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HUMAN RESEARCH

Human subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 on Use of Volunteers in Research.

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testing, the USARTEM Exercise Physiology Division personnel were required to test at four different Army posts simultaneously. The AIT posts included were Ft. Jackson, SC, Ft. Gordon, GA, Ft. Lee, VA and Ft. Sam Houston, TX. During Phase three, a series of performance tasks were also administered to the same soldiers. These performance tasks were designed to represent the true demands of the MOS categories. The Army Research Institute (ARI) was charged with the collection and analysis of the performance task data. The performance tasks involved lifting, pushing, pulling, carrying and torque tasks. After careful comparison of MEPSCAT battery scores and performance task scores, ARI found the Incremental Dynamic Lift test to be the best test item to use to match individual capacity to the performance of the MOS related job tasks. This recommendation has received careful scrutiny and review and has been approved at all levels within the Army, as well as the Office of the Secretary of Defense. A three year longitudinal follow up study will be performed by an army advisory group to determine the effectiveness of the MEPSCAT screening system in reducing work related injuries and improving the quality of job performance.

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USING RESEARCH TO MATCH THE SOLDIER TO THE JOB

BY

Marilyn A. Teves*

Early in 1984, all new accessions will be required to take a new strength test during in-processing at the Military Enlistment Processing Stations (MEPS). This test, called the Incremental Dynamic Lift (IDL), requires recruits to lift the handles of a weight machine to a height of 60", the approximate height of a 2 1/2 ton truck bed. All soldiers start by lifting 40 pounds. The weight is increased by 10 pounds each lift, until the soldier is unable to complete the lift, or the 120 pound maximum is attained. The purpose of this test is to match the soldier's lifting capacity to military occupational specialty (MOS) lifting requirements. The 350-plus Army MOS have been classified into high or low strength categories. The minimum passing weight a soldier must lift to be allowed entrance into the army is 40 lbs. Army enlistees able to lift 120 lbs will receive the highest possible score on this test. To qualify for the high strength category the soldier must be able to lift at least 80 lbs on the IDL test.

Although these standards and testing procedures seem relatively simple and straightforward, they represent years of careful research and planning involving several Army organizations. One of these, the US Army Research Institute of Environmental Medicine (USARIEM) located in Natick, MA has played a major role in this investigation. USARIEM is the Army Surgeon General's

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medical research and development laboratory responsible for examining the physical fitness needs of the Army. The Exercise Physiology Division of USARIEM, under the direction of Dr. James A. Vogel, was tasked by the Deputy Chief of Staff for Personnel in 1977 to develop a physical strength and stamina fitness test battery to help match the soldier with an MOS for which he/she meets the physical requirements. This began a five year effort involving several major, on-site field studies prior to the actual implementation of this new screening procedure. The new system will provide many benefits to the individual soldier if properly utilized. The MOS 51R-Interior Electrician may be used to illustrate this point. Most new recruits do not realize that during combat, interior electricians would perform dangerous front line duty laying minefields. All danger to life and limb aside, this duty would require lifting upwards of 100 lbs to remove obstacles to mine placement. If individuals who do not possess this lifting capacity are selected for this MOS it could lead to injury, job dissatisfaction and inefficient unit functioning.

Attempting to match the soldier to the MOS is not an easy task, and there are several steps necessary in the process. The first step is to determine the physical demands of each MOS. The next step is to determine the best way to test the soldiers' physical capabilities. Finally, a validation of the results of the first two steps must occur. This validation involves testing a group of soldiers, classifying them according to their physical work capacity, and placing them into an MOS for which they are physically and mentally qualified. Then the "on the job" performance of these soldiers must be assessed by experts within that MOS.

In 1977, the first step, MOS physical demands analysis, was begun with a group of MOS training school instructors. These wartime veterans were asked to identify and describe in detail all physically demanding tasks within each MOS. Once these strength and stamina requirements were identified, MOS's were grouped into five clusters based on similar strength and stamina requirements. For example, an 11B (Infantryman) falls into the high strength/high stamina cluster, while a 71L (Administrative Specialist) falls into the low strength/low stamina group.

