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PRINCIPAL INVESTIGATOR: CPT Sarah E. Niles MD

CONTRACTING ORGANIZATION: The Geneva Foundation
Lakewood, WA 98496

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14. ABSTRACTS

Background: Military orthopedists in times of war provide one of the most critical services to Soldiers, Sailors, and Airmen. Practicing evidence based medicine is imperative to optimal outcomes. Methods: Surveys were offered to all military orthopedists, orthopedic surgeons in the OTA and at a orthopedic professional meeting. Methods: Survey questions on amputations, reconstruction, compartment syndromes, soft tissue injury management, wound healing, and deep venous thrombosis preventions from recent literature were developed into scenario based questions. Factors potentially influencing practice also asked. Analysis was done with univariate and multivariate analysis. Results: Significant factors ($p < 0.05$) in univariate analysis working in a higher level trauma center, being in practice for less than ten years and completing a fellowship. In multivariate analysis significant factors included have a smaller patient load, being in practice for less than ten years particularly with military service, and completing a fellowship.

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INTRODUCTION:

Orthopedic trauma remains one of the most survivable traumatic injuries seen on the battlefield. Translating research into practice must be bridged in order to optimize medical outcomes. Orthopedic surgeons serving in the military may practice little to no trauma in their traditional practice however on the battle field this is what they encounter. Determining risk factors for non evidence based practice can help bridge knowledge gaps which can be targeted to providers prior to deployment. Surveys including factors which contribute to continued medical education and practice as well as scenario based questions on military relevant orthopedic trauma with high levels of evidence were developed and given to orthopedists.

BODY:

188 orthopedic surgeons completed the survey over the study period. Surgeons took the survey through the Orthopedic Trauma Association, OTA, website; through the military orthopedic consultant; and at a orthopedic professional meeting. The group developed focus areas to include: amputations, reconstruction, compartment syndromes, soft tissue injury management, wound healing, and deep venous thrombosis preventions. Using these focus areas, a broad literature review was completed and articles were selected for inclusion if they contained military relevant orthopedic trauma in one of the focus areas, were published in the past seven years, and had an evidence level of I or II based on the Center for Evidence –Based Medicine criteria.¹⁻¹⁸ Based on these articles the group developed concise, yet comprehensive scenario based questions for input into the survey, and epidemiologist developed demographic data collection questions.¹⁹⁻²⁹ The scenario questions were independently reviewed by two prominent orthopedic trauma surgeons, and one general orthopedic surgeon for syntax, and relevance to current practice. Ten questions were selected for survey inclusion. The survey questions were built in a web data entry and also manually printed to hand out at professional meetings. The surveys through were then sent to all military orthopedic surgeons electronically and at a professional meeting, as well as on the Orthopedic Trauma Association webpage. Subjects included orthopedic surgeons including those who in PGY-2 onwards. Surgeons whose primary responsibility is administrative were included as they may be called to serve as a deployed surgeon.

Analysis:

Over 63 related factors that could be contributed to evidence based practice were collected. Several were correlated or duplicated and others had similar answers for all subjects. Therefore, we combined them into 16 factors. The demographic factors were gender and age. Since age was highly correlated with service time, we only used age for the crude analyses. Age of subjects was categorized into two groups: less than or equal to 40 and greater than 40. There are several continuous factors and countable factors including years in practice, information sources, and journals. The data was analyzed for number of journals read and number of information sources used and these were analyzed as binary factors. The number of years in practice, patient age, monthly patient number, number of jobs, and the percentage of trauma were treated as continuous variables and categorized by mean into two groups: less than or equal to their means and greater than each factors' specific mean. Additional categories included attending

professional conferences or meetings, military service, completion of a fellowship, working in an academic setting, additional graduate degrees, working at a trauma center, and membership in the Orthopedic Trauma Association.

For the 10 questions, if the answer was correct, it received 10 points. If it was incorrect, it received 0 points. Analysis was done by individual questions, and by the sum of the scores for questions 1, 2 and 4, which all were associated with limb salvage vs. amputation. Finally the total scores of the all questions were analyzed. Analysis was also done using the triple system, 10 for correct answer, 3 for partial correct answer, and 0 for non-response or total wrong answer. This demonstrated that there was not a difference on the association between the total scores and the predictors by the two score systems: binary and triple. Hence all reports are from the binary system.

