The Journal of Arthroplasty xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Return to Work and Functional Outcomes Following Primary Total Knee Arthroplasty in U.S. Military Servicemembers

Philip J. Belmont Jr., MD [a], Ken Heida, MD [a], James A. Keeney, MD [b], William Hamilton, MD [c], Rob Burks, PhD [d], Brian R. Waterman, MD [a]

[a] Department of Orthopaedic Surgery Rehabilitation, William Beaumont Army Medical Center, El Paso, Texas
[b] Department of Orthopaedic Surgery, Washington University School of Medicine, St. Louis, Missouri
[c] Anderson Orthopaedic Clinic, Alexandria, Virginia
[d] Naval Postgraduate School, Monterrey, California

ARTICLE INFO

Article history:
Received 5 November 2014
Accepted 23 January 2015
Available online xxxx

Keywords:
total knee arthroplasty
work
military
functional outcome
physical activity

ABSTRACT

This investigation sought to determine occupational outcomes after total knee arthroplasty (TKA) in a high-demand cohort. A total of 159 military servicemembers underwent 181 primary TKAs with mean follow-up of 4.1 (range, 2.0–6.6) years. Approximately 18% of servicemembers underwent medical separation from the military due to TKA-related limitations, and age <45 years (OR = 2.36; 95% CI: 1.14, 4.90) was established as the significant risk factor. Twenty servicemembers (12.6%) performed postoperative combat deployments, with age <45 years (OR = 3.10; 95% CI: 1.29, 7.47) or combat arms designation (OR = 2.75; 95% CI: 1.13, 6.73) associated with higher rates of deployment. Nine revision TKAs (5.0%) were performed at an average of 1.9 years. Following TKA, 82% of servicemembers remained on active-duty or completed their military service. Level of Evidence: IV

Published by Elsevier Inc.

Total knee arthroplasty (TKA) restores function and quality of life in knee arthritis patients once conservative measures have failed [1–4]. TKA remains one of the most common major surgical procedures performed in the United States [5], and the demand for TKA has risen dramatically over the last two decades [6]. Current estimates have projected that the need for TKA will increase by more than 600% to approximately 3.5 million TKAs annually by 2030 [7]. Particularly among young, active and working cohorts, the demand for TKA has seen over a two-fold increase in patients under 50 years old between the years of 1997–2000 to 2005–2008 [8].

U.S. Army servicemembers maintain strict physical fitness requirements and are exposed to intense occupational demands. These servicemembers regularly participate in organized aerobic exercise training, weight training, and core military tasks, including the ability to march two miles with an additional 40 pounds of gear, to routinely wear individual body armor, to perform specialized field tasks, and to evade direct and indirect enemy fire [9]. Furthermore, all U.S. Army personnel must pass the semi-annual Army Physical Fitness Test, including a timed aerobic event (e.g.s two-mile run, 2.5 mile walk, 6.2 mile stationary bicycle, or 800-yard swim), and adhere to mandated weight and body fat composition standards. Additionally, active-duty military servicemembers regularly participate in rigorous military occupational specialty training and must demonstrate physical stamina in order to complete a combat deployment of up to 12 months. However, if a servicemember is unable to maintain these prerequisites, a medical discharge may be initiated when permanent duty limitations are not feasible.

Greater baseline levels of physical activity have previously been associated with an increased risk for developing knee osteoarthritis [10,11]. When compared with age-matched groups within the general population, U.S. active-duty military servicemembers have shown both disproportionately higher rates and earlier onset of osteoarthritis [12]. Additionally, a prospective longitudinal cohort study of over 4000 U.S. servicemembers revealed that knee arthritis and knee pain were among two of the ten most common unfitting conditions in both the musculoskeletal injury and control groups [13]. Further studies have identified that degenerative and post-traumatic osteoarthritis are among the most common disabling conditions among battle-injured servicemembers and contemporary military veterans [14,15].

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2015.01.044.

No external funding or support was received for this study.

The findings presented in this manuscript have not been previously presented.

Disclaimer: Some authors are employees of the U.S. federal government and the United States Army. The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or reflecting the views of the Department of Defense or United States government.

