

Physical activity in postdeployment Operation Iraqi Freedom/Operation Enduring Freedom veterans using Department of Veterans Affairs services

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Abstract—Veteran activity levels may decrease between Active Duty and postdeployment. We examined attitudes and changes in self-reported activities between the two in Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF) veterans using Department of Veterans Affairs (VA) services. We conducted an online cross-sectional survey (June–August 2008) of postdeployment OIF/OEF veterans registered with the VA Ann Arbor Healthcare System, Ann Arbor, Michigan. Descriptive statistics summarized demographic data and attitudes, while regression analyses compared physical activities during Active Duty with physical activities postdeployment. Participants ($n = 319$, 15.6% response rate) reported that they believe staying physically fit is important, they worry about gaining weight, and they believe exercise will keep them healthy (77%, 72%, and 90% agree or strongly agree, respectively). Running (30.0%), Exercise with Gym Equipment (21.5%), Occupational Activities (14.9%), and Walking (13.0%) were the most frequently reported Active Duty physical activities. The most frequently reported postdeployment physical activities included Walking (21.1%), Running (18.5%), and Exercise with Gym Equipment (17.9%). Health problems (39%) and chronic pain (52%) were common barriers to physical activity. Postdeployment OIF/OEF veterans using the VA believe physical activity is beneficial, yet many report health problems and/or chronic pain that makes exercise difficult. Physical activity promotes health, and strategies are needed to facilitate physical activity in this population.

Key words: chronic disease, exercise, lifestyle, obesity, OIF/OEF, pain, physical activity, postdeployment, survey, veterans.

INTRODUCTION

Despite the high degree of physical fitness required for Active Duty servicemembers of the U.S. Armed Forces and when compared with nonveterans of all ages, the veteran population has a greater prevalence of being overweight [1] and obese [1–2]. Furthermore, veterans receiving healthcare services from the Department of Veterans Affairs (VA) have a greater prevalence of obesity

Abbreviations: BMI = body mass index, OEF = Operation Enduring Freedom, OIF = Operation Iraqi Freedom, PIN = personal identification number, SD = standard deviation, VA = Department of Veterans Affairs.

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than the general public [3–4] as well as veterans not using VA services [2,4]. In comparison with the general public and veterans not using the VA, veterans using VA services have also been shown to self-report poorer health [4–6]; are more likely to be physically inactive [2]; and are more likely to carry one or more chronic diagnoses such as hypertension, hypercholesterolemia, and diabetes [2,4,6–7]. Moreover, U.S. veterans who have spent time in theater often experience mental illnesses, pain syndromes, and musculoskeletal complaints [8–12]. These represent independent risk factors for sedentary behavior and obesity and are associated with increased morbidity and mortality [13–20].

Recently returned Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) veterans represent a unique population served by the VA. Having recently been engaged in a physically demanding environment, these veterans, many with physical and/or mental sequelae from their tour of duty, face an abrupt transition to civilian life [11,21–28]. In light of the growing body of evidence demonstrating the benefits of physical activity, including decreasing both obesity-associated morbidity and mortality [29–30] and disability from chronic musculoskeletal pain [31], OIF/OEF veterans using the VA are an ideal population for interventions centered around increasing physical activity.

Of the postdeployment OIF/OEF veterans using the VA, this study identified their perception of physical activity and the types of physical activity engaged in during Active Duty and postdeployment. By further understanding postdeployment veterans' perceptions of physical activity as well as physical activities they engage in postdeployment, the VA may be able to develop targeted interventions to manage optimal weight and prevent overweight and obesity, along with its sequelae, in this population.

METHODS

We conducted a cross-sectional survey of postdeployment OIF/OEF veterans who were registered with the VA Ann Arbor Healthcare System, Ann Arbor, Michigan, from October 2001 through July 2007. The survey was open for a period of 3 months (June–August 2008). The Computerized Patient Record System, the electronic medical record system used by the VA, was used for recruitment to create a database of 3,352 OIF/OEF veter-

ans and servicemembers. The vast majority of these identified veterans were separated from the military. Those veterans who were deceased, had an unclear period of military service or unclear registration date with the VA, or had an incomplete address were excluded from the database ($n = 1,089$). Invitations to participate in the online survey were sent to the remaining 2,263 OIF/OEF veterans through the U.S. mail. Of those mailed, 214 were returned as undeliverable, resulting in 2,049 delivered invitations. These invitations included a link to the online survey as well as a unique 6-digit personal identification number (PIN) that was required to access the survey. The online survey was conducted through SurveyMonkey (<http://www.surveymonkey.com/>; Palo Alto, California), a for-profit Web site that allows users to design and manage online surveys as well as compile survey responses. After following the survey link, participants were presented with information regarding the survey and an informed consent statement. Participants were required to agree to the informed consent statement to proceed. After consenting, participants were asked to provide their PIN. This PIN was used to screen for uninvited survey respondents and identify any possible duplicate respondents. To increase the response rate, 1,959 reminder letters were sent approximately 3 weeks after the initial mailing to those who had not already responded. A \$10 Target gift card, to be sent by U.S. mail at survey completion, was offered as an incentive to all participants in both the initial recruitment and reminder letters.