Descriptive statistical variables were used to derive the demographic information of the subjects as well as the job related information collected from the questionnaire. Categorical analysis was performed for each individual question to estimate the association between the binary response and the sixteen factors. Proportional test and chi-square test were used to estimate the significance of the proportion difference.

The general linear regression model was used to study the adjusted association between the sum of scores and the 13 factors that were not analyzed as binary factors as well as their interaction. Since age is highly correlated with service year, age was not included in the model. The interaction between the factors was also examined. If the significance of the interaction is higher ($P < 0.20$), we included it into the model. It is well known when interaction was included; the estimation for the main effect was only for a sub category of the reference group. We estimated the least square means (LS-means), which was adjusted by other co-factors. LS-means are predicted population margins; that is, they estimate the marginal means over a balanced population. Each LS-mean is computed as $L'b$ for a certain column vector L , where b is the vector of parameter estimates - that is, the solution of the regression equations. For example, if the model repressors are A, B, C (categorical) and X (numerical), ls means A B A*B will show for each level of the A, B, and A*B effects by control C with a balanced value and the mean of X. The LSMEANS statement performs multiple comparisons on interactions (AXB) as well as main effects of A and B.

Results:

188 surveys were collected and compared for data analysis.

Demographic data is seen in Table 1.

Table 1 Demographic Data of Surveyed Providers		
(n=188)		
Sex**		N (%)
	Male	170 (90)
	Female	16 (9)
Age**		
	20-29	12 (6)
	30-39	82 (44)
	40-49	59 (31)
	50-59	21 (11)
	60-69	11 (6)
	>=70	1 (0.5)
Current Practice*		
	Academic	112 (60)
	Rural	16 (8.5)
	County	9 (5)
	Private	17 (9)
	Urban	45 (24)
	Military	54 (29)
Residency Trained		
	Yes	122 (65)
	No	27 (14)
	Unknown	39 (21)
	More than one	41 (22)
Fellowship		
	None	66 (35)
	Trauma	81 (43)
	Other	41 (22)
US Military Service		
	Active	109 (58)
	Reserve	10 (5)
	None	69 (37)

*Current practice may include multiple categories

** There are 2 missing

Table 2 is a description of the surgical practices of the orthopedist surveyed. The providers averaged 170 patients, the median is 200, and the distribution is skewed to the right. The average provider reads 2.2 journals a month; uses 3.4 information resources and has 1.3 jobs. The average number of years in practice is 13.44 and the median is 12. The percentage of practice time spent on trauma is 2.7%. The average patient age was 34.

Table 2: Summary of Surveyed Providers Clinical Practice:

Category*	Mean	Std	Min	Max	Mid	N
Patient Number	169.36	126.39	0	600	200	173
Number of Journals Read	2.20	0.78	0	4	2	188
Number of Information Resources	3.36	0.89	0	5	3	188
Number of Jobs	1.30	0.55	0	4	1	188
Years in Practice	13.44	8.58	1	40	12	79
Percentage of Practice in Trauma	2.67	1.30	1	5	2	185
Average Patient Age	33.85	6.47	22	52.5	33.75	128

*Each category is per month

Table 3 Significant Factors for Answering Correctly by Question (p<0.05)

Greater than 70% of providers surveyed answered questions 4 and 10 correctly; just under 50% of providers surveyed answered questions 2 and 9 correctly. Question 3 had the lowest correct proportion (about 6%), question number 8 also had very low correct responses.

For the 16 factors being considered, the factors significant associated with answering more questions correctly included: working in a higher level trauma center, being in practice for less than 10 years, and completing a fellowship reaching significance in 4 or more questions.