Reprint requests: Philip J. Belmont Jr., MD, Orthopaedic Surgery Service, William Beaumont Army Medical Center, 5005 North Piedras St., El Paso, TX 79920–5001.

http://dx.doi.org/10.1016/j.arth.2015.01.044
0883-5403/Published by Elsevier Inc.

While TKA has provided reliable outcomes in elderly patients, insufficient data exist for younger patient populations regarding their postoperative function and ultimate clinical and/or occupational outcomes. Both from an individual and a socioeconomic perspective, it is imperative to understand rates of return to work following TKA. Earlier studies evaluating the effect of primary TKA on work status have been limited by one or more of the following shortcomings [16]: (1) small patient cohorts (<120 patients in total) [17–19], (2) average age >60 years old [20,21], (3) low-demand patients [21], (4) study reported in the literature >10 years ago [22], (5) patient response rates of <70% [17,20,21,23] (6) less than a two-year minimum follow-up [17,18,21–24] and (7) study not designed to examine return to work [22].

The surgical outcomes of primary TKA within a high-demand, physically-active, military cohort have only been reported in small case series of 20 or fewer TKA patients [25,26]. The purpose of this study is to determine the medical separation rates of active duty military servicemembers and rates of combat deployment after a primary TKA during the military engagements in Iraq and Afghanistan.

Methods

Following institutional review board approval, the Military Health System Management Analysis and Reporting Tool (M2) database was queried for all U.S. Army active-duty servicemembers undergoing primary total knee arthroplasty (TKA) [Current Procedural Terminology (CPT) Code 27447] for end-stage arthritis between October 2007 and March 2012 performed by military surgeons at civilian or military hospitals. Exclusion criteria were applied to individuals with less than two years clinical follow-up, bilateral TKAs which are infrequently performed and cases of miscoding.

The U.S. Department of Defense electronic health record, Armed Forces Health Longitudinal Application (version 3.3), was extensively reviewed for each servicemember previously identified in the M2 database to confirm accuracy of CPT coding and the occurrence of a primary TKA within the study period. Additionally, demographic information was extracted, including sex, age, branch of military service, military occupational specialty, unilateral versus staged bilateral TKA, and history of combat deployment (Table 1). Military occupational specialty designations were categorized as either combat arms or combat support. Combat arms military occupational specialty denotes military service branches including infantry, armor, engineers, artillery, air defense artillery, and aviation, in which servicemembers conduct direct combat operations and have significantly greater functional demands when compared to those serving in combat support or combat service support roles. Additionally, the Pentagon Defense Manpower Data Center database was cross-referenced to determine the presence of both preoperative and postoperative combat deployments.

The primary outcome was the current military status of the servicemember two years or more following TKA. Specifically, servicemembers were categorized as active-duty with combat deployment, active-duty without combat deployment, no longer with the service due to retirement or expiration of term of service, or having been classified with knee-related medical separation. Standards for medical fitness are delineated within Army Regulation 40–501 (Headquarters, Department of the Army, Washington, D.C.) and encompass the functional abilities required of all Army servicemembers for deployment. Accordingly, any physical duty limitation is recorded on a Physical Profile (DA 3349) within the e-Profile electronic profiling system (version 3.17, Medical Operational Data System, Falls Church, VA), and this information is integrated into the electronic medical record and the Pentagon Defense Manpower Data Center database. Every Army soldiers' ability to deploy is tracked by the Army's Medical Protection System.

Poisson regression analysis was used to determine the association between the independent patient demographic variables and the outcomes of a soldier either being medically separated or performing a combat deployment. Odds ratios (OR) and 95% confidence intervals (CI) were reported for the analyses. Significant independent predictor variables were determined to be those that maintained P-values <0.05 with OR and 95% CI exclusive of 1.0. Calculations were performed using SAS software, version 9.2 (SAS Institute, Cary, NC).

Table 1
Demographics of Active Duty Servicemembers Undergoing Primary Total Knee Arthroplasty.

