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Longitudinal Assessment of Self-Reported Recent Back Pain and Combat Deployment in the Millennium Cohort Study

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Study Design. A prospective cohort study.

Objective. Activities performed during military operations vary in complexity and physical demand. The risk for mental illness following military combat deployment has been well documented. However, information regarding the possible contribution of back pain to decreased mental and functional health is scarce. To our knowledge, this is the first study to prospectively assess deployment and self-reported recent back pain in a population-based U.S. military cohort.

Summary of Background Data. The study consisted of Millennium Cohort participants who were followed for the development of back pain for an average of 3.9 years.

Methods. Descriptive statistics and longitudinal analyses were used to assess the temporal relationship of deployment with self-reported recent back pain at follow-up (N = 53,933).

Results. Recent back pain was self-reported by 8379 (15.5%) participants at follow-up. After adjusting for covariates, deployers with combat experiences had higher odds [odds ratio (OR) = 1.38, 95% confidence interval (95% CI): 1.28–1.50] of recent back pain than noncombat deployers. There was no association between recent back pain and nondeployers compared with noncombat deployers. Service support/supply handlers were at an increased odds of reporting recent back pain (OR = 1.11, 95% CI: 1.02–1.21) than functional support/administration occupations. Occupations associated with a physically demanding work environment had a higher risk of back pain.

Conclusion. Deployers with combat experiences were more likely to report back pain postdeployment. This well-defined group of military personnel may potentially benefit from integrated prevention efforts.

Key words: back pain, chronic pain, cohort studies, combat disorder, mental health, military personnel, occupational health, outcome assessment, statistics, survey methodology.

Level of Evidence: 3

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Back pain is a common medical condition resulting in more than $85 billion in U.S. costs annually and remains an activity limiter for approximately half of the adults with low back pain during the last 3 months.[1,2] Certain occupation-related activities, such as heavy physical strain, frequent lifting, postural stress, and whole-body vibration, have been associated with back pain, although inconsistent findings exist.[3,4] In addition, psychological risk factors, such as anxiety, depression, distress, and catastrophizing, have been associated with back pain.[5–7] Military personnel in particular may be at risk for back pain given the physical and mental demands of this occupation.

Compared with the civilian workforce, military deployment represents a unique experience, with potentially longer work hours and more strenuous and repetitive tasks.[8,9] Activities during deployment that may increase the risk for back pain include driving specialized vehicles, long and frequent flying hours, wearing of body armor, or carrying heavy loads.[10–13] Our study uses prospective data

to assess self-reported recent back pain following deployment and combat experience in support of the operations in Iraq and Afghanistan.

MATERIALS AND METHODS

Population and Data Sources

The Millennium Cohort Study commenced in 2001 before Operation Iraqi Freedom to prospectively assess health outcomes associated with U.S. military service. Of the contacted invited sample, 77,047 (36.0%) consented and were enrolled. Follow-up surveys occurred ~every 3 years, with 55,021 (71.4%) completing the first follow-up and 54,790 (71.1%) completing the second follow-up questionnaire. Of the 63,372 eligible participants who completed a baseline and at least one follow-up, the following exclusions were applied: no response to back pain question at baseline (n = 791) and at least one covariate missing at all three time points (n = 1879), leaving 60,702 for this analysis. Self-reported recent back pain was assessed at follow-up (~3.9 yrs after baseline) among those who did not report recent back pain at baseline (N = 53,933). Repeated recent back pain at follow-up (~3.3 years after baseline) was also examined among those who reported recent back pain at baseline (N = 6769).

Outcome: Recent Back Pain

Recent back pain was assessed by the survey question: "During the last four weeks, how much have you been bothered by any of the following problems?" "Back pain" was one of 13 possible selections. Response options included: "not bothered," "bothered a little," and "bothered a lot." Participants endorsing "bothered a lot" were considered to have recent back pain, while those endorsing the remaining were not. Repeated recent back pain at follow-up was assessed among those reporting recent back pain at baseline. Self-reported recent back pain and repeated recent back pain are heretofore referred to as back pain and repeated back pain, respectively.