Table 3: Percentage of correct answers and p values for questions 1 to 10 by factors

Factor	level	total	%Q1	P_1	%Q2	P_2	%Q3	P_3	%Q4	P_4	%Q5	P_5
Gender	Male	170	39.4	0.73	47.6	0.86	6.5	0.97	70	0.68	40	0.1
	Female	16	43.8		50		6.3		75		18.8	1
Age	Young	109	42.2	0.35	48.6	0.81	3.7	0.09	69.7	0.72	44	0.0
	Old	79	35.4		46.8		10.1		72.2		30.4	6
Trauma Center Level or Non Hospital Practice	1	70	54.3	0.01	54.3	0.65	5.7	0.93	70	0.03	51.4	0.0
	2	46	37		43.5		6.5		65.2		23.9	
	3	22	22.7		45.5		9.1		54.5		36.4	
	4	48	27.1		45.8		6.3		85.4		35.4	
Additional Degree	No	164	39	0.80	47.6	0.82	6.1	0.68	72	0.34	38.4	0.9
	Yes	24	41.7		50		8.3		62.5		37.5	3
Completed Fellowship	No	103	31.1	0.01	40.8	0.03	3.9	0.13	62.1	0.00	36.9	0.6
	Yes	85	49.4		56.5		9.4		81.2		40	6
Work in Academic Setting	No	76	38.2	0.78	48.7	0.85	6.6	0.93	73.7	0.47	30.3	0.0
	Yes	112	40.2		47.3		6.3		68.8		43.8	6
Number of Jobs	<mean	136	39	0.86	48.5	0.77	8.1	0.16	67.6	0.13	36	0.3
	>mean	52	40.4		46.2		1.9		78.8		44.2	0
Military Job	No	134	43.3	0.08	48.5	0.78	7.5	0.35	70.1	0.78	42.5	0.0
	Yes	54	29.6		46.3		3.7		72.2		27.8	6
OTA Membership	No	92	26.1	0.00	38	0.01	7.6	0.50	62	0.01	31.5	0.0
	Yes	96	52.1		57.3		5.2		79.2		44.8	6
Patient Age	<mean	95	34.1	0.04	43.7	0.10	6.3	0.98	70.6	0.96	34.1	0.0
	>mean	93	50		56.5		6.5		71		46.8	9
Patient Count	<mean	126	41.1	0.63	50.5	0.46	5.3	0.53	67.4	0.30	40	0.6
	>mean	62	37.6		45.2		7.5		74.2		36.6	3
Years in Practice Mean = 10 years	<mean	155	43.2	0.02	49.7	0.28	7.1	0.40	75.5	0.00	42.6	0.0
	>mean	33	21.2		39.4		3		48.5		18.2	1
Trauma Practice	<mean	110	31.8	0.01	43.6	0.17	5.5	0.54	66.4	0.12	32.7	0.0
	>mean	78	50		53.8		7.7		76.9		46.2	6
Number of Information Sources	<mean	96	39.6	0.95	52.1	0.24	5.2	0.50	70.8	0.98	47.9	0.0
	>mean	92	39.1		43.5		7.6		70.7		28.3	1
Professional Meeting Attendance	<mean	105	29.5	0.00	43.8	0.21	5.7	0.67	66.7	0.17	35.2	0.3
	>mean	83	51.8		53		7.2		75.9		42.2	3

Military Service Member	No	69	44.9	0.24	52.2	0.37	8.7	0.33	78.3	0.09	46.4	0.0
	Yes	119	36.1		45.4		5		66.4		33.6	
Number of Journal Read	<mean	123	34.1	0.05	48.8	0.73	7.3	0.47	68.3	0.31	33.3	0.0
	>mean	65	49.2		46.2		4.6		75.4		47.7	

Table 3: Percentage of correct answers and p values for questions 1 to 10 by factors (cont)