Identifier	Total (%)
Sex	
Male	121 (76%)
Female	38 (24%)
Diagnosis	
Osteoarthritis	158 (99%)
Rheumatoid arthritis	1 (1%)
Deployment history	
Yes	111 (70%)
No	48 (30%)
Bilateral procedure	
Yes	22 (14%)
No	137 (86%)
Combat arms	
Yes	31 (19%)
No	128 (81%)
Mean age (SD) years	45.7 (6.9)

Results

There were a total of 181 primary total knee arthroplasty procedures, including 137 primary unilateral TKAs and 22 bilateral staged primary TKAs, identified among 159 active-duty U.S. Army servicemembers between October 2007 and April 2012. The average age of the patients in this study at the time of primary TKA was 45.7 (S.D. 6.9, range 24.4–61.3) years. The majority of patients were male (76%), ≥45 years old (72%), and combat support designation (81%) who had a primary unilateral TKA (86%) with a history of a previous combat deployment (70%) (Table 1). The average follow-up from time of surgery was 4.07 (S.D. 1.35; range, 2.0–6.6) years. The average time interval between primary total knee arthroplasties in the patients with bilateral staged primary TKAs was 7.0 (S.D. 6.6, range 3.3–27.5) months.

At minimum two-years postoperatively, the final occupational outcome of servicemembers undergoing a primary TKA was 18% who medically separated and 82% who either returned to active-duty or completed their remaining service commitment (Table 2). The average time for servicemembers undergoing a medical separation was 1.6 (S.D. 0.88, range 0.13–4.08) years from the initial primary TKA.

Multivariate analysis evaluated several demographic risk factors for a soldier undergoing medical separation from active-duty following a primary TKA. When compared with the ≥45 years age group, the <45 years age group had a significantly increased odds ratios for being medically separated (OR = 2.36; 95% CI: 1.14, 4.90) (Table 2). A servicemember's sex, military occupational specialty, isolated primary unilateral TKA, and previous history of combat deployment were not significant predictors for medical separation following primary TKA.

Poisson regression analysis also identified significant demographic variables associated with successful completion of a combat deployment following primary TKA (Table 3). When compared with the ≥45 years age group, the <45 years age group was a significant predictor for serving a postoperative combat deployment (OR = 3.10; 95% CI: 1.29, 7.47). Servicemembers with a combat arms military occupational specialty, when compared to those with a combat support designation, were significantly more likely to serve a postoperative combat deployment (OR = 2.75; 95% CI: 1.13, 6.73). The demographic variables of sex, unilateral TKA, and previous history of combat deployment were not associated with performance of a postoperative combat deployment. Table 4 contains pertinent demographic information and clinical course for all 20 servicemembers who performed a combat deployment

Please cite this article as: Belmont PJ, et al, Return to Work and Functional Outcomes Following Primary Total Knee Arthroplasty in U.S. Military Servicemembers, J Arthroplasty (2015), http://dx.doi.org/10.1016/j.arth.2015.01.044

Table 2
Risk Factors for Medical Separation after Primary Total Knee Arthroplasty.

	TKA	Medically Separated	Not Medically Separated	Odds Ratio (95% CI)	*P* value
Sex					
Male	121	22 (18%)	99 (82%)	Referent	
Female	38	7 (18%)	29 (82%)	1.01 (0.43–2.37)	0.9760
Age					
<45	45	14 (31%)	31 (69%)	2.36 (1.14–4.90)	0.0206
45 or older	114	15 (20%)	96 (80%)	Referent	
Deployment history					
Yes	111	22 (20%)	89 (80%)	1.36 (0.58–3.18)	0.4796
No	48	7 (15%)	41 (85%)	Referent	
Bilateral procedure					
Yes	22	2 (9%)	20 (91%)	Referent	
No	137	27 (19%)	110 (81%)	2.17 (0.52–9.12)	0.2910
Combat arms					
Yes	31	5 (16%)	26 (84%)	Referent	
No	128	24 (19%)	104 (81%)	1.16 (0.44–3.05)	0.7594
Total	159	29	130		

TKA-total knee arthroplasty

after a primary TKA. Additionally, the occupational outcome at a minimum of two years postoperatively for this subset includes retention on active-duty (n = 13), retirement (n = 6), and medically separated (n = 1).

