I agonizing over that. I was suicidal for a period of time...it's been a mess.

Relationship of current findings to previous findings:

The present study has expanded our understanding of the effects of common outpatient elective surgeries on veterans with chronic posttraumatic stress disorder (PTSD). The findings of this study suggest that surgery has a significant but short-lived adverse impact on the physical and mental subjective health status of veterans with chronic PTSD. This adverse impact peaks shortly after surgery, but resolves for the majority of patients within one month. We did not detect an effect on posttraumatic symptom severity or depressive symptom severity one month after surgery, possibly because the adverse effects had abated before these symptoms were reassessed. Finally, we were unable to assess the predictive validity of age, gender, preoperative posttraumatic symptoms, depressive symptoms, pain, and anxiety severity for changes in mental and physical subjective health status over the three months of data collection.

However, the most significant finding may be that the age- and gender-adjusted subjective mental and physical health scores of veterans with chronic PTSD were in the lowest 10% of the United States population (Kazis et al. 1998). This finding suggests a significant burden of physical and mental comorbidity regardless of surgical status, and that physical and mental comorbidity is likely the source of greater risk of postoperative mortality in veterans with PTSD. At baseline, the mean PCS score for a veteran presenting for outpatient elective surgery was 37.0 after adjusting for age and gender. As the PCS is normalized to a mean of 50 and a standard deviation of 10, the veterans who underwent outpatient elective surgery while participating in this study were an average of 1.3 standard deviations below population norms. This is concerning, because a study of outpatient veterans reported that each 5-point increment below a PCS of 50 increased the odds ratio for risk of 1-year mortality by 1.27 compared to veterans within 5 points of the population mean (Fan et al. 2004). Similar findings were

observed for subjective mental health status. At baseline, the mean MCS score for a veteran presenting for outpatient elective surgery was 36.4 after adjustment for age and gender, indicating that surgical group participants were 1.4 standard deviations below population norms. Fortunately, subjective mental health status appears to be less influential on risk of mortality: In outpatient veterans, each 5-point increment below a MCS of 50 increased the odds ratio for risk of 1-year mortality by 1.08 compared to veterans within 5 points of the population mean (Fan et al. 2004). Therefore, the veterans in this study were at greater risk of mortality before they ever entered the operating room.

Participants in the surgical group also presented with clinically significant depressive and posttraumatic symptoms. The mean GDS score of veterans with chronic PTSD was 17.9 before surgery, indicating mild to moderate depression (Yesavage et al. 1983), while the mean CAPS severity score was 71.5 before surgery, indicating moderate to severe PTSD symptomatology (Weathers, Keane, and Davidson 2001). Therefore, patients with chronic PTSD continue to suffer from the psychiatric sequelae of their experiences, even 25 years after being exposed to a traumatic event.

On average, outpatient elective surgery affected both the physical and mental health of patients with chronic PTSD. The impact of elective outpatient surgery on physical subjective health status was transient. Surgical group subjects experienced a mean age-and-gender-adjusted decline of 3.5 points in PCS scores and 2.8 points in MCS scores that resolved by one month after surgery. For comparison, chronic lung disease has been estimated to result in a decline of 3.6 points in PCS score and major depression to result in a decline of 8 points in MCS score outpatient veterans (Kazis et al. 1998).

The qualitative findings of the study expand upon the quantitative findings, and offer insights into the direction of future research and quality improvement projects. In particular, future research studies and quality improvement projects should focus on improving pain management practices, improving interactions with the healthcare system, and supporting families as they support the patient. Subjects reported that chronic pain was prevalent, and was frequently not taken into account when planning post-discharge analgesia. In addition, unrelieved acute pain and disability was associated with greater distress from depressive and posttraumatic symptoms shortly after surgery. Therefore, additional research is needed to improve and coordinate pain management after the patient leaves the hospital. In contrast, subjects reported that pain-alleviating procedures were associated with decreases in distress from posttraumatic symptoms. This finding suggests that in patients with comorbid chronic pain and treatment-resistant PTSD, effective pain management may be a key factor in improving response to PTSD treatment.

Subjects also reported that interactions with the healthcare system influenced their mental and physical health while recovering from outpatient elective surgery. In particular, subjects reported that access to resources and services, the opacity of the process for delivering the surgical benefit, and their interactions with individual healthcare providers were all factors that influenced their health after surgery. Therefore, future quality improvement projects should focus on coordinating timely delivery of resources and services, ensuring that the process of providing the surgical benefit is made as transparent as possible to the patient, and educating staff members about effective strategies for interacting with patients with chronic PTSD.