Factor	level	total	%Q6	P_6	%Q7	P_7	%Q8	P_8	%Q9	P_9	%Q10	P_10
Gender	Male	170	21.8	0.02	33.5	0.75	7.6	0.61	47.1	0.80	74.1	0.94
	Female	16	50		37.5		0		43.8		75	
Age	Young	109	24.8	0.75	43.1	0.00	7.3	0.79	48.6	0.68	78.9	0.10
	Old	79	22.8		21.5		6.3		45.6		68.4	
Trauma Center Level or Non Hospital Practice	1	70	32.9	0.17	32.9	0.30	8.6	0.77	61.4	0.03	68.6	0.02
	2	46	19.6		39.1		6.5		39.1		65.2	
	3	22	18.2		18.2		9.1		36.4		86.4	
	4	48	16.7		39.6		4.2		39.6		87.5	
Additional Degree	No	164	23.8	0.90	35.4	0.32	7.3	0.58	48.2	0.55	76.2	0.15
	Yes	24	25		25		4.2		41.7		62.5	
Completed Fellowship	No	103	20.4	0.21	37.9	0.22	6.8	0.94	39.8	0.02	77.7	0.27
	Yes	85	28.2		29.4		7.1		56.5		70.6	
Work in Academic Setting	No	76	22.4	0.68	27.6	0.13	5.3	0.47	43.4	0.38	76.3	0.63
	Yes	112	25		38.4		8		50		73.2	
Number of Jobs	<mean	136	26.5	0.19	36.8	0.20	8.1	0.32	42.6	0.04	72.8	0.40
	>mean	52	17.3		26.9		3.8		59.6		78.8	
Military Job	No	134	26.1	0.27	36.6	0.25	8.2	0.28	47.8	0.86	72.4	0.30
	Yes	54	18.5		27.8		3.7		46.3		79.6	
OTA Membership	No	92	19.6	0.17	37	0.41	7.6	0.71	42.4	0.18	73.9	0.86
	Yes	96	28.1		31.3		6.3		52.1		75	
Patient Age	<mean	95	23.8	0.95	31	0.20	5.6	0.30	43.7	0.15	77.8	0.14
	>mean	93	24.2		40.3		9.7		54.8		67.7	
Patient Count	<mean	126	27.4	0.27	36.8	0.41	7.4	0.80	54.7	0.04	71.6	0.36
	>mean	62	20.4		31.2		6.5		39.8		77.4	
Years in Practice Mean = 10 years	<mean	155	27.1	0.04	37.4	0.04	7.1	0.83	48.4	0.53	76.8	0.12
	>mean	33	9.1		18.2		6.1		42.4		63.6	
Trauma Practice	<mean	110	20.9	0.25	39.1	0.08	8.2	0.42	40.9	0.04	78.2	0.17
	>mean	78	28.2		26.9		5.1		56.4		69.2	
Number of Information Sources	<mean	96	25	0.73	33.3	0.83	9.4	0.18	49	0.65	74	0.87
	>mean	92	22.8		34.8		4.3		45.7		75	
Professional Meeting Attendance	<mean	105	20	0.16	35.2	0.70	3.8	0.07	44.8	0.43	75.2	0.79
	>mean	83	28.9		32.5		10.8		50.6		73.5	
Military Service Member	No	69	24.6	0.86	33.3	0.88	7.2	0.89	52.2	0.31	69.6	0.24
	Yes	119	23.5		34.5		6.7		44.5		77.3	
Number of Journal Read	<mean	123	20.3	0.11	37.4	0.18	4.1	0.04	44.7	0.32	72.4	0.36
	>mean	65	30.8		27.7		12.3		52.3		78.5	

Table 4 shows the results for Multivariate Analyses

Initially 14 factors and their interactions were considered. Insignificant interactions were then eliminated. The most significant factors for questions 1, 2 and 4 and all 10 questions was time in practice for less than 10 years, current military service, completing a fellowship and monthly

patient load. Figures 1-4 demonstrate the effects of time in practice, completing a fellowship, and working in an academic setting. Patient load was determined to be significant only when analyzing all ten questions with a coefficient of -0.03; so if a provider increases by 10 patients a month they would have a 0.3 point decrease in correct answers on the survey.

Those, whom completed a fellowship and work in a non academic setting, had higher scores. Time in practice and military service were also strong predictors for answering correctly. The most interesting issue is the strong interaction between them. When a model with interactions was used, the main effect was only for a subgroup, hence we evaluated the least square means to show the effects of those factors (see Table 5 and Figure 5).