Among the 181 TKAs, there were a total of 9 TKA revisions (5.0%) performed at an average of 1.9 (S.D. 1.6, range 0.2–4.8) years. There were two septic and seven aseptic TKA revisions. The indications for the aseptic revisions included three cases of arthrofibrosis, two hardware failures, one TKA with posterior instability, and one patient with persistent pain. Additionally, there was one major local complication, a deep space infection, and one minor local complication, a superficial surgical site infection, within 30 days of surgery. The deep infection underwent an irrigation and debridement with polyethylene liner exchange, while the superficial surgical site infection underwent an irrigation and debridement procedure, both of which successfully eradicated the infections.

Discussion

The active-duty retention of Army servicemembers following primary TKA in this study can be considered moderately successful. At a minimum two-year follow-up, 82% of Army servicemembers resumed their military career or fulfilled their remaining service commitment. In civilian patients, the return to preoperative employment after primary TKA varies widely, with rates ranging from 59% to 98%. However, this may reflect relative differences in average length of follow-up (range, 0.25–3.8 years), mean patient age at time of surgery (range, 54–72 years), and the prevalence of patients with high physical job demand categories [17–24]. Similarly, these studies may inadequately reflect the long-term productivity of patients undergoing TKA given the short duration of clinical follow-up [17,18,21–24].

The large scale and protracted nature of the conflicts in Iraq and Afghanistan have imposed significant demands on military personnel, often with multiple combat deployments to maximize the military's deployable force strength. As Mancuso et al [27] postulated, the goal of returning young, active individuals, such as military servicemembers, to occupational duties remains prominent when considering TKA. Prior reports of outcomes after TKA in military servicemembers consist only of two small series [25,26]. Glebus et al [25] identified that 86% of military servicemembers undergoing either a primary knee or hip arthroplasty procedure were able to return to duty at an average of 4.5 years of follow-up. This study was limited by the small sample size of TKAs (n = 20), failure to separately report the occupational and deployment related outcomes, and the lack of analysis of factors affecting military retention and subsequent combat deployment.

Table 4
Demographic Information and Clinical Course of Military Servicemembers Performing a Combat Deployment After Total Knee Arthroplasty.

	Age	Sex	Prior Deployments	Diagnosis	Procedure	Complications of Deployment[a]
1	39	F	0	OA	TKA	None
2	49	M	1	OA	TKA	None
3	44	M	2	PTA	TKA	None
4	44	F	1	PTA	TKA	None
5	55	M	5	OA	TKA	None
6	46	M	3	OA	TKA	None
7	31	M	2	OA	TKA	None
8	42	M	4	OA	TKA	None
9	45	M	3	PTA	TKA	None
10	44	M	1	OA	TKA	None
11	49	F	2	OA	TKA	None
12	34	M	0	OA	TKA	None
13	54	M	3	OA	TKA	None
14	43	M	1	OA	Staged bilateral TKA	Rehabilitation for pain on return
15	51	F	1	OA	Staged bilateral TKA	None
16	42	M	3	OA	TKA	None
17	59	M	4	OA	TKA	None
18	45	M	3	PTA	TKA	None
19	41	F	0	OA	TKA	Pain in bilateral knees
20	47	M	1	PTA	TKA	None

M, male; F, female; OA, osteoarthritis; PTA, post-traumatic arthritis; TKA, total knee arthroplasty;
[a] Related to TKA

Table 3
Prognostic Factors for Deployment After Primary Total Knee Arthroplasty.

	TKA	Active Duty Combat Deployment	No Postoperative Combat Deployment	Odds Ratio (95% CI)	*P* value
Sex					
Male	121	15 (12%)	106 (88%)	Referent	
Female	38	5 (13%)	33 (87%)	1.06 (0.39–2.92)	0.9081
Age					
<45	45	11 (24%)	34 (76%)	3.10 (1.29–7.47)	0.0119
45 or older	114	9 (8%)	105 (92%)	Referent	
Deployment history					
Yes	111	17 (15%)	94 (85%)	2.45 (0.72–8.36)	0.1524
No	48	3 (6%)	45 (94%)	Referent	
Bilateral procedure					
Yes	22	4 (18%)	18 (82%)	1.56 (0.52–4.66)	0.4285
No	137	16 (12%)	121 (82%)	Referent	
Combat arms					
Yes	31	8 (26%)	23 (74%)	2.75 (1.13–6.73)	0.0265
No	128	12 (9%)	116 (91%)	Referent	
Total	159	20	157		