Finally, subjects reported that the support of friends and family members was vital to their mental and physical health while recovering from outpatient elective surgery. Patients

experienced both physical and mental distress when deprived of this support, even if the situation was only temporary. However, this support could be undermined by increased irritability immediately after surgery. Therefore, future studies and quality improvement projects should identify and test the most effective means of supporting the patients' support system after surgery.

Effect of problems or obstacles on the results:

In the first year of the study we experienced very slow response to the flyers advertising for control group subjects. We were forced to remedy this situation by actively recruiting control group subjects from the outpatient PTSD clinic. At present, the majority of patients in the outpatient PTSD clinic are Vietnam veterans, which resulted in the imbalance in age and duration of PTSD symptoms observed in Table 1. Despite the difference in age there was no difference between groups in physical and mental subjective health status, depressive symptom severity, posttraumatic symptom severity, or in the prevalence of any of the comorbidities we assessed for. In addition, we included age as a covariate in each analysis performed. Therefore, we feel that the difference in age between the two groups does not adversely affect the findings.

However, the length of time it took to get an active control group recruitment strategy approved meant that there was an imbalance in subject flow through the two arms of the study. Specifically, surgical group subjects were recruited in an ongoing fashion from September 2011 to July 2012, while approximately 2/3 of control group subjects were recruited between June 2012 and August 2012. This creates the risk of a historical threat to the internal validity of the study, in which outside world events could have influenced results. The best means we had to address this was to incorporate seasonality as a covariate, because anecdotally Vietnam Veterans tend to be more distressed in the summer because of the hot weather, humidity, and frequency of ‘anniversaries’ of traumatic events. While the mismatched progress of the two groups through the study certainly added a degree of unaccounted variation, the absence of an effect of time on the physical and mental health of control subjects would seem to indicate that their health remained relatively stable over the period of data collection, as we hypothesized when designing the study.

Limitations:

Limitations of the present study include the relatively small sample size, the limited duration of data collection, the pragmatic necessity of assessing surgical group subjects approximately one week before surgery, and the reliance on self-report measures to generate data. Limiting data collection to 12 weeks after surgery made the study practicable but means that we cannot rule out an adverse effect of elective surgery on long-term mortality in this population. To address the limited duration of data collection, future studies should attempt to follow patients for 1 to 5 years to further explore the impact of elective surgery on long-term mortality. The pragmatic necessity of assessing surgical group subjects 1 week before surgery was likely an additional source of random error, because events may have occurred to surgical group subjects between baseline assessment and their day of surgery that were not accounted for by the study. Future studies should address this limitation by completing the baseline assessment as close to the day of surgery as possible.

In addition, the inability to complete a face-to face assessment of patients one week after surgery may have resulted in the lack of a significant effect of outpatient elective surgery on depressive and posttraumatic symptoms. We were unable to collect data on posttraumatic and depressive symptom severity one week after surgery because of concerns about excessive subject burden. Given that subjects reported significant decreases in subjective mental health status one week after surgery and complained of greater depressive and posttraumatic symptoms shortly after surgery, a study that collects data about posttraumatic and depressive symptoms within a week after surgery may detect a significant effect of surgery on the severity of these more specific psychiatric symptoms.

The inability to detect the predictive validity of baseline predictors for subjective health change was likely because of the small sample size remaining after removal of the nonsurgical subjects. The findings associated with research question 3 likely represent a combination of type I and type II error: Type I error in erroneously accepting the random coefficients regression model we were obligated to report, and type II error in erroneously excluding age, gender, baseline depressive symptom severity, baseline posttraumatic symptom severity, baseline pain severity, baseline and situational anxiety as predictors of physical or mental subjective health status over time after surgery. The size of the surgical subgroup was simply too small to both account for the non-linear trajectory of subjective health after surgery and evaluate the predictive validity of the covariates under consideration.

The reliance on self-report measures could be addressed by incorporating clinician assessments of functional status. Clinician assessments of functional status were not practicable for this study because of the variety of surgical diagnoses included in the sample. However, future studies that enroll surgical subjects with a single surgical diagnosis, such as total knee replacement surgery, could incorporate any of several objective functional assessments in addition to patient self-reported physical functional status (Mizner et al. 2010).