With MOS strength requirements identified and the clustering completed, the next problem was to devise safe, easily administered tests to match the soldiers strength and stamina qualifications with one of the five clusters. Two on-site studies were conducted to determine the best tests to utilize in the MEP stations. Early in 1978, approximately 950 male and 500 female basic trainees at Ft Jackson, SC participated in an experiment to determine the best way to test soldiers' aerobic capacity, or stamina. These tests included running on a treadmill, bench stepping and skinfold measurements (the "pinch test") to predict percent body fat and lean body mass. These three tests are all good indicators of maximal oxygen uptake, or the maximum amount of oxygen the body can process each minute. While the treadmill test is the most accurate measure of oxygen consumption, the test procedure is very time consuming and requires much expensive equipment. The Exercise Physiology Division of USARIEM found that people could be satisfactorily classified aerobically using only their calculated percent body fat and their sex.

The second study was conducted in the fall of 1979 at Ft Stewart, GA. For

this study strength classification, or more precisely lifting ability, was of primary concern. 83 male and 44 female active duty troops assigned to the 24th Infantry Division were tested on a series of strength measures, skinfolds, and a lifting task. Six isometric tests were used, in which the soldiers pulled, pushed, or squeezed as hard as they could against an immovable piece of equipment that registered their force. Isometric strength of the hand grip, back, upper body, leg, and two isolated positions in a lifting movement were measured. These isometric strength measures were then compared to the amount of weight soldiers were able to lift to the height of a 2 1/2 ton truck bed. Three measures were found to be the best classifiers: lean body mass (total body weight minus fat weight), sex, and score on an isometric upright pull test with handle height of 38cm.

Based on the data collected at Ft Jackson and Ft Stewart, the measures needed to classify recruits into both strength and stamina categories were: skinfold determination of percent body fat and lean body mass, 38cm isometric upright pull force, and the sex of the soldier. This information could be easily and safely obtained from recruits at the military entrance processing stations and used in the job counselling session.

The Women in the Army Policy Review Group (WTAPRG) came into being prior to implementation of this system. Its purpose was to examine problems and policies affecting women in the army. Some of the issues addressed were the uneven distribution of women in the many non-combat MOS's and the complaint from army field commanders that some women were physically incapable of performing their MOS duties. The WTAPRG decided to re-examine the MOS task analysis by a somewhat different methodology--similar to that of the US Department of Labor--which did not include the stamina aspects of the job.

With Army MOS's newly classified according to strength requirements, the strength testing procedures needed to be re-considered. In 1981, when the Secretary of the Army asked the USARIEM Exercise Physiology Division to re-evaluate and validate a gender free military enlistment physical strength capacity test battery (MEPSCAT), they were more than ready to meet this challenge. Based on previous research efforts at Ft Jackson and Ft Stewart, five items were included for consideration in the new MEPSCAT battery:

1. Exercise heart rate bench stepping test of stamina
2. Skinfold determination of percent body fat and lean body mass
3. Isometric 38cm upright pull force-a measure of static lifting strength
4. Isometric handgrip force-indicative of whole body strength
5. Maximal incremental dynamic lift to 152cm and 183cm-a machine test of lifting strength

The study consisted of three MEPSCAT battery administrations. Phase one--Pre-Basic Training evaluation was performed on 980 male and 1000 female new recruits at Ft Jackson, SC during September and October, 1982. Phase two--Post Basic Training evaluation was a subsample of the original group consisting of 90 males and 110 females. The purpose of Phase two was to examine changes in fitness levels following 7 weeks of basic training. Phase three--Post-Advanced Individual Training evaluation was administered to 470 males and 485 females who were members of the original

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With the implementation of the new MEPSCAT system, a major effort by the medical research community will be completed, and the improved personnel management tools provided will be utilized throughout the Army. The USARIEM Exercise Physiology Division is now focusing its sites one step higher - to determine the physical demands of units during combat. This is another initiative in their mission to improve the physical readiness of our soldiers.