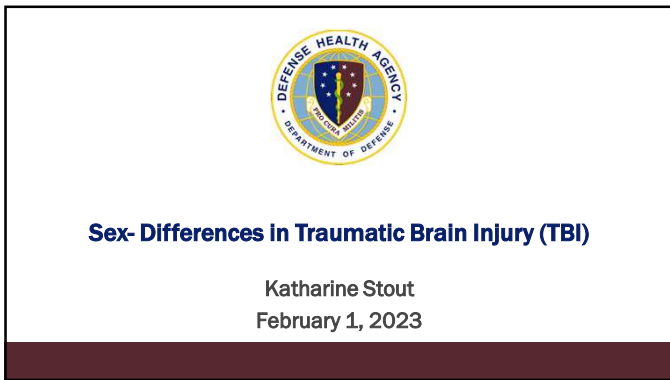
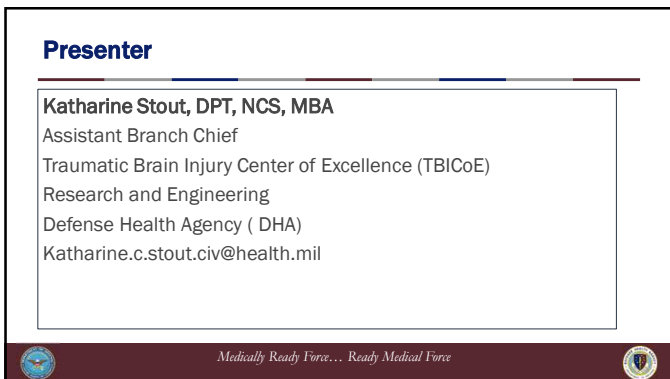




1




2



3

Disclaimer


The views expressed in this presentation are those of the authors and do not necessarily represent the official policy or position of the Defense Health Agency, Department of Defense, or any other U.S. government agency. For more information, please contact dha.TBICOEinfo@health.mil.

*Medically Ready Force... Ready Medical Force*

4

Learning Objectives


- At the conclusion of this presentation, the participants will be able to:
 - Describe two differences in TBI rates between men and women.
 - Describe two differences in post-concussion symptom reporting between men and women.
 - Name one physiological difference between men and women that may contribute to different outcomes after TBI.

*Medically Ready Force... Ready Medical Force*

5

Outline

- Why gender differences?
- Epidemiology
- Post-concussive symptoms
- Functional outcomes
- Behavioral/emotional outcomes
- Conclusions

*Medically Ready Force... Ready Medical Force*

6

Biomechanics and hormones may play a role

- There is some evidence that menstrual cycle phase impacts symptoms and recovery in women after mTBI. (Wunderle et al., 2014)
- Among 64 patients with mTBI, those with the larger rectus capitis posterior minor muscles had lower symptom severity and shorter recovery time. (Fakhran et al., 2016)




Image source: wikipedia

Rectus capitis posterior minor muscles

Medically Ready Force... Ready Medical Force

7

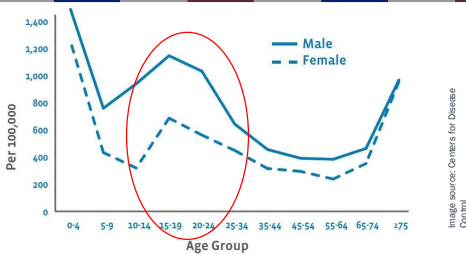
Female sex hormones

- Pre-clinical data shows that progesterone improves experimental TBI outcomes in animals (Brodfain et al., 2016)
- Researchers have yet to translate positive results in a large-scale clinical trial
 - PROTECT III and SYNAPSE showed no benefit (Wright et al., 2014; Skolnick et al., 2014)

Medically Ready Force... Ready Medical Force

8

Females experience fewer TBIs overall



Age Group	Male (Per 100,000)	Female (Per 100,000)
0-4	1400	1300
5-9	800	450
10-14	400	350
15-19	1100	700
20-24	1000	550
25-34	600	450
35-44	450	350
45-54	400	300
55-64	400	250
65-74	450	350
75+	1000	900

Image source: Centers for Disease Control

Medically Ready Force... Ready Medical Force

9

Female athletes sustain more concussions per athlete-exposure

- An athlete-exposure is one practice or game for one person
- Several studies have found higher concussion rates in females
- College ice hockey, soccer, and basketball data shown.