Table 4: Multivariate analyses for Question 124 With major factors

Factors	Questions 1-2-4			Questions 1-10		
	Parameter	Standard	Pr > t	Parameter	Standard	Pr > t
	Estimate	Error		Estimate	Error	
Intercept	8.35	6.52	0.20	40.40	14.39	0.01
Female	-0.25	2.72	0.93	0.80	6.02	0.89
Practicing Orthopedics	2.26	3.58	0.53	13.59	7.92	0.09
Practice >10 years	-4.47	1.80	0.01	-9.08	3.97	0.02
Completed Fellowship	7.46	2.02	0.00	20.80	4.47	<.0001
No Military Service	3.45	2.32	0.14	10.55	5.12	0.04
Practice > 10 years and in Military service*	-6.69	3.47	0.06	-14.72	7.66	0.06
Non Academic Facility	3.45	1.75	0.05	5.78	3.86	0.14
Patient Count Increasing by 10	-0.0012	0.01	0.84	-0.0307	0.01	0.03
Number of Journals Read**	0.59	1.04	0.57	2.26	2.29	0.33
Number of Information Sources**	-0.21	0.89	0.81	-3.72	1.96	0.06
Patient Age	0.07	0.13	0.61	0.14	0.29	0.62
OTA Membership	2.23	1.61	0.17	1.92	3.55	0.59
Attend Professional Meeting	0.94	1.61	0.56	0.93	3.56	0.79
Level 1 Trauma Center	1.37	2.12	0.52	5.93	4.68	0.21
Level 2 Trauma Center	-2.29	1.94	0.24	-6.41	4.28	0.14
Level 3 Trauma Center	-3.88	3.05	0.21	-3.44	6.74	0.61
Level 4 Trauma Center	0	.	.	0.00	.	.

* This is the interaction between service year and if in military

** Increasing by 1 information source or journal

Table 5 (or Figures 5) shows that those who have been in practice for longer than 10 years, and were in military had the less knowledge on questions 1, 2 and 4, and on all 10 questions. However, if they had been in practice for less than 10 years providers who were in military had better knowledge than providers who were not. This difference was not significant. In addition providers with less than 10 years of service answered more consistently regardless of factors, but

for those, who had been in practice longer the performance and the knowledge varied across the factors.

Table 5: The Adjusted least-square mean of the scores by Years in Practice and Military Status

Years in Practice	If Military	Answers for Questions 1,2 and 4			Answers for Questions 1-10		
		LSMean	Stdev	P Value	LSMean	Stderv	P Value
<=10 years	No	11.34	3.09	0.08	38.92	6.74	0.00
	Yes	13.48	2.35	0.00	42.13	5.13	0.00
>10 years	No	10.33	2.71	0.09	32.64	5.92	0.03
	Yes	6.42	2.56	Reference	21.69	5.60	Reference

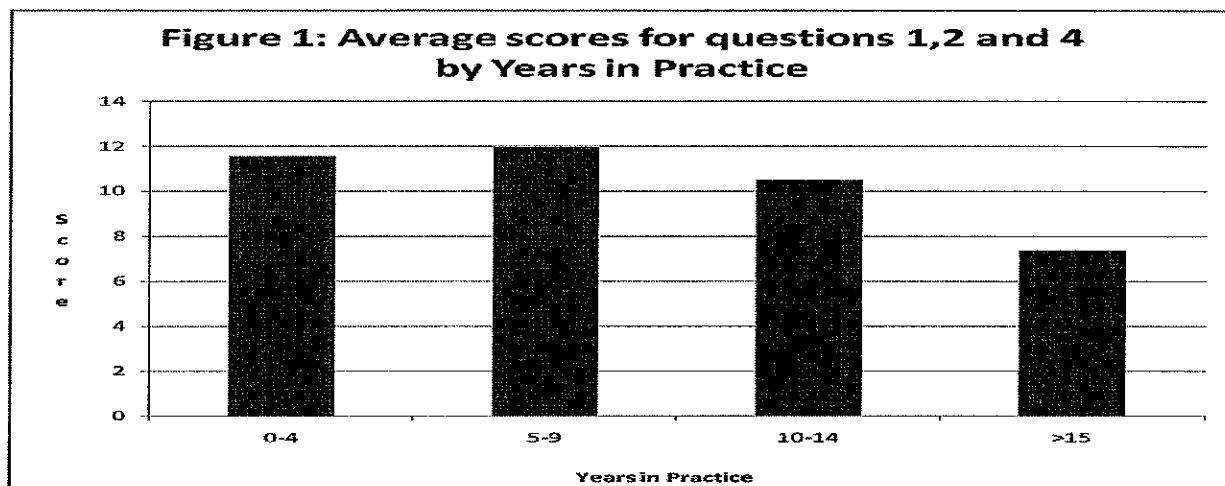


Figure 1 shows that for those who had been in practice for less than 10 years the adjusted averages questions 1, 2, and 4 increased a little in the initial years in practice; then the scores begin to decrease after 10 years in practice.

