



Contents lists available at ScienceDirect

Journal of Science and Medicine in Sport

journal homepage: www.elsevier.com/locate/jsams



U.S. Army physical demands study: Identification and validation of the physically demanding tasks of combat arms occupations

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ARTICLE INFO

Article history:

Received 24 March 2017
Received in revised form 7 September 2017
Accepted 14 September 2017
Available online xxx

Keywords:

Job analysis
Focus group
Questionnaire
Critical task
Army soldier
Physical exertion

ABSTRACT

Objectives: In 2013, the U.S. Army began developing physical tests to predict a recruit's ability to perform the critical, physically demanding tasks (CPDTs) of combat arms jobs previously not open to women. The purpose of this paper is to describe the methodology and results of analyses of the accuracy and inclusiveness of the critical physically demanding task list. While the job analysis included seven combat arms jobs, only data from the 19D Cavalry Scout occupation are presented as the process was similar for all seven jobs.

Design: Job analysis

Methods: As the foundation, senior subject matter experts from each job reviewed materials and reached consensus on the CPDTs and performance standards for each job. The list was reviewed by Army leadership and provided to the researchers. The job analysis consisted of reviewing job and task related documents and field manuals, observing >900 soldiers performing the 32 CPDTs, conducting two focus groups for each job, and analyzing responses to widely distributed job analysis questionnaires.

Results: Of the 32 CPDTs identified for seven combat jobs, nine were relevant to 19D soldiers. Focus group discussions and job analysis questionnaire results supported the tasks and standards identified by subject matter experts while also identifying additional tasks.

Conclusions: The tasks identified by subject matter experts were representative of the physically demanding aspects of the 19D occupation.

Published by Elsevier Ltd on behalf of Sports Medicine Australia.

1. Introduction

In 2013 the U.S. Secretary of Defense rescinded the 1994 Direct Ground Combat Definition and Assignment Rule, which was the law barring women from enlisting into combat occupations in the U.S. Armed Forces. This opened seven Army combat occupations to women including Infantryman, Indirect-fire Infantryman, Combat Engineer, Cannon Crewmember, Field Artillery Fire Support Specialist, Cavalry Scout and Armor Crewmember. To facilitate the incorporation of qualified personnel into these newly opened combat jobs, the Army developed physical employment standards (PES) screening tests to predict a recruit's ability to perform the critical, physically demanding tasks (CPDTs) of combat arms jobs.¹ Beginning in January 2017, all recruits must pass a PES screening

test before initiating training.^{2–4} Additional aspects concerning the development of the PES screening tests are published elsewhere.^{5–7}

PES tests are used for selection of emergency service personnel^{8,9} and other physically demanding occupations,¹⁰ as well as for defense organizations in the United Kingdom,¹¹ Canada¹² and Australia.^{13,14} Sharing PES among allied countries will assist in preparing for joint operations; however, it is critical that each organization examine the unique physical requirements of its own forces.¹⁵ The equipment, tasks and missions specific to each organization affects the physical demands of the tasks. For example, the type of body armor and load carriage equipment worn during a foot march will affect the difficulty of the task. It is important to perform a thorough physical job analysis to identify and accurately describe the critical tasks of each job.^{16–18}

From 2013–2015, U.S. Army Training and Doctrine Command (TRADOC) and U.S. Army Research Institute of Environmental Medicine (USARIEM) conducted the Physical Demands Study (PDS)

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to develop a PES pre-enlistment screening test to predict a recruit's ability to serve in a combat arms job. The first step was the physical job analysis to identify the CPDTs within each job. TRADOC tasked the Army Branch Offices for Infantry, Field Artillery, Armor, and Combat Engineers to develop a list of tasks critical and essential to their combat military occupational specialties (MOSSs) and to define the minimum acceptable performance standards (MAPSs) and conditions for task performance. TRADOC convened branch working groups (BWGs) consisting of senior service members, each of whom had worked in the branch training office for ≥ 12 months, held a senior rank in the MOS, and had deployed within three years. The BWGs identified the most physically demanding tasks in their MOS and determined quantitative MAPS for each task.¹⁹ They considered information from Army doctrine, the Center for Army Lessons Learned, and after action reports from deployed service members. The CPDTs, conditions and MAPS were reviewed and approved by a group of senior leaders in the operational forces (non-training). The TRADOC Commanding General approved the final list of 32 CPDTs, MAPSs and supporting justification (listed in Supplementary Appendix Table A.1).