Sport (no. years data collected)	Men (n = 706)	Women (n = 750)
Ice hockey (4 years)	~2.2	~2.7
Soccer (16 years)	~1.1	~1.4
Basketball (16 years)	~0.4	~0.6

(Dick, 2009)
* = Significant difference based on non-overlapping CIs
Image source: Br J Sports Med

Medically Ready Force... Ready Medical Force

10

Female athletes may be more likely to report a concussion

- 288 high school athletes, 31% female, 80% with no concussion history
- Surveyed regarding 13 possible reasons for not reporting a concussion
- Females reported more willingness to report concussion on 8 of 13 questions
- Top reason for not reporting was same for male and female: they did not think it was serious (49.5% of males, 38.9% of females)**

Medically Ready Force... Ready Medical Force

11

Symptom Reporting

- Females report more symptoms, and more severe symptoms
 - Case-control study regarding gender differences in combat mTBI. Females had higher scores on Neurobehavioral Symptom Inventory (NSI) and PTSD Symptom Checklist (PCL) scores, but there was no gender difference in proportion of participants with clinically elevated PCL scores. (Brickell et al., 2016)
 - Prospective study of 1,425 civilians with mTBI (recruited from an emergency department) found that 3 months after injury, females reported more symptoms and more severe post-concussive symptoms than males. (Bazarian et al., 2010)
 - SCAT-2 Results of 147 student athletes at initial clinic visit (average 9 or 12 days post-injury for men and women) (Baker et al., 2016)
 - Meta-analysis that reports females are 43% more likely to report any baseline symptom and have significantly higher odds of reporting individual symptoms of difficulty concentrating, hearing/vision problems, headache/migraine, emotional disturbance, and energy/sleep disturbance (Brown et al 2016).

Medically Ready Force... Ready Medical Force

12

Female athletes take longer to return to play (RTP)

- Retrospective study of athletes with sports concussion: 365 males (age 15 ± 1.7), 214 females (age 15.2 ± 1.5)
- Outcome: time to be cleared by physician for RTP progression
- Females took longer to start RTP progression (29.1 ± 26.3 days) compared with age-matched males (22.7 ± 18.3 days; P = 0.002).

Medically Ready Force... Ready Medical Force

13

Depression after TBI: Gender effect unclear

- Evidence is inconsistent regarding gender differences in depression after TBI.
- Systematic review and meta-analysis examined results from 8 studies including 768 civilians with TBI of any severity.
 - Females were just under twice as likely to be diagnosed with MDD after TBI as compared to men. (OR 1.72, 95% CI 1.19 to 2.48). (Cnossen et al., 2017)
- Recent study of 238 civilians with moderate or severe TBI (25% female) found no gender difference in depression symptoms after 1 year. (Lavoie et al., 2017)

Medically Ready Force... Ready Medical Force

14

Female veterans report intimate partner violence and PTSD symptoms

- In a web-based survey of 411 U.S. women veterans, 224 (55%) reported a lifetime history of intimate partner violence (IPV).
- Of these, 28% (63 of 224) screened positive for history of IPV-related TBI.
- IPV-related TBI was associated with probable post-traumatic stress disorder (PTSD).

(Iverson, Dardis, & Pogoda, 2017)

Medically Ready Force... Ready Medical Force

15

Take-home messages

- In the general population, females sustain fewer concussions than males. (Faul et al., 2010)
- Females sustain concussions via different mechanisms. (Coronado et al., 2015)
- Females service members, civilians, and athletes report a higher number and more severe post-concussion symptoms, according to available data. (Dick, 2009; Brickell et al., 2016; Bazarian et al., 2010)
- Intimate partner violence (IPV) related TBI is associated with post-traumatic stress disorder (PTSD) in U.S. veterans. (Iverson, Dardis, & Pogoda, 2017)
- Biomechanics and hormones may play a role in injury risk and recovery outcomes. (Wunderle et al., 2014; Fakhran et al., 2016)

Medically Ready Force... Ready Medical Force

16

Way forward

- Current clinical evidence based on self report measures
 - **Need objective data sources**
- Most research that is gender specific is focused on neurocognitive and mood related symptoms
 - **Gender differences in vestibular, visual, and auditory processing and other areas of sequelae from concussion are current research gaps**