Primary Exposure Variables: Deployment and Occupation

Status on deployment in support of the operations in Iraq and Afghanistan, obtained from the Defense Manpower Data Center (DMDC), was allowed to vary at each time point. Participants were considered deployed if they had an in-theater date of 4 weeks before their survey response date. The deployment variable had three levels: nondeployed, noncombat deployed, and combat deployed. Combat deployed was defined as self-report of being personally exposed to at least one of the following: witnessing a person's death due to war, disaster, or tragic event; witnessing instances of physical abuse (*e.g.*, torture, beating, rage); dead and/or decomposing bodies; maimed soldiers or civilians; and prisoners of war or refugees. Cumulative days of deployment were categorized as 0, 1 to 270, and >270 days.

Occupation

Occupation, obtained from DMDC, was allowed to vary at each time point and grouped into 10 broad categories: functional support/administration, combat specialists, electrical repair, communications/intelligence, health-care specialists, other technical, electrical/mechanical, craft workers, service support/supply hander, and students/other.

Other Covariates

Covariates derived from the questionnaires included marital, behavioral, mental, and physical variables. Military service variables were from DMDC. Covariates allowed to vary at each time point included separation from service, behavioral, mental, and physical variables. If missing, the most recent available time point was used.

Prior deployment included operations in support of Bosnia, Kosovo, Southwest Asia, the first Gulf War, and Iraq and Afghanistan before baseline survey. Body mass index was calculated from self-reported height and weight.[14] Alcohol dependence was based on any positive response to CAGE (Cutting down, Annoyance by criticism, Guilty feeling, Eye-opener) questions.[15] Smoking status was ascertained by self-report of having ever smoked 100 cigarettes in a lifetime (never = no), cigarette use in the past year (current = yes), and quitting success (former = yes). Panic/anxiety and depression symptoms were assessed through the Patient Health Questionnaire[16,17] and PTSD symptoms using the PTSD Checklist—Civilian Version[18] based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.[19] Mental and physical component summary scores were derived from the Medical Outcomes Study Short Form, a 36-item questionnaire for Veterans.[20] Usual daily activities, such as doing heavy work or carrying heavy loads, were based on the National Health and Nutrition Examination Survey.[21]

Statistical Analysis

Descriptive and univariate analyses compared characteristics among back pain groups. Multivariable regression models predicting recent onset and recurrent back pain were fit by including independent variables summarized in Table 1 in these models as covariates. A backward selection strategy was performed in order to arrive at the final models while accounting for potential confounding. The following variables were forced into the final model: deployment experience, occupation, and demographic characteristics. Remaining variables were retained in the model if removal of the variable from the model resulted in a change in the odds ratio (OR) associated with deployment by 10% or more, as has been previously recommended as a threshold for the presence of confounding.[22] Significant ($P < 0.05$) and relevant variables based on the literature were included in the reduced final models. Both models were adjusted for the amount of time between baseline and follow-up assessments. The back pain model included deployment experience, occupation, sex, birth year, education, race/ethnicity, marital status, body mass index, service component, military paygrade, service branch, prior

TABLE 1. Characteristics of Millennium Cohort Participants who Recently Reported Back Pain, 2001–2008