Measures

The survey questions used for this study were included as part of and analyzed separately from a larger survey examining help-seeking behavior in OIF/OEF veterans using VA services. The survey collected demographic and anthropometric data from participants, including sex, age, race, height, weight, branch of service, employment status, time back from most recent OIF/OEF deployment, total time in theater, number of deployments, Active Duty status, and service-connected disability. In addition, participants responded to 10 questions with a Likert scale response set (ranging from 1–5, where 1 = strongly disagree and 5 = strongly agree) assessing perceptions of physical activity. To understand physical activities engaged in during Active Duty and postdeployment, participants were asked to “List the kinds of physical activity or exercise you did in a typical day while you were on Active Duty,” and “List the kinds of physical

activity or exercise you did in a typical day now postdeployment.” For each of those questions, participants were given four free-text response fields in which to respond. Furthermore, participants were provided one free-text response field to answer the question, “What is the kind of physical activity that you most enjoy doing?” Finally, the survey assessed email use, cellular telephone ownership, smoking status, and self-reported ability to comfortably walk one block without assistance for all participants.

Data Analysis

Descriptive statistics included means \pm standard deviations (SDs) for continuous and normally distributed variables. Frequencies and percentages were calculated for categorical data. Likert scale responses regarding percep-

tions of physical activity were grouped into “agree,” “neutral,” or “disagree” categories and analyzed as frequencies.

A research assistant analyzed the free-text responses of types of physical activities engaged in during Active Duty and postdeployment and coded them according to themes (**Table 1**). Free-text responses not considered to represent a physical activity or with an unclear meaning were omitted. Furthermore, responses indicating an inability to be physically active were analyzed separately. Once all responses had been coded, a second coder reviewed categorical assignments for accuracy. The number of categories of physical activities each participant reported for Active Duty and postdeployment was calculated and compared using a Wilcoxon signed rank test, a nonparametric test for repeated measures used when normal distributions cannot be assumed.

Table 1.

Free-text response categories, definitions, and examples of physical activity.

Category	Definition	Example
Calisthenics/Aerobics	Gymnastics or aerobic activities performed without apparatus.	Push-ups, sit-ups, calisthenics, cardio, aerobics, pull-ups.
Cycling	Cycling, excluding stationary exercise bike at home or gym.	Cycling, biking, mountain biking.
Domestic Chores	Indoor activities related to maintaining living space.	Doing laundry, cleaning house, helping parent around house, vacuuming.
Exercise with Gym Equipment	Exercise involving stationary equipment or weights, excluding treadmill running or walking.	Gymnasium, working out, weight training, weight lifting, rowing machine, elliptical machine, stationary bike, muscle-failure lifting.
Martial Arts	Any form of martial arts.	Martial arts, mixed martial arts, Muay Thai Kickboxing.
Occupational Activities	Activity involved in military Active Duty or postdeployment occupational responsibilities.	Loading truck, lifting heavy objects or boxes, walking at work, road marching, hiking, ruck marches, working on vehicles, cutting concrete, working as factory laborer, carrying machines, climbing ladders, working as union plumber.
Outdoor Activities	Physical activities that can only be performed outdoors, excluding running and walking.	Gardening, fishing, hunting, camping, mowing lawn, cutting wood, snowboarding.
Pool-Based Activities	Activities that can only be performed in body of water.	Swimming, water sports, water aerobics.
Running	Running or jogging, including using treadmill.	Running, jogging (indoor, outdoor, or treadmill).
Sports	Competitive activity involving at least two people.	Basketball, volleyball, boxing, competitive sports, touch football, golf.
Walking	Walking, excluding that associated with occupational activities.	Walking, walking specific speed or distance.
Other	Activities that do not fit into any other category.	Salsa dancing, rock climbing, playing with kids, yoga.

Finally, to compare Active Duty and postdeployment participation in each physical activity category, we used a logistic regression model with a first dichotomous-dependent variable indicating participation in or no participation in the physical activity category and a second dichotomous-independent variable indicating Active Duty versus postdeployment as a predictor of physical activity. Robust standard errors were calculated to account for clustering by individual participants. All statistics were calculated with use of STATA 10.0 (StataCorp; College Station, Texas).