Medically Ready Force... Ready Medical Force

17

Way forward (continued)

- Most data discussed in female-focused civilian concussion studies is from females with persistent post concussion symptoms
 - **Need to stratify cohorts into acute and chronic to elucidate mitigation and treatment factors**
- Current female component of armed forces is 17% (Defense Manpower Data Center, 2020)
 - **Need studies to represent this portion of female cohorts**

Medically Ready Force... Ready Medical Force

18

References

Baker, J. G., Ledy, J., Darling, S. R., Shucard, J., Melkissidi, M., & Willer, B. S. (2016). Gender Differences in Recovery From Sports-Related Concussion in Adolescents. *Clin Pediatr (Phila)*, 55(8), 771-775. doi:10.1177/0009922815606417

Bazarian, J. J., Byth, B., Monnerette, S., He, H., & McDermott, M. P. (2010). Sex differences in outcome after mild traumatic brain injury. *J Neurotrauma*, 27(3), 527-539. doi:10.1089/neu.2009.1068

Berry, C., Ley, E. J., Tillou, A., Oyer, G., Margulies, D. R., & Salim, A. (2009). The effect of gender on patients with moderate to severe head injuries. *J Trauma*, 67(5), 950-953. doi:10.1097/TA.0b013e3181923354

Brickey, T. A., Lippa, S. M., French, L. M., Kennedy, J. E., Bailie, J. M., & Lange, R. T. (2016). Female Service Members and Symptom Reporting after Combat and Non-Combat-Related Mild Traumatic Brain Injury. *J Neurotrauma*. doi:10.1089/neu.2016.4403

Brown DA, Elias JA, Miller AJ, Reed LE, Renshaw JC. Differences in Symptom Reporting Between Males and Females at Baseline and After a Sports-Related Concussion: A Systematic Review and Meta-Analysis. *Sports Med*. 2015;45(7):1027-40.

Broffman, E., Grunbaum, S. E., Boyko, M., Kutz, R., Zlotnik, A., & Klein, M. (2016). Neuroprotection by Estrogen and Progesterone in Traumatic Brain Injury and Spinal Cord Injury. *Curr Neuropharmacol*, 14(6), 614-623.

Crossen, M. C., Scholten, A., Lingam, H. F., Synnot, A., Haugma, J., Steyerberg, P. E., & Polinder, S. (2017). Predictors of Major Depression and Posttraumatic Stress Disorders Following Traumatic Brain Injury: A Systematic Review and Meta-Analysis. *J Neuropsychiatry Clin Neurosci*, Epub 2017 Feb 14. appineuropsych16090165. PMID: 28193126

Coronado, V. G., Halseyenus, Y., Cheng, T. A., Bell, J. M., Heerbaue-Krupa, J., Liorbanger, M. R., ... Glchrist, J. (2015). Trends in Sports and Recreation-Related Traumatic Brain Injuries Treated in US Emergency Departments: The National Electronic Injury Surveillance System-All Injury Program (NEISS-APJ 2001-2012). *J Head Trauma Rehabil*, 30(3), 185-197. doi:10.1097/HTR.0000000000000156

Defense Manpower Data Center. (2020). Active Duty Military Personnel by Service by Rank/Grade. Retrieved from https://www.dmdc.osd.mil/appj/dep/rest/download?fileName=rg1612_female.pdf&group=Name+Rank+Grade

Dick, W. (2009). Is there a gender difference in concussion incidence and outcomes? *Br J Sports Med*, 43 Suppl 1, i46-50. doi:10.1136/bjsm.2009.058172

Fakhren, S., Qi, C., & Anilini, L. M. (2016). Effect of the Suboccipital Musculature on Symptom Severity and Recovery after Mild Traumatic Brain Injury. *JNIR Am J Neurorehabil*. doi:10.3174/jnir.44730

Medically Ready Force... Ready Medical Force

19

References

Faul, M., Xu, L., Wald, M., & Coronado, V. G. (2010). Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths 2002-2006. Centers for Disease Control and Prevention, Atlanta (GA). Retrieved from http://www.cdc.gov/traumaticbraininjury/pdf/brain_book.pdf