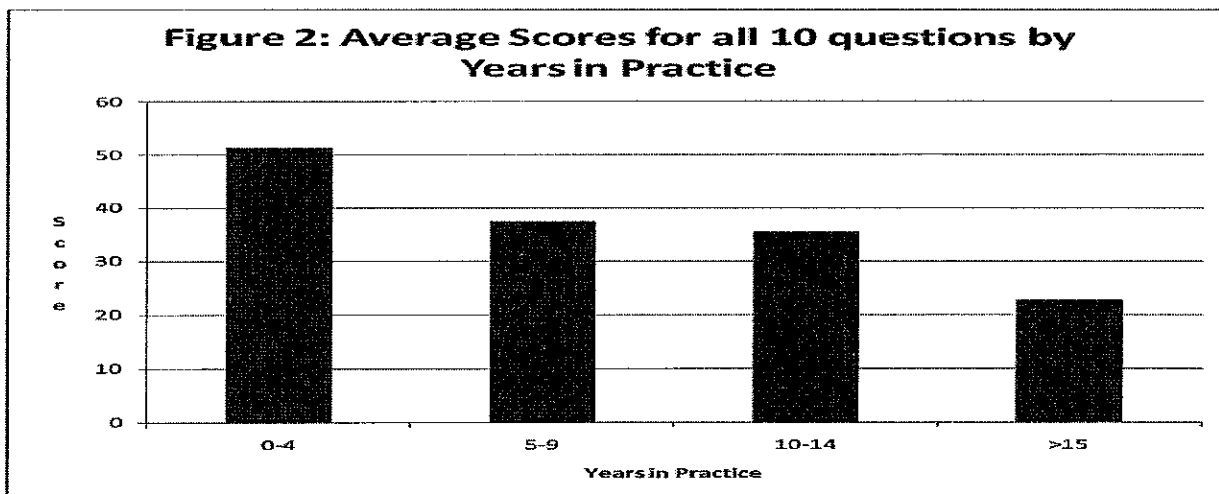
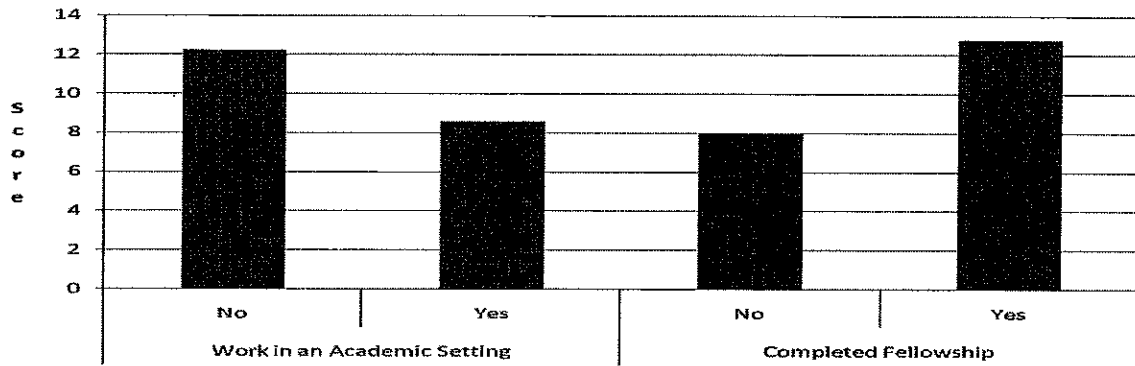


Figure 2 demonstrates that as practice time increased scores declined on the adjusted average for the 10 questions.

Figure 3: Average Scores for Questions 1,2 and 4 by working in an Academic Facility and Completing a Fellowship



Figures 3 and 4 shows for both questions 1, 2, and 4 and all 10 questions that those practicing in a non academic setting and who had completed a fellowship had higher scores.