Characteristics N = 60,702	Recent Back Pain‡				Repeated Back Pain§			
	No n = 45,554 n (%)		Yes n = 8379 n (%)		No n = 2818 n (%)+		Yes n = 3951 n (%)	
Main exposures of interest								
Deployment experience*								
Nondeployed	31,814	(69.8)	5621	(67.1)	2099	(74.5)	2986	(75.6)
Deployed without combat	7390	(16.2)	1171	(14.0)	348	(12.3)	399	(10.1)
Deployed with combat	6350	(13.9)	1587	(18.9)	371	(13.2)	566	(14.3)
Occupation*								
Functional support/admin	8836	(19.4)	1792	(21.4)	623	(22.1)	923	(23.4)
Combat specialists	9486	(20.8)	1628	(19.4)	525	(18.6)	741	(18.8)
Electrical repair	4353	(9.6)	660	(7.9)	230	(8.2)	288	(7.3)
Communications/intelligence	3235	(7.1)	609	(7.3)	213	(7.6)	279	(7.1)
Health-care specialists	5125	(11.2)	848	(10.1)	283	(10.0)	372	(9.4)
Other technical	1153	(2.5)	203	(2.4)	77	(2.7)	108	(2.7)
Electrical/mechanical	6427	(14.1)	1187	(14.2)	444	(15.8)	598	(15.1)
Craft workers	1361	(3.0)	261	(3.1)	88	(3.1)	120	(3.0)
Service support/supply handlers	3682	(8.1)	827	(9.9)	232	(8.2)	403	(10.2)
Students/prisoners/other	1893	(4.2)	362	(4.3)	103	(3.7)	117	(3.0)
Demographics								
Sex*								
Male	34,171	(75.0)	5999	(71.6)	1894	(67.2)	2669	(67.6)
Female	11,383	(25.0)	2380	(28.4)	924	(32.8)	1282	(32.5)
Birth year*								
Before 1960	10,930	(24.0)	1834	(21.9)	608	(21.6)	983	(24.9)
1960–1969	17,931	(39.4)	3617	(43.2)	1032	(36.6)	1684	(42.6)
1970–1979	14,773	(32.4)	2532	(30.2)	1008	(35.8)	1120	(28.4)
1980 or later	1920	(4.2)	396	(4.7)	170	(6.0)	164	(4.2)
Education*								
Some college or less	31,390	(68.9)	6499	(77.6)	2274	(80.7)	3216	(81.4)
Bachelor's degree or higher	14,164	(31.1)	1880	(22.4)	544	(19.3)	735	(18.6)
Race/ethnicity*								
White non-Hispanic	32,577	(71.5)	5767	(68.8)	1955	(69.4)	2580	(65.3)
Black non-Hispanic	5433	(11.9)	1112	(13.3)	391	(13.9)	628	(15.9)
Other	7544	(16.6)	1500	(17.9)	472	(16.8)	743	(18.8)
Marital status*								
Never married	8922	(19.6)	1499	(17.9)	503	(17.9)	571	(14.5)
Married	30,892	(67.8)	5565	(66.4)	1953	(69.3)	2714	(68.7)
Divorced/separated/widowed	5740	(12.6)	1315	(15.7)	362	(12.9)	666	(16.9)
Body mass index*								
Underweight/normal	17,412	(38.2)	2930	(35.0)	1023	(36.3)	1304	(33.0)
Overweight	23,529	(51.7)	4487	(53.6)	1413	(50.1)	2048	(51.8)
Obese	4613	(10.1)	962	(11.5)	382	(13.6)	599	(15.2)
Military								
Service component*								
Reserve/National Guard	20,810	(45.7)	3285	(39.2)	1001	(35.5)	1316	(33.3)
Active duty	24,744	(54.3)	5094	(60.8)	1817	(64.5)	2635	(66.7)
Military paygrade*								
Enlisted	32,693	(71.8)	6665	(79.5)	2337	(82.9)	3320	(84.0)
Officer	12,861	(28.2)	1714	(20.5)	481	(17.1)	631	(16.0)
Service branch*								
Army	20,060	(44.0)	4607	(55.0)	1426	(50.6)	2379	(60.0)

TABLE 1 (*Continued*)