Harrison-Felix, C., Kreider, S. E., Arango-Laspalla, J. C., Brown, A. W., Dijkers, M. P., Hammond, F. M., ... Zessler, N. D. (2012). Life expectancy following rehabilitation: a NIDRR Traumatic Brain Injury Model Systems study. *J Head Trauma Rehabil*, 27(6), E69-80. doi:10.1097/HTR.0b013e3182738010

Herrera-Metero, M. C., Egea-Guerrero, J. J., Vilches-Arenas, A., Rincon-Ferrari, M. D., Flores-Cordero, J. M., Leon-Carrion, J., & Murillo-Cabezas, F. (2015). Acute predictors for mortality after severe TBI in Spain: Gender differences and clinical data. *Brain Inj*, 29(12), 1439-1444. doi:10.3109/02699052.2015.1071428

Iverson, K. M., Dantia, C. M., & Pogoda, T. K. (2017). Traumatic brain injury and PTSD symptoms as a consequence of intimate partner violence. *Compr Psychiatry*, 74, 80-87. PMID: 28126481

Lavoie, S., Sechrist, S., Quach, N., Ehsanlian, R., Duong, T., Gotlib, I. H., & Isaac, L. (2017). Depression in Men and Women One Year Following Traumatic Brain Injury (TBI): A TBI Model Systems Study. *Front Psychol*, 8, 634. doi:10.3389/fpsyg.2017.00634

Ley, E. J., Short, S. S., Liu, D. Z., Singer, M. B., Mincha, J., Melo, N., ... Salim, A. (2013). Gender impacts mortality after traumatic brain injury in teenagers. *J Trauma Acute Care Surg*, 75(4), 682-686. doi:10.1097/TA.0b013e31829d024f

Niemeier, J. P., Marwitz, J. H., Lester, K., Walker, W. C., & Bodnick, T. (2007). Gender differences in executive functions following traumatic brain injury. *Neuropsychol Rehabil*, 17(3), 293-313. doi:10.1080/09602000600844729

Niemeier, J. P., Perrin, P. B., Holcomb, M. G., Robston, C. D., Artman, L. K., Lu, J., & Nersissova, K. S. (2014). Gender differences in awareness and outcomes during acute traumatic brain injury recovery. *J Womens Health (Larchmt)*, 23(7), 573-580. doi:10.1089/jwh.2013.4535

PinKConcussions.com. (2021). PinK Concussions: Female Concussions via sports, violence, accidents or military services. from <http://www.pinkconcussions.com/>

Rigon, A., Tarkstra, T., Mutis, B., & Duff, M. (2016). The female advantage: sex as a possible protective factor against emotion recognition impairment following traumatic brain injury. *Cogn Affect Behav Neurosci*, 16(5), 866-875. doi:10.3758/s13415-016-0437-0

Medically Ready Force... Ready Medical Force

20

References

Robertson, C. L., Fishan, E., Zhanley, R. M., Nigg, C., & Bayir, H. (2015). Progesterone for neuroprotection in pediatric traumatic brain injury. *Pediatr Crit Care Med*, 16(3), 235-244. doi:10.1097/PCC.0000000000000323

Saban, K. L., Smith, B. M., Collins, E. G., & Page, T. L. (2011). Sex differences in perceived life satisfaction and functional status one year after severe traumatic brain injury. *J Womens Health (Larchmt)*, 20(2), 179-186. doi:10.1089/jwh.2010.2324

Scholten, A. C., Haugma, J. A., Crossen, M. C., Cliff, M., van Beeck, E. F., & Polinder, S. (2016). Prevalence of and Risk Factors for Anxiety and Depressive Disorders after Traumatic Brain Injury: A Systematic Review. *J Neurotrauma*, 33(22), 1959-1994. doi:10.1089/neu.2015.4252

Seedat, S., Scott, N. M., Angermeyer, M. C., Bejda, P., Broner, E. J., Brugha, T. S., ... Kessler, R. C. (2009). Cross-national associations between gender and mental disorders in the World Health Organization World Mental Health Surveys. *Arch Gen Psychiatry*, 66(7), 785-793. doi:10.1001/archgenpsychiatry.2009.36

Singh, M., & Siu, C. (2013). Progesterone-induced neuroprotection: factors that may predict therapeutic efficacy. *Brain Res*, 1514, 18-105. doi:10.1016/j.brainres.2013.01.027