RESULTS

Demographics

In total, 319 individuals (15.6% of delivered invitations) responded to the physical activity portion of the survey. The age of participants was 35.5 ± 9.7 years (mean \pm SD), and the majority were male (86%), Caucasian (87%), >2 years since most recent OIF/OEF deployment (76%) (Table 2), and separated from the military (98.5%). According to body mass index (BMI) calculations, approximately 75 percent of participants were overweight or obese, with 44 percent classified as overweight (BMI: 25.0–29.9), and 32 percent as obese (BMI: ≥ 30). Nearly one-third of participants (27%) smoked cigarettes. Finally, OIF/OEF veterans using the VA were frequent technology users: 74 percent of participants reported checking email almost every day or more and 93 percent reported carrying a cellular telephone.

Attitudes Toward Physical Activity

The majority of participants reported a positive attitude toward physical activity, recognizing it as a way to reduce stress (70% agree or strongly agree) and citing it as “important” (77% agree or strongly agree). Participants also endorsed exercise for maintaining health (90% agree or strongly agree) and worried about gaining weight (72% agree or strongly agree). Regarding physical activity settings, a similar proportion of participants enjoyed exercising by him or herself (46% agree or strongly agree) or with one or two friends (49% agree or strongly agree). Only a minority of participants enjoyed exercising in a group (22% agree or strongly agree). In terms of exercise limitations, 39 percent of participants reported health problems that made exercising difficult, and 52 percent of participants reported chronic pain that interfered with exercise (Table 3).

Table 2.

Participant demographics ($N = 319$).

Demographic	<i>n</i> (%) [*]
Male	274 (86)
Age, yr (mean \pm SD)	35.5 ± 9.7
BMI (score)	
<18.5	2 (<1)
18.5–24.9	74 (23)
25.0–29.9	140 (44)
≥ 30	100 (32)
Cigarette Smoker	86 (27)
Able to Walk 1 Block Comfortably Without Assistance	302 (96)
Race	
Caucasian	279 (87)
African American	18 (6)
Hispanic	12 (4)
Asian	2 (<1)
American Indian/Alaska Native	4 (1)
Don't Wish to Respond	4 (1)
Employment	
Full-Time (35–40 h/wk)	215 (67)
Part-Time (<35 h/wk)	32 (10)
Unemployed	46 (14)
Disability	26 (8)
Military Branch	
Army	151 (47)
Navy	23 (7)
Air Force	23 (7)
Marine Corps	37 (12)
National Guard	85 (27)
Time Since Last OIF/OEF Deployment	
<6 mo	6 (2)
6 mo–1 yr	12 (4)
1.0–1.5 yr	29 (9)
1.5–2.0 yr	30 (9)
>2 yr	242 (76)
Carry Cellular Telephone	291 (93)
Frequency of Email Use	
Never	4 (1)
<Once per Month	9 (3)
1 to 4 Times per Month	20 (6)
1 to 4 Times per Week	50 (16)
Almost Every Day	121 (38)
Several Times a Day	113 (36)

^{*}Errors caused by rounding.

BMI = body mass index, OIF/OEF = Operation Iraqi Freedom/Operation Enduring Freedom, SD = standard deviation.

Table 3.

Summary of perceptions and associated preferences and limitations of physical activity among Operation Iraqi Freedom/Operation Enduring Freedom veterans following deployment.

Summary	Disagree/Strongly Disagree (%) [*]	Neutral (%) [*]	Agree/Strongly Agree (%) [*]
Perceptions of Exercise			
I don't like to exercise.	67	16	17
Exercise helps me deal with stress.	12	18	70
Staying physically fit is important to me.	7	17	77
I worry about gaining weight.	16	12	72
Getting exercise will keep me healthy.	3	8	90
Exercise Preferences			
I like to exercise by myself.	28	26	46
I like to exercise with one or two friends.	23	28	49
I like to exercise in a group.	51	27	22
Exercise Limitations			
I have health problems that make it hard for me to exercise.	40	21	39
I have chronic pain such as back pain that makes it hard for me to exercise.	31	17	52

^{*}Errors caused by rounding.

Patterns of Physical Activity

Table 1 shows the 12 categories of physical activity that coders identified.

Active Duty

Participants reported 2.08 ± 1.08 types of physical activity (median = 2) performed during a typical Active Duty day. Running, Exercise with Gym Equipment, Occupational Activities, and Walking represented the most frequently mentioned physical activity categories with 30.0, 21.5, 14.9, and 13.0 percent of responses, respectively (**Table 4**). Thirty-two participants did not list any codable activities during Active Duty, and three participants indicated an inability to perform physical activities during Active Duty.