Note that we do not consider these results applicable to veterans who undergo more intensive or painful surgeries, those who are hospitalized after elective surgery, or those suffering from more acute exposure to traumatic events. Future studies should assess the impact of surgery and hospitalization on veterans with chronic posttraumatic stress disorder, and potentially include a control group of veterans without PTSD to provide a better estimation of the impact of PTSD on physical and mental health after surgery. Future studies should also

explore the effect of surgery on younger veterans, with more recent exposure to traumatic experiences.

Conclusion:

The foremost implication of this study are that veterans with PTSD appear to be at greater risk for mortality at presentation for surgery due to poor baseline physical and mental health. However, that risk does not appear to be increased by undergoing outpatient elective surgery. On average, veterans with chronic PTSD can expect a significant but transient decline in their physical and mental subjective health after elective surgery, but should recover by one month after common outpatient elective surgeries. The present study found no evidence for a detrimental effect of outpatient elective surgery on physical or mental subjective health after three months. The present study also did not support a detrimental effect of common outpatient elective surgeries on posttraumatic or depressive symptom severity in veterans with chronic PTSD, but this may have been due to the timing of data collection for these mental health issues. The qualitative findings lend explanatory power to the quantitative findings. Subjects reported that pain and disability, interactions with the healthcare system, and support from friends and family members were the most important factors that influenced their physical and mental health during recovery from surgery.

Significance of Study or Project Results to Military Nursing

This study suggests that outpatient elective surgery did not have a sustained and detrimental effect on the health of veterans with chronic PTSD. However, PTSD should be viewed as an indicator that other physical and mental comorbidities are present in the patient that should be explored before proceeding with surgery. The decision to proceed to elective surgery should be based on the expected impact of the surgery on patient's functional status, and surgeries that can be expected to substantially improve chronic pain may also help improve psychiatric distress.

One the day of surgery healthcare providers should strive to reassure patients and keep them informed about the probable timeline for the day. Any changes in the plan should be explained to the patient as early as possible. Efforts should also be made to provide continuity of care, so that the patient has to opportunity to build a trusting relationship with healthcare providers. Before discharge, healthcare providers should establish a pain management plan that is of sufficient duration, takes into account chronic opiate tolerance, and stipulates who is responsible for adjusting the plan if necessary.

The patient with chronic PTSD needs careful monitoring in the days following surgery. The patient and their family members should be counseled to expect a substantial worsening of both physical and mental health after surgery. The risk factors for suicide should be reviewed, and patients and family members should be made aware of how to contact emergency mental health resources if necessary.

In summary, future efforts to improve the perioperative care of patients with chronic PTSD should focus on improving pain management, educating staff about how to interact with patients with PTSD, and supporting families in the days after surgery. These efforts should

greatly decrease the amount of distress patients with chronic PTSD experience during the perioperative process. By minimizing distress related to the process of having surgery, we can ensure that the beneficial effects of surgery are maximized for these vulnerable patients.

**Changes in Clinical Practice, Leadership, Management, Education, Policy, and/or Military
Doctrine that Resulted from Study or Project**

None as yet, although we have presented these findings in a seminar designed to educate civilian healthcare practitioners about military-related mental health issues such as PTSD and traumatic brain injury.

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Summary of Dissemination		
Type of Dissemination	Citation	Date and Source of Approval for Public Release
Publications		
Publications in Press		
Published Abstracts		
Podium Presentations	Wofford, KA, (2012, December). The influence of elective surgery on health in veterans with PTSD. Podium presentation at the first annual Joining Forces Seminar at the Duke School of Nursing, Durham, NC	N/A
Poster Presentations	Wofford, KA, Barroso, J, Silva, S, Hertzberg, M, and Vacchiano, C. (2012, August). Factors influencing mental and physical health after elective surgery in veterans with chronic PTSD. Poster session presented at the annual meeting of the American Association of Nurse Anesthetists, San Francisco, CA	30JUL12, TSNRP/USU PAO.