Srinivas, B. E., Maas, A. I., Narayan, R. K., van der Kooij, R. G., Mackintosh, T., Ward, J. D., ... Investigators, S. T. (2014). A clinical trial of progesterone for severe traumatic brain injury. *N Engl J Med*, 371(26), 2487-2496. doi:10.1056/NEJMoa1411090

Stone, S., Lee, B., Garrison, J. C., Blumitt, D., & Creed, K. (2016). Sex Differences in Time to Return-to-Play Progression After Sport-Related Concussion. *Sports Health*. doi:10.1177/1941788116672184

Wallace, J., Covassin, T., & Beecher, E. (2017). Sex Differences in High School Athletes' Knowledge of Sport-Related Concussion Symptoms and Reporting Behaviors. *J Athl Train*, 52(7), 682-688. doi:10.4085/1062-0019.16.3106

Wright, D. W., Kelemanni, A. L., Hertzberg, V. S., Clark, P. L., Frankel, M., Goldstein, F. C., ... Stein, D. G. (2007). PROTECT: a randomized clinical trial of progesterone for acute traumatic brain injury. *Ann Emerg Med*, 49(4), 391-402. doi:10.1016/j.annemergmed.2006.07.932

Wright, D. W., Yeatts, S. D., Silberglied, R., Pinesch, V. Y., Hertzberg, V. S., Frankel, M., ... Investigators, N. (2014). Very early administration of progesterone for acute traumatic brain injury. *N Engl J Med*, 371(26), 2487-2496. doi:10.1056/NEJMoa1404304

Wunderlic, K., Hoeger, K. M., Wasserman, E., & Bazarian, J. J. (2014). Menstrual phase as predictor of outcome after mild traumatic brain injury in women. *J Head Trauma Rehabil*, 29(5), E4-8. doi:10.1097/HTR.0000000000000006

Xiao, G., Wei, J., Yan, W., Wang, W., & Lu, Z. (2008). Improved outcomes from the administration of progesterone for patients with acute severe traumatic brain injury: a randomized controlled trial. *Crit Care*, 12(2), R61. doi:10.1186/cc5887

Medically Ready Force... Ready Medical Force


21

Evidenced based programs for MSKI for CAF Women throughout their career and supported by research

Observations from the US and CAN

US Surgeon General
MSI led to the most frequent medical visits with over 2 million medical encounters in 2012, the greatest number of theater evacuations for non-combat injuries, and the most likely reason for disability discharge from the military.²
According to the most recent Health of the Force Report (2016), 17% of soldiers were medically non-deployable for reasons linked to injuries and overweight status.

CAF
The prevention and reduction of MSKi is one targeted way to improve recruit and retain. From 2014-2017, women had higher percentage of medical releases than men (43% vs 39%) and at earlier points in their careers (14 years vs 17 years) (Serr L, 2019)




25

Evidenced based programs for MSKI for CAF Women throughout their career and supported by research

Considerations

Injury rates in female and male military personnel: a systematic review and meta-analysis (Schram, et al. 2022)

While this review found a higher rate of reported injuries in female military personnel when compared to male personnel, differences between the sexes in average fitness levels and injury reporting behaviors may explain this rate difference and the difference is most pronounced at BMQ and reduced thereafter, possibly due in part to a reduced difference in fitness between the sexes or increased opportunity to self determine workloads relative to fitness levels




26

Evidenced based programs for MSKI for CAF Women throughout their career and supported by research

Existing Initiatives

- Examples of successful programs
 - 8 week Maternity Wellness Program at 4 Wing Cold Lake.
 - CFB Petawawa has had a PSP led post-natal exercise program for appx 5 years.
- An example of occupational specific CFHS and PSP led physical training designed to reduce work related MSKi is the Air Crew Conditioning Program. (Smith and Reilly, 2021).
- Recent research initiatives directed by CFRG and CFLRS attempted to provide virtual physical training to recruits awaiting training due to COVID-19 related Public Health restrictions.
- GRIT Injury prevention training at CFB Meaford (DP1 INF) CFB Gagetown (ATCC – 25% Women), CFHSTC (-70%)
 - 3 DP1 EXP vs CON resulted in 58% less Overuse MSKi and 371 fewer MEL days



27


Evidenced based programs for MSKI for CAF Women throughout their career and supported by research

Prevention of injuries in female service members

1. Prepare women for occupational/operational training;
2. Reduce susceptibility to musculoskeletal injury;
3. Accommodate women during career interruptions; and
4. Maintain function through aging and gender specific development stages.

