Physiological Sex Differences: How They Informed the Integration of Women into the Army Combat Arms Military Occupational Specialties (MOSs)

Defense Advisory Committee on Women in the Services Meeting
Alexandria, VA
22 March 2017

Marilyn Sharp
Military Performance Division
U.S. Army Research Institute of Environmental Medicine
Natick, MA
marilyn.a.sharp.civ@mail.mil

OPAT Background

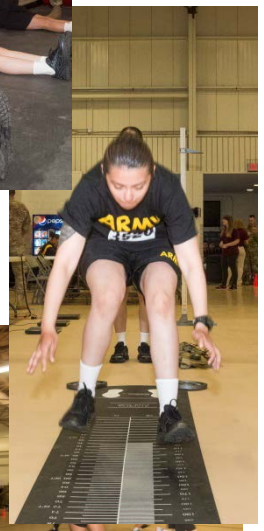
- 2013: USARIEM was tasked by TRADOC to develop predictive physical performance tests for Soldiers in combat arms military occupational specialties (MOSs) as part of Soldier 2020

- 2013-15: The USARIEM Physical Demands Study of active duty Soldiers resulted in the development and concurrent validation of the Occupational Physical Assessment Test (OPAT).

- The goal of the OPAT is to select recruits with the physical potential to perform the critical physically demanding tasks of combat arms MOSs.

- In JAN 2016, CSA GEN Milley ordered the OPAT be used to screen all individuals entering the Army (non-combat MOS, Officers, Cadets, Reserves, National Guard).

- JAN-DEC 2016 USARIEM longitudinally validated the OPAT procedures and standards in new recruits.