Characteristics N = 60,702	Recent Back Pain‡				Repeated Back Pain§			
	No n = 45,554 n (%)		Yes n = 8379 n (%)		No n = 2818 n (%)+		Yes n = 3951 n (%)	
Air Force	14,642	(32.1)	2122	(25.3)	677	(24.0)	801	(20.3)
Navy/Coast Guard	8791	(19.3)	1285	(15.3)	559	(19.8)	578	(14.6)
Marine Corps	2061	(4.5)	365	(4.4)	156	(5.5)	202	(5.1)
Prior deployment experience*,‖								
No	27,390	(60.1)	4790	(57.2)	1700	(60.3)	2252	(57.0)
Yes	18,164	(39.9)	3589	(42.8)	1118	(39.7)	1699	(43.0)
Separated from service								
No	43,285	(95.0)	7977	(95.2)	2577	(91.5)	3513	(88.9)
Yes	2269	(5.0)	402	(4.8)	241	(8.6)	438	(11.1)
Behavioral								
Alcohol-related problems*								
No	37,398	(82.4)	6624	(79.5)	2198	(78.4)	3093	(78.6)
Yes	8017	(17.7)	1712	(20.5)	605	(21.6)	840	(21.4)
Smoking status*								
Never smoker	27,491	(60.7)	4379	(52.6)	1427	(51.1)	1932	(49.3)
Former smoker	10,901	(24.1)	2261	(27.2)	788	(28.2)	1144	(29.2)
Current smoker	6884	(15.2)	1678	(20.2)	578	(20.7)	844	(21.5)
Mental								
Panic and/or anxiety*								
No	44,867	(98.6)	8070	(96.5)	2613	(92.8)	3516	(89.1)
Yes	634	(1.4)	294	(3.5)	203	(7.2)	429	(10.9)
Depression*								
No	44,752	(98.3)	8043	(96.2)	2601	(92.5)	3494	(88.7)
Yes	781	(1.7)	323	(3.9)	210	(7.5)	446	(11.3)
Posttraumatic stress disorder*								
No	44,008	(97.6)	7801	(94.3)	2565	(92.0)	3311	(85.2)
Yes	1070	(2.4)	474	(5.7)	224	(8.0)	576	(14.8)
Mental component summary*								
>85%	6920	(15.3)	1198	(14.4)	472	(16.9)	630	(16.1)
15–85%	33,192	(73.4)	5595	(67.3)	1656	(59.3)	2139	(54.7)
<15%	5128	(11.3)	1518	(18.3)	666	(23.8)	1145	(29.3)
Physical								
Physical component summary*								
>85%	7948	(17.6)	890	(10.7)	93	(3.3)	67	(1.7)
15–85%	33,451	(73.9)	5932	(71.4)	1567	(56.1)	1638	(41.9)
<15%	3841	(8.5)	1489	(17.9)	1134	(40.6)	2209	(56.4)
Usual daily activities*								
Sitting	12,288	(31.2)	2338	(31.6)	673	(29.5)	1126	(32.1)
Standing	17,008	(43.2)	3005	(40.7)	967	(42.4)	1489	(42.5)
Light loads and stairs	8273	(21.0)	1623	(22.0)	500	(21.9)	674	(19.2)
Heavy work or loads	1846	(4.7)	424	(5.7)	142	(6.2)	216	(6.2)

*$P < 0.05$ for recently reported back pain at follow-up among those who did not recently report back pain at baseline.

†$P < 0.05$ for recently reported back pain at follow-up among those who recently reported back pain at baseline.

‡Reported being bothered a lot by recent back pain in last four weeks at follow-up, but not at baseline.

§Reported being bothered a lot by recent back pain in last four weeks at follow-up, as well as at baseline.

‖Deployment experience prior to baseline, including deployment to Bosnia, Kosovo, Southwest Asia, and/or operations in support of Iraq and Afghanistan.

deployment experience, separated from service, smoking status, panic and/or anxiety, posttraumatic stress disorder, mental component summary, physical component summary, and usual daily activities. The repeated back pain model included deployment experience, occupation, sex, birth year, education, race/ethnicity, marital status, body mass index, service component, military paygrade, service branch, alcohol-related problems, smoking status,

posttraumatic stress disorder, mental component summary, physical component summary, and usual daily activities.

Regression models using Generalized Estimating Equations assessed the temporal relationship of deployment and occupation with back pain over multiple time intervals. Time-varying covariates were assessed before the outcome, except for usual daily activities (first available 2004–2006 follow-up), to determine directionality of associations. Multicollinearity was deemed likely if variance inflation factor was >4. SAS software, version 9.3, was used for all analyses.[23]

RESULTS

Back pain was reported in 8379 (15.5%) participants, while repeated back pain was reported in 3951 (58.4%). Nearly 30% of the study population deployed at least once after baseline survey, with 14% of deployers reporting combat exposure. Baseline characteristics for back pain and repeated back pain groups are summarized in Table 1.