\$18M over 5 years. 28 new positions. 16 B/W 12 HQ


DCMP asked us to “to submit a holistic plan looking specifically a female programs for prevention throughout someone career. From new recruits, occupations specific, pre/post-partum, sedentary transition, and 40+/menopausal. PSP programs and research topic.”



28

Evidenced based programs for MSKI for CAF Women throughout their career and supported by research

Women’s wellness 5 year plan




- RECRUITMENT AND BASIC TRAINING**
Pre-MSKI physical fitness training for applicants emphasis on individual results based on self-assessments.
- 1ST POSTING (0-25 YEARS)**
Increased on specific training focused on enhancing occupational health fitness by continuing and increasing lean body mass at onset of career.
- DEPLOYMENT (25-40+ YEARS)**
Epidemiology and bioactive analytics to guide the development of targeted interventions related to Operational Occupational training and injury prevention.
- CAREER INTERRUPTION/PRE-NATAL/POSTPARTUM PROGRAMS (PMPs)**
More CAF emphasis on military employment capabilities during pregnancy and a post-natal program in collaboration with C-14 to ensure up to date on lean body mass and long leave (6-18 months).
- PROMOTION/BACK AT THE DESK (40-50+ YEARS)**
CAF emphasis on health related physical training to maintain lean body mass and achieve a healthy weight FORCE Test Compliance should also be an area of focus to gain support resource allocation.

In Consultation with:
 Col / col H.L. Wright
 Director Force Health Protection and Health Care for Diversity
 Canadian Armed Forces
 Cell: 613-292-9671 / Email: helen.wright@forces.gc.ca

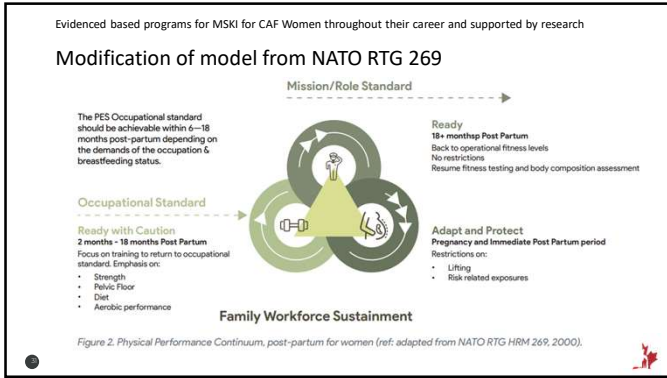
29

Metrics to determine effectiveness of programs

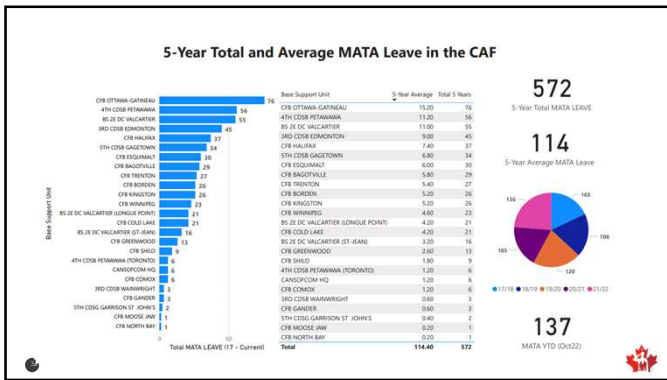
1. Number of new women applicants and recruits
2. Rates of injuries by gender and by course
3. BALANCE metrics by gender
4. FORCE compliance and results by gender
5. Overall participation in wellness and fitness activities
6. Increased percentage of women in leadership positions and on operations
7. Percentage of medical releases by gender
8. Length of career by gender