TKA-total knee arthroplasty

Please cite this article as: Belmont PJ, et al, Return to Work and Functional Outcomes Following Primary Total Knee Arthroplasty in U.S. Military Servicemembers, J Arthroplasty (2015), http://dx.doi.org/10.1016/j.arth.2015.01.044

All military servicemembers in the current study would be classified in either the medium-very heavy [28] or moderate/strenuous labor [29] categories based on previous reports [17,23]. Many studies concerning primary TKA do not classify occupational demand [18,19,21,22], whereas others employ differing organization schemes that limit generalizability [17,18,23,24]. Additionally, the percentage of TKA patients with sedentary or light occupational physical demands in the available literature lies between 22% and 48% [17,20,23,24], differing from the current military cohort.

Lombardi et al [23] demonstrated that 13% of civilian patients were unable to return to labor-intensive occupations classified as heavy or very heavy work following primary TKA. By comparison, Army servicemembers in more rigorous, military occupational specialties may supersede the corresponding activity profile seen in high-functioning, civilian cohorts. Moreover, several studies confirm decreased levels of physical activity following TKA [30–32] with upwards of 16% of primary TKA patients reporting pain in the joint with sports activities [31]. These combined factors might adversely affect Army servicemembers' ability to return to active duty service.

Few studies have reported on determinants of occupational status after TKA [17,19,22–24]. Age <45 years was associated with an increased risk for medical separation in the current military population. Younger servicemembers are subject to greater physical rigors than more senior servicemembers during combat deployments. These inherent demands common to servicemembers <45 years ostensibly result in a greater risk for medical separation following primary TKA, which reinforce previous findings correlating relatively lower rates of return to preoperative function following primary TKA with patients employed in heavy/very heavy work categories [17,23]. Williams et al [33] also reported significantly lower self-reported satisfaction scores in patients aged less than 55 years following primary TKA. However, this was not reflected by other standardized knee scoring measures, suggesting that additional factors relating to functional demands may play an important role in younger patients undergoing primary TKA.

In the current study, 13% of Army servicemembers performed a postoperative combat deployment following primary TKA, and no unique, TKA-related medical issues occurred within this resource-limited environment (Table 4). The authors acknowledge that during this study the conflict in Iraq ended and in Afghanistan diminished, thus decreasing the number of opportunities for deployment. Army servicemembers with a combat arms military occupational specialty, when compared to those with combat support designation, were more likely to serve a postoperative combat deployment; however, there was no significant association with active duty retention rate. After a primary TKA, the level of preoperative activity and occupational demands are significant considerations that often determine ultimate postoperative function. Higher levels of pre-operative self-efficacy, such as a combat arms designation in the current study, have been reported to be a long-term predictor of postoperative outcome [34]. Age <45 years is also a significant predictor for serving a postoperative combat deployment after TKA and may serve as a proxy for increased pre-operative physical function.

Active patients might still have limitations and activity-related symptoms, especially with kneeling and squatting [35,36], following primary TKA. Army servicemembers contemplating TKA should have preoperative counseling about the potential post-surgical occupational outcomes and its resultant impact on quality of life [37]. Selected surgeons have advocated for more explicit patient counseling with consideration of activity modification following TKA, particularly sporting and high-impact activities [38,39]. Patients' expectations that should be addressed with preoperative counseling include relief of painful symptoms, improvement in physical function, and enhancement of psychosocial well-being [40]. An important component of psychosocial well-being following surgery is gainful employment. This study may afford more effective patient counseling detailing the risks and psychosocial benefits associated with a return to high-demand occupations.

The authors acknowledge limitations in this investigation. First, this is a retrospective study of prospectively-gathered data, which depends upon surgeon-reported outcomes and clinical information extracted from the electronic medical record. Second, there was no control group in the study, and functional or patient satisfaction scores in the cohort were not assessed. Third, military servicemembers are likely to represent a more physically fit population than other high-demand TKA cohorts. Fourth, we cannot exclude the potential for secondary gain and acknowledge that a servicemember may pursue a disability-associated medical separation under these pretenses. However, this is also documented among civilian laborers in the Workers Compensation system after knee arthroplasty [17].