Table 2 presents two separate models for back pain and repeated back pain. After adjusting for covariates, combat deployers had a 38% [95% confidence interval (95% CI): 1.28–1.50] higher odds of reporting back pain than noncombat deployers. No association was found between nondeployers and back pain (OR = 1.03, 95% CI: 0.96–1.10] *versus* noncombat deployers. Compared with functional support/administration occupations, the occupation with higher odds of back pain was service support/supply handler (OR = 1.11, 95% CI: 1.02–1.21), while occupations with significantly lower odds of back pain were electrical repair, communications/intelligence, health-care specialists, and other technical occupations.

In the multivariate model for factors associated with repeated back pain at follow-up, after adjusting for covariates, combat deployers were at an increased odds compared with noncombat deployers (OR = 1.27, 95% CI: 1.08–1.50). However, unlike the main back pain model, a positive association was found between nondeployers and repeated back pain (OR = 1.18, 95% CI: 1.03–1.35) *versus* noncombat deployers. Compared with functional support/administration occupations, no other occupation was significantly associated with repeated back pain.

In a separate model investigating length of deployment instead of combat experiences, after adjusting for covariates, participants with an increased length of deployments had higher odds of back pain than nondeployers, with adjusted odds of 1.08 (95% CI: 1.02–1.15) for 1 to 270 days and 1.30 (95% CI: 1.23–1.40) for >270 days. No association was observed between repeated back pain and cumulative days deployed 1 to 270 days (OR = 0.94, 95% CI: 0.84–1.05) or >270 days (OR = 1.05, 95% CI: 0.91–1.20) compared with nondeployers.

DISCUSSION

Combat deployers had a 38% higher odds of reporting back pain at follow-up and 27% higher odds of repeated back pain, than noncombat deployers. Those with longer deployments had higher odds of back pain than nondeployers. Similar to previous studies that assessed a variety of physical health outcomes,[24–27] combat experience appears to be the primary risk factor rather than deployment itself, possibly attributed to higher physical demands and psychological load from life-threatening combat situations. Deployment length may impact back pain risk, possibly due to sustained operations and prolonged wearing of protective armor. Nondeployers had 18% higher odds of repeated back pain than noncombat deployers. Chronic back pain may increase the likelihood of being disqualified for deployment or can be a contributing factor to other disqualifying comorbidities. Medical exemptions from deployment are determined at the individual level and are fluid, with multiple reasons that may fluctuate at any given time. These data are challenging to capture at the larger population-based level and further substudies may be warranted.

In military personnel, back pain is among the most frequent reasons for medical visits and lost duty time and has been associated with pain-related disability.[28,29] Further, back pain potentially reduces mental and physical health[5,30,31] and may result in high medical costs and dependence on pain medication(s).[32,33] The importance of addressing back pain to potentially mitigate high costs associated with opioid use cannot be overstated.[32,33] The overall rate of lower back pain related medical encounters in active-duty U.S. Armed Forces was 74.1 visits per 1000 person-years, with recurrence within 1 year at 23%.[29] In our study, 16% of service members self-reported back pain, while 58% had repeated back pain, highlighting the substantial burden and need for further studies.

In this study, service support/supply handlers had an increased odds of back pain compared with functional support/administrative occupations. Previous research also found higher odds of low back pain among U.S. Marines service/supply *versus* administrative/other occupations.[13] We identified reduced odds of back pain in electrical/mechanical *versus* functional support/administrative occupations, inconsistent with previous research.[13]

Potential risk factors for back pain are numerous and may include genetics, age, sex, enlisted rank, obesity, smoking, psychosocial factors (attitude toward employer/pay), high workload and psychological load (high demand/low control), heavy or static work with lifting or vibration, history of back pain, job dissatisfaction, and wearing of body armor.[3,9,34,35] Similar to previous studies, we found that back pain is associated with age (born before 1960 *vs.* 1970–1979), being female, being enlisted, being overweight or obese, being former or current smokers, and engaging in heavy *versus* light work. We were unable to assess genetics, job dissatisfaction, wearing of body armor, and history of back pain though previous back pain was incorporated in the repeated back pain model. Active-duty members and Army personnel had increased odds of back pain; these subgroups may be more likely to perform physically demanding activities, such as repetitive motions or carrying heavy loads during deployments, warranting targeted prevention efforts.