Postdeployment

Participants reported 1.59 ± 1.20 types of physical activity (median = 2) during a typical day postdeployment. Walking, Running, Exercise with Gym Equipment, and Occupational Activities represented 21.1, 18.5, 17.9, and 9.5 percent of the total responses, respectively (**Table 4**). Participants engaged in fewer types of physical activity during postdeployment than during Active Duty (Wilcoxon signed rank test: $p < 0.001$). The odds of a participant reporting Walking, Cycling, Outdoor Activities, and Other during postdeployment were significantly greater than during Active Duty (1.37, 1.70, 5.73, and 6.20 times, respec-

tively) (**Table 4**). The odds of a participant reporting Running, Exercise with Gym Equipment, Occupational Activities, and Calisthenics/Aerobics were significantly lower postdeployment compared with Active Duty (0.25, 0.49, 0.39, and 0.53 times, respectively). Finally, 76 participants did not list any codable activities during postdeployment, and 23 participants reported being unable to perform physical activities postdeployment. This difference was significant (logistic regression: odds ratio = 8.18, $p < 0.001$), with the odds of reporting an inability to perform physical activities postdeployment being eight times greater than an inability to perform physical activities during Active Duty.

Favorite Physical Activity

Running was the most common response to the question about favorite physical activity (18.1%), followed by Exercise with Gym Equipment (16.6%), Sports (16.6%), Walking (13.7%) and Outdoor Activities (12.3%). Cycling and Other represented an additional 9.0 and 5.4 percent, respectively, and Calisthenics/Aerobics, Occupational Activities, Martial Arts, and Pool-Based Activities each represented <3 percent of responses. Although participants were not asked whether they were able to engage in their favorite physical activities postdeployment or not, 24 participants indicated pain, depression, or inability to engage in previously enjoyed physical activities.

Table 4.

Associations of physical activities performed by Operation Iraqi Freedom/Operation Enduring Freedom veterans postdeployment compared with Active Duty.

Physical Activity	Active Duty <i>n</i> (%)	Postdeployment <i>n</i> (%)	Odds Ratio	95% CI	<i>p</i> -Value
Running	199 (30.0)	94 (18.5)	0.25	0.19–0.33	<0.001
Exercise with Gym Equipment	143 (21.5)	91 (17.9)	0.49	0.38–0.64	<0.001
Occupational Activities	99 (14.9)	48 (9.5)	0.39	0.29–0.54	<0.001
Walking	86 (13.0)	107 (21.1)	1.37	1.04–1.81	0.03
Sports	51 (7.7)	37 (7.3)	0.69	0.47–1.01	0.06
Calisthenics/Aerobics	44 (6.6)	25 (4.9)	0.53	0.35–0.81	0.003
Cycling	19 (2.9)	31 (6.1)	1.70	1.01–2.87	0.05
Outdoor Activities	8 (1.2)	41 (8.1)	5.73	2.90–11.33	<0.001
Pool-Based Activities	7 (1.1)	9 (1.8)	1.29	0.50–3.34	0.59
Martial Arts	6 (0.9)	4 (0.8)	0.66	0.29–1.49	0.32
Other	2 (0.3)	12 (2.4)	6.20	1.36–28.21	0.02
Domestic Chores	0 (0)	8 (1.6)	—	—	—
Total	664 (100.1)*	507 (100)	—	—	—

Note: Bold numbers represent statistically significant findings ($\alpha = 0.05$).

*Error caused by rounding.

CI = confidence interval.

DISCUSSION

Despite the demand for physical fitness during Active Duty OIF/OEF deployment and the positive perceptions of physical activity among OIF/OEF veterans using the VA, this postdeployment population struggles to maintain a physically active lifestyle and avoid weight gain. In our sample of 319 OIF/OEF veterans using the VA, 75 percent were overweight or obese, which is greater than the estimated nationwide prevalence of overweight and obesity (68%) [32]. Additionally, 72 percent worried about gaining weight.

When comparing lists of physical activities supplied by participants, we found fewer reported physical activities engaged in during postdeployment than during Active Duty. Although Running, Exercise with Gym Equipment, Occupational Activities, and Walking represented the most prevalent physical activities of veterans during both Active Duty and postdeployment, the prevalence of Running, Exercise with Gym Equipment, and Occupational Activities that accompanied the return to civilian life clearly decreased while Walking nearly doubled. It appears that participants shifted from higher-intensity physical activity during Active Duty to lower-intensity physical activity such as Walking postdeployment.

The reason for the significant decreases in the number of physical activities engaged in postdeployment is likely multifactorial. Civilian life is typically not structured around physical activity, because exercise is frequently viewed as an individual, supplemental, or leisure activity. This contrasts to Active Duty service in the U.S. Armed Forces, which involves jobs that are physical in nature and often includes regimented daily exercise. Additionally, the burden of medical morbidity and pain in the veteran population may limit physical activity in OIF/OEF veterans using VA, because these veterans have been shown to represent a lower socioeconomic group, have greater comorbidity, and have a greater prevalence of overweight and obesity than veterans not using VA [1–7,33–34]. The frequency of free-text responses indicating pain, depression, or disability in place of a favorite physical activity ($n = 24$) likely underrepresents the true prevalence, but taken together with the large percentage of participants endorsing pain or health as a limitation for physical activity (52% and 39%, respectively), it would be consistent with this national trend among VA users (Table 3). Littman et al. reported a similar percentage (45.7%) of veterans using VA reporting physical activities limited by disability compared with 24.1 percent of veterans not using VA and 19.1 percent of nonveterans [2]. Additionally, Littman et al.'s study showed that, particularly among older age groups,

veterans were more likely to meet physical activity recommendations and less likely to be inactive than their non-veteran peers. However, after analyzing populations of veterans using and not using VA, they found that veterans using VA were more likely to be inactive and less likely to meet physical activity recommendations than veterans not using VA.