In conclusion, this is the only known clinical series comprised of a large, homogenous patient cohort with moderate to heavy work demands undergoing TKA that reports on occupational outcomes at a minimum of two years postoperatively. Following primary TKA, 82% of patients remained on active duty or successfully completed their military service, while 18% of servicemembers were medically separated from the military due to persistent TKA-related limitations. Age <45 years was a risk factor for medical separation, while age <45 years and a combat arms military occupational specialty were associated with a servicemember performing a postoperative combat deployment.

References

1. Bourne RB, McCalden RW, MacDonald SJ, et al. Influence of patient factors on TKA outcomes at 5 to 11 years follow up. Clin Orthop Relat Res 2007;464:27.
2. Ethgen O, Bruyere O, Richy F, et al. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. J Bone Joint Surg Am 2004;86:963.
3. Kane RL, Saleh KJ, Wilt TJ, et al. The functional outcomes of total knee arthroplasty. J Bone Joint Surg Am 2005;87:1719.
4. Quintana JM, Escobar A, Arostegui I, et al. Health-related quality of life and appropriateness of knee and hip joint replacement. Arch Intern Med 2006;166:220.
5. Garrett Jr WE, Swiontkowski MF, Weinstein JN, et al. American Board of Orthopaedic Surgery Practice of the Orthopaedic Surgeon: part-II, certification examination case mix. J Bone Joint Surg Am 2006;88(3):660.
6. Kim S. Changes in surgical loads and economic burden of hip and knee replacements in the US: 1997–2004. Arthritis Rheum 2008;59:481.
7. Kurtz S, Ong K, Lau E, et al. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. J Bone Joint Surg Am 2007;89:780.
8. Singh JA, Vessely MB, Harmsen WS, et al. A population-based study of trends in the use of total hip and total knee arthroplasty, 1969–2008. Mayo Clin Proc 2010;85:898.
9. Army Regulation 40–501: Standards of Medical Fitness; 2011.
10. Spector TD, Harris PA, Hart DJ, et al. Risk of osteoarthritis associated with long-term weight-bearing sports: a radiologic survey of the hips and knees in female athletes ex-athletes and population controls. Arthritis Rheum 1996;39:988.
11. Sandmark H, Vingård E. Sports and risk for severe osteoarthrosis of the knee. Scand J Med Sci Sports 1999;9:279.
12. Cameron KL, Hsiao MS, Owens BD, et al. Incidence of physician-diagnosed osteoarthritis among active duty United States military service members. Arthritis Rheum 2011;63:2974.
13. Schoenfeld AJ, Goodman GP, Burks R, et al. The influence of musculoskeletal conditions, behavioral health diagnoses and socio-economic status on injury-related outcome in a high-demand population. J Bone Joint Surg Am 2014;96(1–8):e106.
14. Cross JD, Ficke JR, Hsu JR, et al. Battlefield orthopaedic injuries cause the majority of long-term disabilities. J Am Acad Orthop Surg 2011;19(Suppl. 1):S1.
15. Patzkowski JC, Rivera JC, Ficke JR, et al. The changing face of disability in the US Army: the Operation Enduring Freedom and Operation Iraqi Freedom effect. J Am Acad Orthop Surg 2012;20(Suppl. 1):S23.
16. Tilbury C, Schaasberg W, Plevier JW, et al. Return to work after total hip and knee arthroplasty: a systematic review. Rheumatology 2014;53:512.
17. Clyde CT, Goyal N, Matar WY, et al. Workers' compensation patients after total joint arthroplasty do they return to work? J Arthroplasty 2013;28:883.
18. Foote JA, Smith HK, Jonas SC, et al. Return to work following knee arthroplasty. Knee 2010;17:19.
19. Lyall H, Ireland J, El-Zebdeh MY. The effect of total knee replacement on employment in patients under 60 years of age. Ann R Coll Surg Engl 2009;91:410.
20. Kievet AJ, van Geenen RC, Kuijer PP, et al. Total knee arthroplasty and the unforeseen impact on return to work: a cross-sectional multicenter survey. J Arthroplasty 2014;29:1163.
21. Walton NP, Jahromi I, Lewis PL, et al. Patient-perceived outcomes and return to sport and work: TKA versus mini-incision unicompartmental knee arthroplasty. J Knee Surg 2006;19:112.
22. Weingarten S, Riedinger MS, Sandhu M, et al. Can practice guidelines safely reduce hospital length of stay? Results from a multicenter interventional study. Am J Med 1998;105:33.
23. Lombardi Jr AV, Nunley RM, Berend KR, et al. Do patients return to work after total knee arthroplasty? Clin Orthop Relat Res 2013:138.