TABLE 2. Adjusted Odds of Recently Reported Back Pain Among Millennium Cohort Participants, 2001–2008

Covariates	Model 1: Recent Back Pain*,‡ (N = 53,933)		Model 2: Repeated Back Pain†,‡ (N = 6769)	
	OR	95% CI	OR	95% CI
Main exposures of interest				
Deployment experience				
Nondeployed	1.03	0.96–1.10	**1.18**	**1.03–1.35**
Deployed without combat	1.00		1.00	
Deployed with combat	**1.38**	**1.28–1.50**	**1.27**	**1.08–1.50**
Occupation				
Functional support/admin	1.00		1.00	
Combat specialists	1.00	0.93–1.08	0.97	0.84–1.11
Electrical repair	**0.87**	**0.79–0.96**	0.99	0.83–1.18
Communications/intelligence	**0.90**	**0.82–0.99**	0.92	0.77–1.09
Health-care specialists	**0.91**	**0.83–0.99**	0.85	0.73–1.00
Other technical	**0.79**	**0.68–0.93**	0.94	0.73–1.20
Electrical/mechanical	1.00	0.92–1.08	0.95	0.82–1.09
Craft workers	0.98	0.85–1.13	0.97	0.75–1.26
Service support/supply handlers	**1.11**	**1.02–1.21**	1.08	0.92–1.26
Students/prisoners/other	1.09	0.95–1.24	1.04	0.82–1.32
Demographics				
Sex				
Male	1.00		1.00	
Female	**1.29**	**1.21–1.37**	1.02	0.92–1.14
Birth year				
Before 1960	1.00		1.00	
1960–1969	1.02	0.96–1.09	0.99	0.88–1.11
1970–1979	**0.80**	**0.74–0.86**	**0.66**	**0.58–0.76**
1980 or later	0.90	0.78–1.03	**0.60**	**0.47–0.76**
Education				
Some college or less	1.00		1.00	
Bachelor's degree or higher	**0.77**	**0.71–0.84**	0.96	0.82–1.12
Race/ethnicity				
Non-Hispanic white	1.00		1.00	
Non-Hispanic black	0.97	0.90–1.04	1.05	0.93–1.21
Other	**1.09**	**1.02–1.16**	1.05	0.94–1.19
Marital status				
Never married	1.00		1.00	
Married	1.05	0.98–1.13	0.98	0.86–1.12
Divorced/separated/widow	**1.17**	**1.07–1.28**	1.17	0.99–1.37
Body mass index				
Underweight/normal	1.00		1.00	
Overweight	**1.12**	**1.07–1.19**	1.01	0.92–1.11
Obese	**1.17**	**1.09–1.26**	1.00	0.89–1.14
Military				
Service component				
Reserve/National Guard	1.00		1.00	
Active duty	**1.53**	**1.44–1.62**	**1.38**	**1.25–1.53**
Military paygrade				
Enlisted	1.00		1.00	
Officer	**0.78**	**0.71–0.85**	**0.82**	**0.70–0.97**
Service branch				
Army	1.00		1.00	
Air Force	**0.65**	**0.61–0.69**	**0.76**	**0.67–0.85**

TABLE 2 (*Continued*)