Regardless of the reasons why participants listed fewer types of physical activities during postdeployment, the need to create targeted interventions within the VA to increase the physical activity of this population is evident. Intercepting veterans postdeployment through targeted prevention-oriented interventions for maintaining optimal weight and physical activity should be a priority for preventing the onset of weight-related chronic disease in this population. The Veterans Health Administration has created innovative national programs such as MOVE! [35], which targets overweight and obese veterans receiving services from the VA. However, this program serves all overweight and obese veterans and is not specifically tailored to OIF/OEF veterans, who are generally younger, more recently active, and more technologically savvy than previous veteran cohorts. Qualification for participation in MOVE! requires preexisting morbidity, specifically a diagnosis of overweight or obesity as well as a weight-related disease, leaving veterans without targeted intervention at risk for becoming overweight or obese.

Although few studies have investigated physical activity as an intervention in the veteran population, available data are promising. Peterson et al. demonstrated that in a sample of 44 older veterans (72.9 ± 6.9 years), those participating in an outpatient exercise program ($n = 23$) performed comparably with the national average in measures of physical function (30 s chair stand, 6 min walk test), whereas sedentary older veterans ($n = 21$) performed worse than both the exercising older veterans ($p < 0.05$) and the national average ($p < 0.05$) [36]. This study did not measure health outcomes, but we can infer that a more active population can potentially benefit from the health gains demonstrated in other studies.

Given the numbers of veterans returning from OIF/OEF deployment with injuries (as of January 25, 2011, 42,164 OIF/OEF veterans were reported wounded in action) [37], the lack of lifestyle and behavior-focused preventive programs for this population, many of whom are experiencing health problems and chronic pain, is a major gap in the VA's suite of healthcare programs for veterans. Results from this study suggest that walking as a form of

physical activity nearly doubles in prevalence in postdeployment; thus, structured VA interventions focused on walking may be particularly well suited for this population. Furthermore, since 74 percent of participants report checking email almost every day or more and 93 percent report having access to a cellular telephone, Internet-based and/or text message-based interventions may prove effective for maintaining and/or increasing physical activity in our target population. Such technology-mediated approaches to lifestyle and behavior-change interventions have previously proven to be efficacious in increasing physical activity and promoting healthy diets in other at-risk groups [38–44].

Although the current study is one of the first to examine VA-using OIF/OEF veterans' perceptions of physical activity postdeployment, this research is not without limitations. The first limitation is that, despite sending reminders to eligible individuals to participate in this survey, we still had a relatively low response rate (15.6%). Although post hoc analysis on demographic variables did not reveal any significant differences between survey participants and nonparticipants, the two groups may possibly have differed in other ways that were not measured, which may skew the results and limit the generalizability of our findings.

The second limitation is our reliance on self-reported recall data for Active Duty and postdeployment physical activities. Because the majority of our participants were >2 years from their last OIF/OEF deployment, the potential for recall bias in the form of under- or overreporting physical activities, particularly for Active Duty measures, is increased. Moreover, participants may not have provided exhaustive accounts of physical activities engaged in during Active Duty and postdeployment.

The third limitation was that we did not use a validated physical activity instrument that gathers useful physical activity duration and frequency data. Self-reported measures of physical activity are inherently problematic and particularly poor at capturing less-intensive and less-structured physical activity. We focused on collecting data on types of physical activity rather than on quantitatively assessing amounts of physical activity. While we did attempt to obtain self-reported data on duration and frequency of exercise bouts from participants for Active Duty and postdeployment physical activities, the quality of these data was poor because of incomplete and ambiguous responses. The poor quality of self-reported duration and frequency data, coupled with the fact that this was not the focus of the current

study, meant that we chose not to use these data in a quantitative analysis. Future investigations that seek to build on our work and focus on quantitative physical activity levels, rather than on the types of physical activities engaged in during Active Duty and postdeployment, should consider using objective measures of physical activity to better assess the frequency, duration, and intensity of physical activity in this target population.

The fourth limitation is that, because this investigation focuses solely on OIF/OEF veterans receiving care at the VA, results from this investigation have limited generalizability to OIF/OEF veterans outside of the VA system.