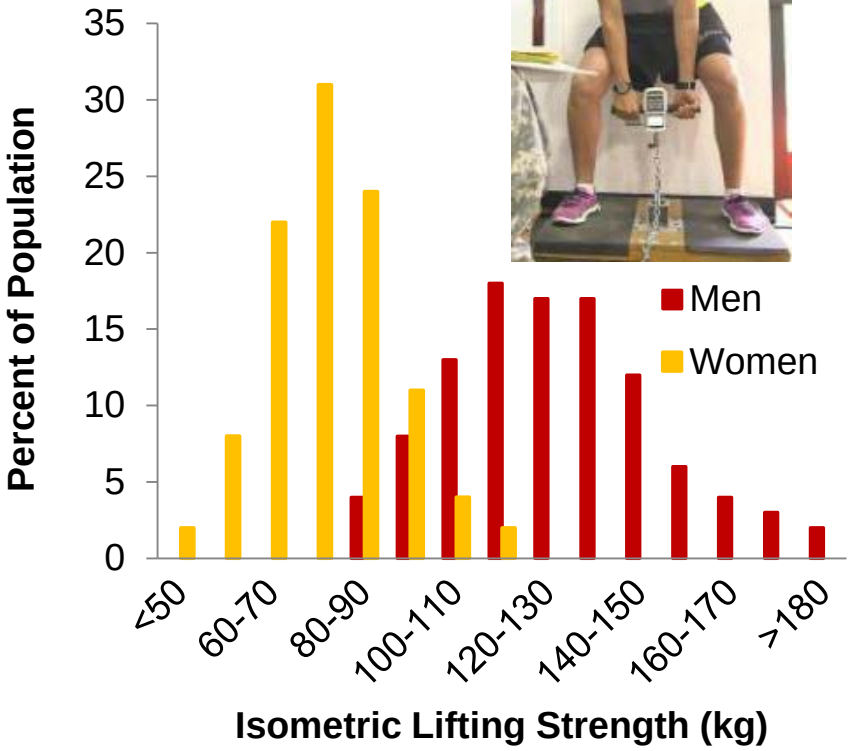


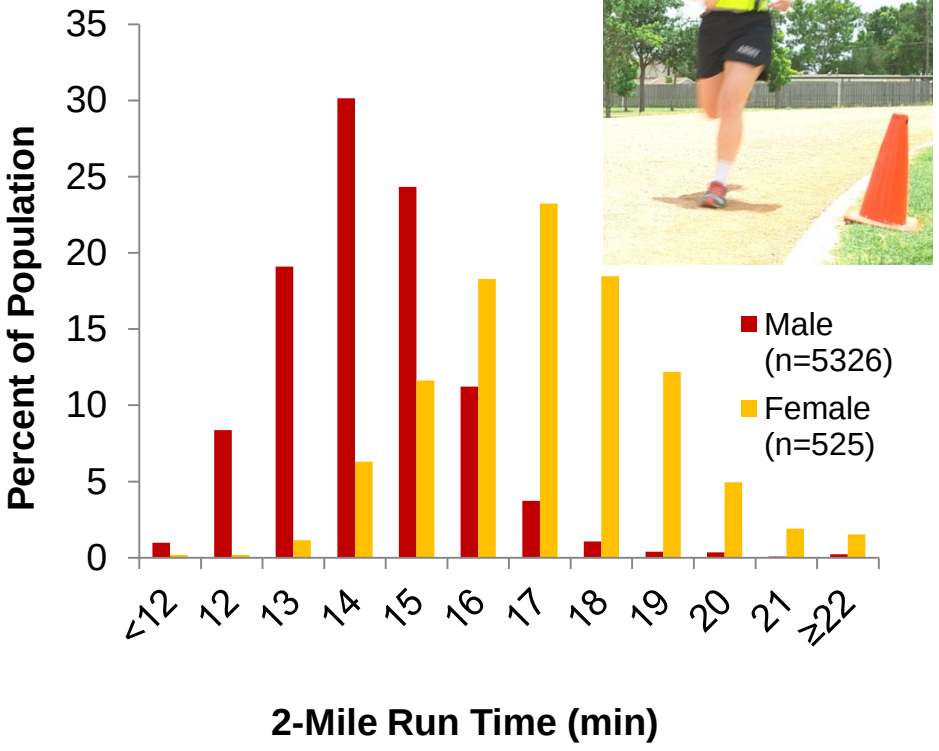
Physiological Differences

- Compared to men, women have:
  - 8% less height
  - 20% less weight
  - 10% more fat mass
  - 30-50% less **muscle mass**
  - 30% smaller lung capacity
  - 25% lower cardiac output
  - 10-30% lower **maximal oxygen uptake**
  - 40-60% less **muscle strength**
  - 30-40% less **anaerobic power**
  - 26% lower **tibial bone strength**

These factors result in greater maximal physical performance in men and contribute to higher musculoskeletal injury rates in women when performing physically demanding tasks

Distribution of Isometric Lifting Strength and Run Time by Sex



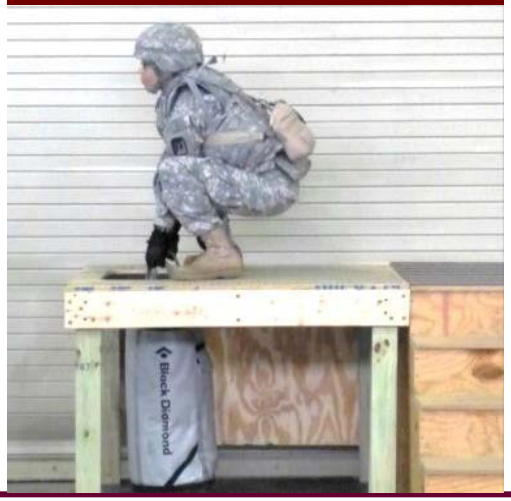


There are clear sex differences in performance, but some women can outperform some men.

Maximal Performance vs Meeting the Standard

Load 18 - 55lb tank rounds in 10 min

Lift half the weight of a 207 lb casualty.



	Men	Women	Women/Men Ratio
Resupply rate (rounds·min^{-1})	7.15	3.26	45%
% Performing to Standard (1.8 rounds·min^{-1})	100%	78%	78%
Casualty Evac (lbs)	200	133	67%
% Performing to Standard (100 lbs)	100%	86%	86%

Sex comparisons based on maximal effort may be different from those focused on successful task completion. The important question is:

Does the Soldier have the physical capacity to complete the task to standard?

(Foulis, et al, DTIC: AD1007832, 2015)

Considerations for Soldier Assignment

When developing the OPAT:

- Ensure critical job tasks are accurately defined and allow for alternative techniques if safe and efficient
- Base minimum acceptable standards on actual job requirements, not on incumbent male performance
- Consider gender bias in selection of predictor tasks
- Ensure women are proportionately represented in all validation testing
- Ensure all Soldiers have adequate training and practice to perform the critical job tasks
- Ensure performance on predictor tests is statistically related to performance of critical job tasks

Sex Differences & Injury

- In initial entry training (IET), women tend to be injured at 2X the rate of men (~50% vs 25%)
- During IET women have a 3X greater risk of stress fracture
- The sex difference appears to be lower for incumbent Soldiers than for recruits (1.2-1.5), but varies with MOS and deployment
- Structural and biomechanical differences may increase the risk of women for some injuries
- The higher relative work intensity required of women compared to men may also increase the propensity for injury (% aerobic capacity, % maximal strength)
- Irrespective of sex, lower fitness is correlated with increased risk of injury

(Hauret, AJSM, 2015)

Implications

- There are select women who, through their innate capabilities and/or training, will be able to meet these demands.
- A major medical issue for women in combat MOSs will be musculoskeletal injuries (overuse) resulting in:
  - Loss of duty days
  - Delay in completion of training
  - Medical costs, Disability discharges
  - Quality of life