Please cite this article as: Belmont PJ, et al, Return to Work and Functional Outcomes Following Primary Total Knee Arthroplasty in U.S. Military Servicemembers, J Arthroplasty (2015), http://dx.doi.org/10.1016/j.arth.2015.01.044

24. Styron JF, Barsoum WK, Smyth KA, et al. Preoperative predictors of returning to work following primary total knee arthroplasty. J Bone Joint Surg Am 2011;93:2.
25. Glebus GP, Feather TW, Hsu JR, et al. Return to duty and deployment after major joint arthroplasty. J Arthroplasty 2013;28:1270.
26. Kuklo TR, Heekin RD, Temple HT, et al. A review of total joint replacement in active duty soldiers. Mil Med 1997;162:201.
27. Mancuso CA, Ranawat CS, Esdaile JM, et al. Indications for total hip and total knee arthroplasties. Results of orthopaedic surveys. J Arthroplasty 1996;11:34.
28. Dictionary of occupational titles (DOT). US Department of Labor, Office of Administrative Law JudgesRevised 4th ed. ; 1991[Available at www.oalj.dol.gov/PUBLIC/DOT/REFERENCES/DOTAPPC.HTM. Accessed 27 October, 2014].
29. Misamore GW, Ziegler DW, Rushton II JL. Repair of the rotator cuff. A comparison of results in two populations of patients. J Bone Joint Surg Am 1995;77:1335.
30. Bradbury N, Borton D, Spoo G, et al. Participation in sports after total knee replacement. Am J Sports Med 1998;26:530.
31. Huch K, Müller KA, Stürmer T, et al. Sports activities 5 years after total knee or hip arthroplasty: the Ulm Osteoarthritis Study. Ann Rheum Dis 2005;64:1715.
32. Wylde V, Blom A, Dieppe P, et al. Return to sport after joint replacement. J Bone Joint Surg (Br) 2008;90:920.
33. Williams DP, Price AJ, Beard DJ, et al. The effects of age on patient-reported outcome measures in total knee replacement. J Bone Joint Surg (Br) 2008;95:38.
34. Akker-Scheek I, Stevens M, Groothoff JW, et al. Preoperative of post-operative self-efficacy: which is a better predictor of outcome after total hip or knee arthroplasty? Patient Educ Couns 2007;66:92.
35. Noble PC, Conditt MA, Cook KF, et al. The John Insall Award: patient expectations affect satisfaction with total knee arthroplasty. Clin Orthop Relat Res 2006;452:35.
36. Scott CE, Bugler KE, Clement ND, et al. Patient expectations of arthroplasty of the hip and knee. J Bone Joint Surg (Br) 2012;94:974.
37. Kuijer PP, de Beer MJ, Houdijk JH, et al. Beneficial and limiting factors affecting return to work after total knee and hip arthroplasty: a systematic review. J Occup Rehabil 2009;19:375.
38. Healy WL, Sharma S, Schwartz B, et al. Athletic activity after total joint arthroplasty. J Bone Joint Surg Am 2008;90:2245.
39. McGory BJ, Stuart MJ, Sim FH. Participation in sports after hip and knee arthroplasty: review of literature and survey of surgeon preferences. Mayo Clin Proc 1995;70:342.
40. Mancuso CA, Graziano S, Briskie LM, et al. Randomized trials to modify patients' preoperative expectations of hip and knee arthroplasties. Clin Orthop Relat Res 2008;466:424.

Please cite this article as: Belmont PJ, et al, Return to Work and Functional Outcomes Following Primary Total Knee Arthroplasty in U.S. Military Servicemembers, J Arthroplasty (2015), http://dx.doi.org/10.1016/j.arth.2015.01.044