Figure 4: Average Total Scores for all 10 Questions by Academic Status or Completing a Fellowship

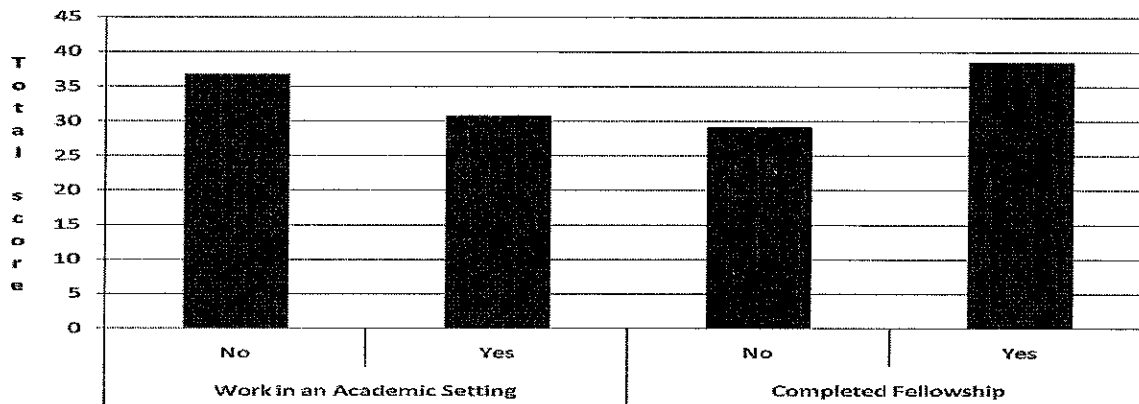
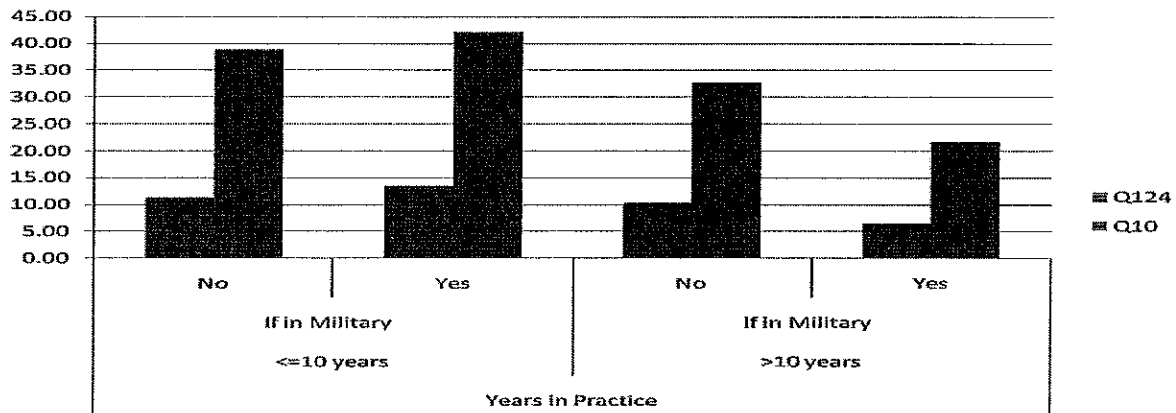


Figure 5: The Average scores for Questions 1,2 and 4 and all 10 Questions by Time in Practice and Military Status



KEY RESEARCH ACCOMPLISHMENTS:

- Survey Development Completed
- Survey Collection Completed
- Data Analysis Completed
- Presentation at professional meeting August 2010
- Paper prepared for submission to a peer reviewed journal – currently undergoing author review.

REPORTABLE OUTCOMES: Provide a list of reportable outcomes that have resulted from this research to include:

Initial findings presented in poster presentation Force Health Protection Conference August 2010.

Manuscript being prepared for presentation to peer reviewed journal winter 2010.

CONCLUSION:

Orthopedic providers who have been in practice less than 10 years with military service are optimally bridging research into military relevant general orthopedic trauma. Risk factors for not practicing evidence based medicine include: being in practice for longer than ten years, not having any military service, practices with very high patient loads, not work in a trauma center, not completing a fellowship and surgeons working in an academic setting. The data was unable to distinguish between fellowship training for trauma only vs. other fellowship training. It was also unable to distinguish type of patient loads with density of patient loads. The risk factor of academic practice may represent a surgeon whose focus is in a different area of orthopedic surgery or whose responsibilities are predominately administrative. Focused education, rotations, or mentorship with deployments may be beneficial to consider in orthopedic surgeons with risk factors for non evidence based practice.

REFERENCES: List all references pertinent to the report using a standard journal format (i.e. format used in *Science*, *Military Medicine*, etc.).

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