As an additional check, the MAPS for each task were verified during training exercises involving hundreds of soldiers at five Army posts, representing all seven combat arms MOSs (unpublished white paper, J. Hydren, July 2015). Demographics for observed soldiers are in Supplementary Appendix Table A.2. During this observation period, quantifiable task parameters were recorded including weights, displacement (vertical and horizontal) of objects, distances traveled, protective clothing and equipment. If more than 10% of the soldiers could not perform a CPDT to the MAPS, the BWGs reviewed the task and revised it, if needed. This resulted in the review of seven CPDTs and changed the MAPS for three CPDTs. The remaining four tasks were deemed accurate and the higher failure rates attributed to lack of soldier training (i.e., grenade throw while wearing body armor), the testing procedures (i.e., inappropriate dummy used to remove a casualty from a vehicle), or adverse environmental conditions (i.e., high heat load during tactical foot movements).

The methods and results of this study describe the process used to establish the accuracy and inclusiveness of the CPDT list provided by the BWGs. Although the study included seven MOSSs, the 19D Cavalry Scout MOS (19D) is used to illustrate the process. The CPDTs relevant to 19Ds are relevant to several other MOSSs (see Table 1), demonstrating the generalizability of the job analysis results.

2. Methods

The research project was approved by the Internal Review Committee of USARIEM, adhered to the policies for protection of human subjects described in Army Regulation 70-25, and all research volunteers provided written or electronic informed consent.

The physical job analysis included examining Army doctrine for each CPDT, conducting focus groups and distributing a job analysis questionnaire (JAQ).^{20–22} The objectives for the focus groups were to ensure that the MAPS were accurate as written, to identify any additional CPDTs performed by soldiers in each MOS, and to estimate the frequency of CPDT performance in both training and deployed environments. Volunteers completed a demographic questionnaire,²³ which included deployment history and the number of times they completed each CPDT in both training and deployed environments. Two focus groups were conducted. One group consisted of eight junior enlisted soldiers (Private First Class through Sergeant) who would likely perform the CPDTs. The second group consisted of seven senior enlisted soldiers (Staff Sergeants and Sergeants First Class) who had experience performing and supervising the CPDTs.

During the focus group interviews, soldiers viewed slides outlining the CPDTs, conditions and MAPSs for 19Ds. They discussed: (1) whether each task was regularly performed; (2) the accuracy of the descriptions and equipment lists; and (3) the acceptable level of performance for each CPDT. Focus group members who believed a task description was inaccurate provided rationale for their opinions. After reviewing each task, the group identified and described additional physical tasks they performed in training or deployment.

Independent sample t-tests were used to examine differences between the demographics of junior and senior focus groups such as time in training and deployment environments, and frequency of completing CPDTs. The amount of time (years) soldiers spent in a training environment during their military career was calculated by subtracting time spent deployed from total time in the military. The average number of times soldiers completed each CPDT annually in training and deployed environments was calculated by dividing the total number of times they reported completing the task in each environment by the number of years they spent in each environment. The percentage of soldiers who had completed each task in training and/or deployed environments, as well as the percentage of soldiers who believed each task was accurate was calculated. Three-way analysis of variance (ANOVA) was used to examine differences in task frequency by rank (junior vs senior soldiers) and by environment (deployed vs training).

The 19D JAQ was designed to obtain information concerning both job-specific tasks and tasks common to more than one MOS. The JAQ consisted of demographic information (e.g., age, race, deployment history), and physical tasks with qualifying questions. The physical tasks included questions pertaining to frequency of task performance, importance of task performance to success in the MOS, time needed to complete each task, whether the respondent was expected to perform each task when the situation arose, and the uniform typically worn while completing each task. The tasks included the CPDTs specified by the SMEs, plus additional tasks derived from the focus groups, task observation and Army doctrine. There was an open-ended response option for participants to suggest additional CPDTs.²⁴

All current active duty 19D soldiers ($n = 8580$) received an email from the Commandant of the Armor School explaining the purpose of the JAQ, requesting their participation, and including a link to the JAQ. The responses of all participants were anonymous.

Descriptive statistics were calculated for the JAQ respondents. One-way ANOVAs and Duncan's post-hoc tests were used to analyze task mean differences in frequency, importance and time to complete. Task means for these items ranged from one to five for frequency and task importance or one to six for time spent to perform the task, with higher means indicating greater frequency, importance, and time spent. Chi-square analyses were used to identify which demographic groups of subjects were more likely to be expected to complete each of the tasks when the situation demanded.

3. Results

Senior 19D focus group members were older (35.7 ± 8.6 vs. 23.8 ± 4.9 years, $p < 0.01$), spent more time in the military (15.5 ± 7.8 vs. 3.4 ± 3.6 years, $p < 0.01$) and in their current MOS (11.9 ± 2.3 vs. 1.7 ± 0.8 years, $p < 0.01$), and were more likely to have been previously deployed (2.9 ± 0.9 vs. 0.7 ± 0.7 times, $p < 0.01$) than the junior 19Ds.

The junior 19Ds agreed with all CPDTs as written. The senior 19Ds agreed with most CPDTs, but stated soldiers would drop their gear prior to the grenade throw. They also stated they would not wear body armor while filling and carrying sandbags, because this was usually done in a secure environment. The BWG did not

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