Despite these limitations, this investigation has many strengths. First, although our response rate was low, a large sample of participants completed this survey, which adds to the validity of our findings. Second, because we specifically asked participants about their preferences for physical activity and use of technology, we now have valuable information that may be useful for developing future interventions aimed at increasing physical activity in postdeployment OIF/OEF veterans using the VA. Third, using free-text response questions gave us a more accurate view of physical activity in our target population, because participants were able to add qualifying statements such as an inability to engage in physical activity postdeployment.

Given these findings, future studies to identify specific barriers and motivations among veterans using the VA would help in developing appropriate physical activity programs. Additionally, future longitudinal research investigating deconditioning and health-related changes postdeployment would help us understand the effect of civilian life on the health of postdeployment veterans and could provide additional evidence to bolster the importance of early prevention.

CONCLUSIONS

Results from this investigation indicate that postdeployment OIF/OEF veterans using the VA recognize the benefits of regular physical activity, yet many report barriers to physical activity caused by health problems and/or chronic pain.

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REFERENCES

1. Koepsell TD, Forsberg CW, Littman AJ. Obesity, overweight, and weight control practices in U.S. veterans. *Prev Med.* 2009;48(3):267–71. [PMID: 19297689] DOI:10.1016/j.ypmed.2009.01.008
2. Littman AJ, Forsberg CW, Koepsell TD. Physical activity in a national sample of veterans. *Med Sci Sports Exerc.* 2009;41(5):1006–13. [PMID: 19346987] DOI:10.1249/MSS.0b013e3181943826
3. Das SR, Kinsinger LS, Yancy WS Jr, Wang A, Ciesco E, Burdick M, Yevich SJ. Obesity prevalence among veterans at Veterans Affairs medical facilities. *Am J Prev Med.* 2005; 28(3):291–94. [PMID: 15766618] DOI:10.1016/j.amepre.2004.12.007
4. Nelson KM. The burden of obesity among a national probability sample of veterans. *J Gen Intern Med.* 2006;21(9):