Covariates	Model 1: Recent Back Pain*,‡ (N = 53,933)		Model 2: Repeated Back Pain†,‡ (N = 6769)	
	OR	95% CI	OR	95% CI
Navy/Coast Guard	**0.63**	**0.58–0.67**	**0.64**	**0.56–0.73**
Marine Corps	**0.78**	**0.69–0.88**	0.88	0.73–1.08
Prior deployment experience§				
No	1.00			
Yes	**1.07**	**1.01–1.13**		
Separated from service				
No	1.00			
Yes	**0.81**	**0.75–0.88**		
Behavioral				
Alcohol-related problems				
No			1.00	
Yes			**0.90**	**0.81–0.99**
Smoking status				
Never smokers	1.00		1.00	
Former smokers	**1.20**	**1.14–1.27**	1.05	0.96–1.16
Current smokers	**1.26**	**1.18–1.35**	1.03	0.92–1.15
Mental				
Panic and/or anxiety				
No	1.00			
Yes	**1.17**	**1.02–1.34**		
Posttraumatic stress disorder‖				
No	1.00		1.00	
Yes	**1.32**	**1.17–1.48**	**1.42**	**1.24–1.64**
Mental component summary				
>85%	**0.88**	**0.83–0.95**	**0.82**	**0.74–0.93**
15–85%	1.00		1.00	
<15%	**1.53**	**1.43–1.65**	**1.17**	**1.05–1.29**
Physical				
Physical component summary				
>85%	**0.57**	**0.52–0.61**	**0.68**	**0.55–0.85**
15–85%	1.00		1.00	
<15%	**1.96**	**1.84–2.09**	**1.82**	**1.68–1.98**
Usual daily activities				
Sitting	**1.14**	**1.07–1.22**	**1.25**	**1.12–1.40**
Standing	1.01	0.95–1.07	**1.19**	**1.08–1.33**
Light loads and stairs	1.00		1.00	
Heavy work or loads	**1.12**	**1.01–1.25**	**1.29**	**1.07–1.57**

Bolded numbers indicate statistical significance.

**Reported being bothered a lot by recent back pain in last four weeks at follow-up, but not at baseline. Included deployment experience, occupation, sex, birth year, education, race/ethnicity, marital status, body mass index, service component, military paygrade, service branch, prior deployment experience, separated from service, smoking status, panic and/or anxiety, posttraumatic stress disorder, mental component summary, physical component summary, and usual daily activities.*

†Reported being bothered a lot by recent back pain in last four weeks at follow-up, as well as at baseline. Included deployment experience, occupation, sex, birth year, education, race/ethnicity, marital status, body mass index, service component, military paygrade, service branch, alcohol-related problems, smoking status, posttraumatic stress disorder, mental component summary, physical component summary, and usual daily activities.

‡Both models were adjusted for the amount of time between baseline and follow-up assessments.

§Deployment experience prior to baseline, including deployment to Bosnia, Kosovo, Southwest Asia, and/or operations in support of Iraq and Afghanistan.

‖Screened positive for posttraumatic stress disorder sensitive criteria.

We also observed a weak association (OR = 1.17, 95% CI: 1.02–1.34) between back pain and positive screen for panic/anxiety disorder consistent with previous studies, although earlier studies differ by definitions of risk or prognostic factors, populations, and assessed outcomes (*e.g.*, incident low back pain, return to work status, persistent disabling low back pain).[36–39] A prospective study examining disabling pain after 12 months found anxiety to be an independent predictor (relative risk = 1.84, 95% CI: 1.05–3.25) of back pain in general practice patients,[6]

while depression, initially identified as a prognostic indicator, was not significant after adjusting for other covariates. Pre-pain psychopathology has been hypothesized to heighten vulnerability to developing chronic pain after acute injury based on a ''diathesis-stress'' model in which predisposing psychological characteristics are activated by stress.[40] In our study, both back pain and repeated back pain models confirmed positive association between back pain and PTSD symptoms, as well as lower mental component scores. Other studies have shown psychosocial and psychological factors, including depression, psychological distress, passive coping strategies, fear-avoidance beliefs, and catastrophizing, to be associated with persistent back pain.[7,41–46] A multifactorial relationship between mental health conditions and back pain is supported by these findings.

We observed an increase in odds of back pain in former and current smokers that is consistent with previous reports linking smoking and musculoskeletal disorders. Toxins contained in tobacco smoke may promote damage to vascular structures of discs and joints, as well as tissue damage and changes in neurological pain response.[47]

Limited physical functioning and daily activities have been reported among those with back pain.[3,28] We found lower physical component summary scores in participants with back pain and repeated back pain. Those who sat or engaged in heavy work had increased odds of back pain and repeated back pain than those doing light work. However, occupations requiring long periods of standing had increased odds of repeated back pain compared with light work. It is possible that individuals with back pain choose more sedentary work following injury. Nonsedentary work, without prolonged standing or heavy lifting, may provide activity needed to reduce repeated back pain.