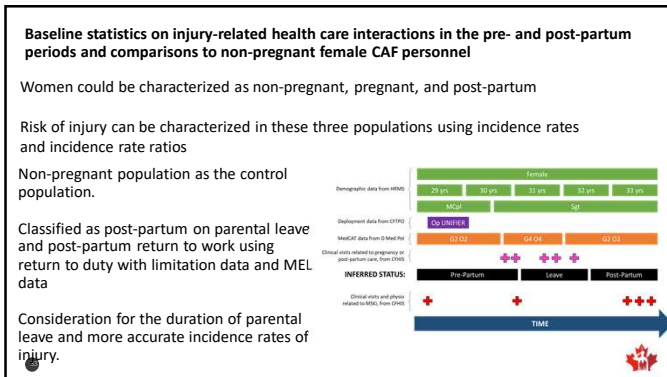
30



31




32



33

CAREER INTERRUPTION/PRENATAL/POSTPARTUM PROGRAMS (PNP3)
 More CAF exploration on military employment capabilities during pregnancy and a post-natal program in collaboration with CFHS to ensure op readiness at return from long leave (6-18 months).

- P3T (US) PERFORM (UK) NEPPE (EU) New Era of Pre- and Postnatal Exercise
- PRE-NATAL: CSEP trg manual
 - An increased risk of falling and musculoskeletal injuries, potentially related to laxity of the pelvic ligaments
- POSTPARTUM:
 - Ligaments may require up to 3 months to return to pre-pregnancy configuration. Abdominal muscle function (Salari, et al 2014; Kovac et al 2016).
 - These recent research findings should be considered in Post-Natal training to optimize recovery and minimize chance of injury.




34

Postpartum Exercise and Return to Fitness: Optimize Readiness for Military Mums (PERFORM)

Army Health and Performance Research (AHPR)

- Measurements include:
 - Occupational physical performance,
 - Pelvic health:
 - Pelvic organ prolapse will be measured by a pelvic health physiotherapist at weeks 6, 12, and 24;
 - Pelvic floor strength will be measured by a pelvic health physiotherapist at weeks 6, 12, and 24 using the PERFECT (power, endurance, repetitions, fast, every contraction timed) scheme; and
 - Musculoskeletal physiotherapy assessments performed by a pelvic health physiotherapist at weeks 6, 12, and 24.
- Musculoskeletal health outcomes:
 - vertical jump, mid-thigh pull, seated medicine ball throw, and a timed 2-km run.
- Psychological well-being:
 - quality of life.



35

Optimizing Women's Health in the Officer Cadet Environment

Lt Col Jessica Lotridge, MD, MTM&H, CTropMed®
 Chief of Preventive Medicine
 USAF Academy, CO



36

Disclosures

- No financial interests to disclose

37

Summary

- Service Academy Curriculum
- 10th MDG Overview
- Bone Stress/Overuse Injuries
- Female Athlete Triad
- Abnormal Uterine Bleeding
- Preventive Care
 - Cervical Cancer Screening
 - HPV Vaccination
 - STIs
 - Contraception

38

Service Academy Curriculum

- Military Training
 - Academic year squadrons
 - Summer courses
 - Airmanship
- Academics
 - Robust core curriculum
- Athletics
 - PE courses
 - Fitness testing
 - Competitive sports
- Character Development
- Goal – skills and knowledge to succeed as an officer
- Must meet accession and retention standards entire 4 years



39

10th Medical Group Overview

- Cadet Clinic
 - Cadet Medicine
 - Primary Care
 - Sports Medicine
 - Adolescent Medicine
 - Preventive Medicine
 - Immunizations
 - Flight Medicine
 - Dental
 - Physical Therapy
 - Optometry
 - Pharmacy
 - Lab
 - Radiology
 - Plain film
- 10th MDG
 - Mental Health
 - Women's Health
 - Nutrition
 - Subspecialty Care
 - Allergy/Immunology
 - Cardiology
 - Dermatology
 - Neurology
 - Surgical Specialties
 - General surgery
 - ENT
 - Orthopedics
 - Ophthalmology
 - Podiatry
 - Radiology
 - CT
 - US
 - MRI