- 915–19. [\[PMID: 16918734\]](#)
[DOI:10.1007/BF02743137](#)
5. Agha Z, Lofgren RP, VanRuiswyk JV, Layde PM. Are patients at Veterans Affairs medical centers sicker? A comparative analysis of health status and medical resource use. *Arch Intern Med.* 2000;160(21):3252–57. [\[PMID: 11088086\]](#)
[DOI:10.1001/archinte.160.21.3252](#)
 6. Larson RJ, Welch HG. Risk for increased utilization and adverse health outcomes among men served by the Veterans Health Administration. *Mil Med.* 2007;172(7):690–96. [\[PMID: 17691680\]](#)
 7. Yu W, Ravelo A, Wagner TH, Phibbs CS, Bhandari A, Chen S, Barnett PG. Prevalence and costs of chronic conditions in the VA health care system. *Med Care Res Rev.* 2003;60(3 Suppl):146S–67S. [\[PMID: 15095551\]](#)
[DOI:10.1177/1077558703257000](#)
 8. Dohrenwend BP, Turner JB, Turse NA, Adams BG, Koenen KC, Marshall R. The psychological risks of Vietnam for U.S. veterans: A revisit with new data and methods. *Science.* 2006;313(5789):979–82. [\[PMID: 16917066\]](#)
[DOI:10.1126/science.1128944](#)
 9. Kang HK, Li B, Mahan CM, Eisen SA, Engel CC. Health of US veterans of 1991 Gulf War: A follow-up survey in 10 years. *J Occup Environ Med.* 2009;51(4):401–10. [\[PMID: 19322107\]](#)
[DOI:10.1097/JOM.0b013e3181a2feeb](#)
 10. Kang HK, Mahan CM, Lee KY, Magee CA, Murphy FM. Illnesses among United States veterans of the Gulf War: A population-based survey of 30,000 veterans. *J Occup Environ Med.* 2000;42:491–501. [\[PMID: 10824302\]](#)
[DOI:10.1097/00043764-200005000-00006](#)
 11. Smith TC, Ryan MA, Wingard DL, Slymen DJ, Sallis JF, Kritz-Silverstein D; Millennium Cohort Study Team. New onset and persistent symptoms of post-traumatic stress disorder self reported after deployment and combat exposures: Prospective population based US military cohort study. *BMJ.* 2008;336(7640):366–71. [\[PMID: 18198395\]](#)
[DOI:10.1136/bmj.39430.638241.AE](#)
 12. Stimpson NJ, Thomas HV, Weightman AL, Dunstan F, Lewis G. Psychiatric disorder in veterans of the Persian Gulf War of 1991. Systematic review. *Br J Psychiatry.* 2003;82:391–403. [\[PMID: 12724242\]](#)
[DOI:10.1192/bjp.182.5.391](#)
 13. Andersen J, Wade M, Possemato K, Ouimette P. Association between posttraumatic stress disorder and primary care provider-diagnosed disease among Iraq and Afghanistan veterans. *Psychosom Med.* 2010;72(5):498–504. [\[PMID: 20368471\]](#)
[DOI:10.1097/PSY.0b013e3181d969a1](#)
 14. Andersson HI. Increased mortality among individuals with chronic widespread pain relates to lifestyle factors: A prospective population-based study. *Disabil Rehabil.* 2009;31(24):1980–87. [\[PMID: 19874076\]](#)
[DOI:10.3109/09638280902874154](#)
 15. Cohen BE, Marmar C, Ren L, Bertenthal D, Seal KH. Association of cardiovascular risk factors with mental health diagnoses in Iraq and Afghanistan war veterans using VA health care. *JAMA.* 2009;302(5):489–92. [\[PMID: 19654382\]](#)
[DOI:10.1001/jama.2009.1084](#)
 16. Duque I, Parra JH, Duvallet A. Physical deconditioning in chronic low back pain. *J Rehabil Med.* 2009;41(4):262–66. [\[PMID: 19247546\]](#)
[DOI:10.2340/16501977-0324](#)
 17. Kåreholt I, Brattberg G. Pain and mortality risk among elderly persons in Sweden. *Pain.* 1998;77(3):271–78. [\[PMID: 9808352\]](#)
[DOI:10.1016/S0304-3959\(98\)00103-1](#)
 18. McBeth J, Nicholl BI, Cordingley L, Davies KA, Macfarlane GJ. Chronic widespread pain predicts physical inactivity: Results from the prospective EPIFUND study. *Eur J Pain.* 2010;14(9):972–79. [\[PMID: 20400346\]](#)
[DOI:10.1016/j.ejpain.2010.03.005](#)
 19. Rugulies R. Depression as a predictor for coronary heart disease. A review and meta-analysis. *Am J Prev Med.* 2002;23(1):51–61. [\[PMID: 12093424\]](#)
[DOI:10.1016/S0749-3797\(02\)00439-7](#)
 20. Wittink H, Hoskins Michel T, Wagner A, Sukiennik A, Rogers W. Deconditioning in patients with chronic low back pain: Fact or fiction? *Spine (Phila Pa 1976).* 2000;25(17):2221–28. [\[PMID: 10973406\]](#)
 21. Amin MM, Parisi JA, Gold MS, Gold AR. War-related illness symptoms among Operation Iraqi Freedom/Operation Enduring Freedom returnees. *Mil Med.* 2010;175(3):155–57. [\[PMID: 20358703\]](#)
 22. Gironde RJ, Clark ME, Massengale JP, Walker RL. Pain among veterans of Operations Enduring Freedom and Iraqi Freedom. *Pain Med.* 2006;7(4):339–43. [\[PMID: 16898945\]](#)
[DOI:10.1111/j.1526-4637.2006.00146.x](#)
 23. Hawkins EJ, Lapham GT, Kivlahan DR, Bradley KA. Recognition and management of alcohol misuse in OEF/OIF and other veterans in the VA: A cross-sectional study. *Drug Alcohol Depend.* 2010;109(1–3):147–53. [\[PMID: 20167440\]](#)
[DOI:10.1016/j.drugalcdep.2009.12.025](#)
 24. Helmer DA, Chandler HK, Quigley KS, Blatt M, Teichman R, Lange G. Chronic widespread pain, mental health, and physical role function in OEF/OIF veterans. *Pain Med.* 2009;10(7):1174–82. [\[PMID: 19818029\]](#)
[DOI:10.1111/j.1526-4637.2009.00723.x](#)
 25. Hoge CW, Auchterlonie JL, Milliken CS. Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *JAMA.* 2006;295(9):1023–32. [\[PMID: 16507803\]](#)
[DOI:10.1001/jama.295.9.1023](#)

26. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *N Engl J Med*. 2004;351(1):13–22. [PMID: 15229303] DOI:10.1056/NEJMoa040603
27. Lew HL, Otis JD, Tun C, Kerns RD, Clark ME, Cifu DX. Prevalence of chronic pain, posttraumatic stress disorder, and persistent postconcussive symptoms in OIF/OEF veterans: Polytrauma clinical triad. *J Rehabil Res Dev*. 2009;46(6):697–702. [PMID: 20104399] DOI:10.1682/JRRD.2009.01.0006
28. Seal KH, Bertenthal D, Miner CR, Sen S, Marmar C. Bringing the war back home: Mental health disorders among 103,788 US veterans returning from Iraq and Afghanistan seen at Department of Veterans Affairs facilities. *Arch Intern Med*. 2007;167(5):476–82. [PMID: 1735495] DOI:10.1001/archinte.167.5.476
29. Knowler WC, Fowler SE, Hamman RF, Christophi CA, Hoffman HJ, Brenneman AT, Brown-Friday JO, Goldberg R, Venditti E, Nathan DM. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. *Lancet*. 2009;374(9702):1677–86. [PMID: 19878986] DOI:10.1016/S0140-6736(09)61457-4
30. Leon AS, Connett J, Jacobs DR Jr, Rauramaa R. Leisure-time physical activity levels and risk of coronary heart disease and death. The Multiple Risk Factor Intervention Trial. *JAMA*. 1987;258(17):2388–95. [PMID: 3669210] DOI:10.1001/jama.258.17.2388
31. Oesch P, Kool J, Hagen KB, Bachmann S. Effectiveness of exercise on work disability in patients with non-acute non-specific low back pain: Systematic review and meta-analysis of randomised controlled trials. *J Rehabil Med*. 2010;42(3):193–205. [PMID: 20411212] DOI:10.2340/16501977-0524
32. Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999–2008. *JAMA*. 2010;303(3):235–41. [PMID: 20071471] DOI:10.1001/jama.2009.2014
33. Arterburn DE, McDonnell MB, Hedrick SC, Diehr P, Fihn SD. Association of body weight with condition-specific quality of life in male veterans. *Am J Med*. 2004;117(10):738–46. [PMID: 15541323] DOI:10.1016/j.amjmed.2004.06.031
34. Kazis LE, Miller DR, Clark J, Skinner K, Lee A, Rogers W, Spiro A 3rd, Payne S, Fincke G, Selim A, Linzer M. Health-related quality of life in patients served by the Department of Veterans Affairs: Results from the Veterans Health Study. *Arch Intern Med*. 1998;158(6):626–32. [PMID: 9521227] DOI:10.1001/archinte.158.6.626
35. Kinsinger LS, Jones KR, Kahwati L, Harvey R, Burdick M, Zele V, Yevich SJ. Design and dissemination of the MOVE! Weight-Management Program for Veterans. *Prev Chronic Dis*. 2009;6(3):A98. [PMID: 19527600]
36. Peterson MJ, Crowley GM, Sullivan RJ, Morey MC. Physical function in sedentary and exercising older veterans as compared to national norms. *J Rehabil Res Dev*. 2004;41(5):653–58. [PMID: 15558394] DOI:10.1682/JRRD.2003.09.0141
37. Casualty update [Internet]. Washington (DC): Department of Defense [updated 2011 May 31; cited 2011 Jan 26]. Available from: <http://www.defense.gov/news/casualty.pdf>
38. Alexander GL, McClure JB, Calvi JH, Divine GW, Stopponi MA, Rolnick SJ, Heimendinger J, Tolsma DD, Resnicow K, Campbell MK, Strecher VJ, Johnson CC; MENU Choices Team. A randomized clinical trial evaluating online interventions to improve fruit and vegetable consumption. *Am J Public Health*. 2010;100(2):319–26. [PMID: 20019315] DOI:10.2105/AJPH.2008.154468
39. Hurling R, Catt M, Boni MD, Fairley BW, Hurst T, Murray P, Richardson A, Sodhi JS. Using internet and mobile phone technology to deliver an automated physical activity program: Randomized controlled trial. *J Med Internet Res*. 2007;9(2):e7. [PMID: 17478409] DOI:10.2196/jmir.9.2.e7
40. Napolitano MA, Fotheringham M, Tate D, Sciamanna C, Leslie E, Owen N, Bauman A, Marcus B. Evaluation of an internet-based physical activity intervention: A preliminary investigation. *Ann Behav Med*. 2003;25(2):92–99. [PMID: 12704010] DOI:10.1207/S15324796ABM2502_04
41. Prestwich A, Perugini M, Hurling R. Can implementation intentions and text messages promote brisk walking? A randomized trial. *Health Psychol*. 2010;29(1):40–49. [PMID: 20063934] DOI:10.1037/a0016993
42. Richardson CR, Brown BB, Foley S, Dial KS, Lowery JC. Feasibility of adding enhanced pedometer feedback to nutritional counseling for weight loss. *J Med Internet Res*. 2005;7(5):e56. [PMID: 16403720] DOI:10.2196/jmir.7.5.e56
43. Richardson CR, Mehari KS, McIntyre LG, Janney AW, Fortlage LA, Sen A, Strecher VJ, Piette JD. A randomized trial comparing structured and lifestyle goals in an internet-mediated walking program for people with type 2 diabetes. *Int J Behav Nutr Phys Act*. 2007;4:59. [PMID: 18021411] DOI:10.1186/1479-5868-4-59
44. Spittaels H, De Bourdeaudhuij I, Vandelanotte C. Evaluation of a website-delivered computer-tailored intervention for increasing physical activity in the general population.

Prev Med. 2007;44(3):209–17. [\[PMID: 17197015\]](#)
[DOI:10.1016/j.ypmed.2006.11.010](#)

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