Because this cohort study oversampled females, previously deployed, and U.S. Reserve/National Guard personnel at baseline, it may not be representative of all deployers or the general military population. However, previous reviews of Millennium Cohort baseline data suggested that this cohort is reasonably representative of military personnel in terms of demographic and health characteristics and has reliable self-reported health and exposure information.[48–51] The back pain sample is representative of the baseline enrolled sample as well as the invited sample with 74.5% male (compared with 73.2% in the baseline and 76.0% male in the invited).[8] Because of the intentional oversampling to ensure adequate power for statistical inferences, it is slightly lower than the U.S. military at 84.7% male.[8] Likewise, the top three occupations are combat specialists, functional support/admin, and electrical/mechanical in the back pain sample (20.6%, 19.7%, and 14.1%, respectively), representative of the baseline sample (20.0%, 20.0%, and 14.8% respectively), the invited sample (20.9%, 17.9%, and 16.2%, respectively), and the U.S. military population (21.9%, 17.6%, and 15.1%, respectively).[8] Misclassification of back pain may exist despite assessment of individuals at multiple time points, as comprehensive information on duration, frequency, and location of symptoms were not available. Pain estimates are often dependent upon self-report, as there is no definitive test or validated standard for these symptoms.[3,52] Although response bias may exist, investigation of the initial cohort responders found little cause for concern. The Cohort had greater than 70% follow-up, and potential loss-to-follow-up nonresponse bias was previously found to have limited to no effect on findings.[53]

Our study is the first to prospectively investigate back pain over multiple time points and focuses on deployment (differentiated by combat experience) and occupation as primary predictor variables. Other unique strengths include large sample size and inclusion of all Services and components of the military. Approximately 30% of the Cohort deployed in support of the operations in Iraq and Afghanistan from 2001 through 2006, resulting in robust numbers for investigating deployment-related concerns. Finally, self-reported health symptoms, such as back pain, may better frame health issues when there are no validated objective standards for outcome measures or potentially underreported medical visits.

Deployment with combat experiences was found to increase the odds of back pain and repeated back pain in a relatively young U.S. military and veteran population. This study frames the burden of back pain in the military, which may be associated with both reduced physical and mental functioning. Occupational associations identified may aid in targeted efforts to improve overall health and functioning long after leaving military service.

➢ Key Points

- ❑ To our knowledge, this is the first study to prospectively assess deployment and self-reported recent back pain in a population-based U.S. military cohort.
- ❑ Deployers with combat experiences had higher odds of recent back pain than noncombat deployers.
- ❑ There was no association between recent back pain and nondeployers compared with noncombat deployers.

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14. ABSTRACT

STUDY DESIGN: A prospective cohort study. OBJECTIVE: Activities performed during military operations vary in complexity and physical demand. The risk for mental illness following military combat deployment has been well documented. However, information regarding the possible contribution of back pain to decreased mental and functional health is scarce. To our knowledge, this is the first study to prospectively assess deployment and self-reported recent back pain in a population-based U.S. military cohort. SUMMARY OF BACKGROUND DATA: The study consisted of Millennium Cohort participants who were followed for the development of back pain for an average of 3.9 years. METHODS: Descriptive statistics and longitudinal analyses were used to assess the temporal relationship of deployment with self-reported recent back pain at follow-up (N=53,933). RESULTS: Recent back pain was self-reported by 8379 (15.5%) participants at follow-up. After adjusting for covariates, deployers with combat experiences had higher odds [odds ratio (OR)=1.38, 95% confidence interval (95% CI): 1.28-1.50] of recent back pain than noncombat deployers. There was no association between recent back pain and nondeployers compared with noncombat deployers. Service support/supply handlers were at an increased odds of reporting recent back pain (OR=1.11, 95% CI: 1.02-1.21) than functional support/administration occupations. Occupations associated with a physically demanding work environment had a higher risk of back pain. CONCLUSION: Deployers with combat experiences were more likely to report back pain postdeployment. This well-defined group of military personnel may potentially benefit from integrated prevention efforts.

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back pain, deployment, military personnel, occupations

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