Media Reports		
Other		

Reportable Outcomes

Reportable Outcome	Detailed Description
Applied for Patent	None
Issued a Patent	None
Developed a cell line	None
Developed a tissue or serum repository	None
Developed a data registry	None

Recruitment and Retention Table

Recruitment and Retention Aspect	Number	
Subjects Projected in Grant Application	80	
Subjects Available	205	
Subjects Contacted or Reached by Approved Recruitment Method	174	
Subjects Screened	205	
Subjects Ineligible	0	
Subjects Refused	113	
Human Subjects Consented	61	
Subjects Intervention Group / Control or Sham Group	29	32
Intervention Group / Control or Sham Group Subjects Who Withdrew	2	7
Intervention Group / Control or Sham Group Subjects Who Completed Study	27	25
Intervention Group / Control or Sham Group Subjects With Complete Data	27	25
Intervention Group / Control or Sham Group Subjects With Incomplete Data	2	6

Demographic Characteristics of the Sample

Characteristic	
Age (yrs)	55.7 ± 1.9
Women, n (%)	8 (13)
Race	
White, n (%)	25 (42)
Black, n (%)	34 (57)
Hispanic or Latino, n (%)	0 (0)
Native Hawaiian or other Pacific Islander, n (%)	1 (2)
Asian, n (%)	0 (0)
Other, n (%)	0 (0)
Military Service or Civilian	
Air Force, n (%)	0 (0)
Army, n (%)	0 (0)
Marine, n (%)	0 (0)
Navy, n (%)	0 (0)
Civilian, n (%)	0 (0)
Service Component	
Active Duty, n (%)	0 (0)
Reserve, n (%)	0 (0)
National Guard, n (%)	4 (7)
Retired Military, n (%)	5 (8)
Prior Military but not Retired, n (%)	51 (85)
Military Dependent, n (%)	0 (0)
Civilian, n (%)	0 (0)

Final Budget Report

See next page.

Project/MS Element: F01 3180031

H00001-13-1-3503.M11-F02

Person Responsible: VACCHIANO, CHARLES A

Project Period: 08/01/2013 - 12/31/2012

Project To Date thru: Period 5 Fiscal Year 2013

Cost Element	YTD Plan	Cost-Md Actual	YTD Actual	YTD Actual	Balance	Commitments
324200 FEDERAL GRANTS		4,034.90-	19,796.33-	6,960.79-	6,960.79-	
324205 FEDERAL PROJECTS		4,034.90-	19,796.33-	19,796.33-	19,796.33-	
Sponsored Programs Reven			26,757.12-	26,757.12-	26,757.12-	
603300 COST SAVING		1,093.42	5,467.10	17,182.11	17,182.11-	
603300 COST SAVING		266.42	1,332.10	3,781.98	3,781.98-	
Salaries Cost-Shared		1,359.84	6,799.20	20,963.69	20,963.69-	
610000 PRIME BENEFITS		331.80	1,659.00	5,299.24	5,299.24-	
Fringe Benefits		331.80	1,659.00	5,299.24	5,299.24-	
808000 COST SAVING		1,691.64-	8,458.20-	26,282.93-	26,282.93-	
Salaries Cost-Sharing Co		1,691.64-	8,458.20-	26,282.93-	26,282.93-	
622500 EXPERIMENTAL SUP		600.00	6,470.00	14,895.00-	14,895.00-	
Professional Services an		600.00	6,470.00	14,895.00-	14,895.00-	
645000 LAB & RESEARCH S		1,297.00	1,934.94	1,097.00	1,097.00	
Supplies and Materials		1,297.00	1,934.94	1,097.00	1,097.00	
698600 TRAVELING EXP		1,825.00	1,934.94	109.94-	109.94-	
Travel		1,825.00	1,934.94	109.94-	109.94-	
675700 MINOR MACHINERY		21,400.00	612.81	612.81-	612.81-	
MISCELLANEOUS		21,400.00	612.81	612.81-	612.81-	
Other COSTS		21,400.00	612.81	612.81-	612.81-	
TOTAL DIRECT COSTS		24,522.00	8,404.94	17,642.75	20,787.19	
694600 INDIRECT COSTS		342.00	4,790.82	10,056.37	6,879.25	
INDIRECT Expense		342.00	4,790.82	10,056.37	3,921.63	
TOTAL PROJECT COSTS		38,500.00	13,195.76	27,699.12	10,800.88	
Sponsored Programs Award		38,500.00	13,195.76	27,699.12	10,800.88	
Cost element group		38,500.00	13,195.76	27,699.12	10,800.88	
		38,500.00	6,600.57-	942.00	37,558.00	