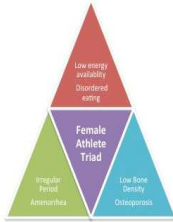
40

Bone Stress/Overuse Injuries

- Especially of lower extremities
- Causes
 - Low aerobic fitness
 - Low physical activity level prior to training
 - Short stature
 - Low body mass
 - Previous injury
 - Menstrual irregularities
- Prevention
 - Enter training with high aerobic fitness
 - Lower extremity strength training
 - Address menstrual irregularities
- USAFA Practices
 - Impact
 - Can delay training or result in turnback/MEB
 - Management
 - Appointee Handbook
 - Graded exercise plan with goals for overall fitness and by gender
 - Created by Athletic Dept staff and Physical Therapy
 - Graded exercise plan during start of BCT
 - Allows also for acclimation to altitude
 - Allows for completion of Sickle Cell Trait screen and counseling
 - Running shoe checks on In-processing Day

41

Female Athlete Triad



- Treatment
 - Gain weight
 - Adequate caloric intake for energy expenditure
 - Decrease stress
- USAFA Practices
 - Multidisciplinary Team
 - Adolescent physicians
 - Nutrition
 - Sports Medicine
 - Mental Health
 - Low index of suspicion
 - Example – anemia screening

42

Abnormal Uterine Bleeding & Dysmenorrhea

- Common problem
- Variety of causes
 - Uterine pathology
 - Nonuterine causes
- Subtypes
 - Abnormalities in frequency
 - Irregular bleeding
 - Prolonged menstrual bleeding
 - Abnormalities in volume
 - Intermenstrual bleeding
 - Painful periods
- Impact on Training
 - Inconvenient
 - Activity limiting
 - Anemia
 - Associated with worse training outcomes
 - Altitude
- USAFA Practices
 - Full-scope primary care equipped to address these conditions
 - Screen all cadets for anemia
 - Face-to-face appointment
 - Iron replacement
 - Evaluate for other causes of anemia if indicated
 - Contraception offered

43

Preventive Care – Cervical Cancer Screening

- Nearly all female cadets are 21 by the time they graduate
 - Will likely have first pap smear at USAFA
- MHS Genesis has made it challenging to pull overdue lists
 - Catch due cadets at their graduation physical
- Offer cervical cancer screening in Cadet Medicine
 - Recommend ensuring there are female providers
 - Not just for patient comfort
 - But also to expose female cadets to female medical providers!
- Also have a Women's Health Clinic at the 10th MDG
 - Periodically come through Cadet Med to assist in screening
 - Manage abnormal pap smear
- 2022 USAFA Data
 - 176 total pap smear
 - 10 abnormal
 - 5 Unsatisfactory



44

Preventive Care – HPV Vaccination

- All female cadets are within recommended age group
- HPV Process Improvement Project
 - Worked with Allergy/Immunizations to add HPV vaccine to Cadet Medicine Immunizations program
 - Added HPV vaccine tracking to ASIMS
- Pre-COVID robust HPV vaccination campaigns for all cadets
- Rates declined during COVID
- As of Sept 2022
 - 76% of female cadets had received more than one vaccine
 - Compared to 77.1% of U.S. teenagers
 - 59.3% had completed the series
 - Compared to 61.4% of U.S. teenagers
 - Rates were about 10% lower in male cadets
 - Lower than national average for U.S. teenagers



45

Preventive Care - STIs

- 1 in 5 people in US have an STI
- Almost half of new STIs were among youth aged 15-24 in the US
- Young women face serious long-term health consequences
 - Infertility
- Most female cadets in age range for annual chlamydia screening
- Military incidence 2013-2021
 - Chlamydia – 198/10,000 p-yrs
 - Gonorrhea – 32/10,000 p-yrs
- USAFA incidence
 - 2484 tests performed in 2022
 - 36 chlamydia cases
 - 50% decline from 2021
 - Cases steadily declined since 2018
 - Chlamydia incidence of 87.98/10,000 p-yrs
 - Gonorrhea incidence of 4.89/10,000 p-yrs
- USAFA screens all cadets for GC/CT
 - 2022 Basic training prevalence
 - Cadets – Chlamydia 0.3%; No gonorrhea
 - Prep school – Chlamydia 2.3%; No gonorrhea
 - 2022 Graduation physical prevalence
 - Chlamydia 2.8%; No gonorrhea
- HIV screening done on 1-day and at grad physical
 - No cases in 2022
 - Offer PrEP in Cadet Med
- Hep C screening
 - USPSTF recommendation
 - Catch some cadets if grad physical requirement
 - Adding to 1-day labs for Class of 2027
- Other STI screening done when indicated
 - Can be seen in regular clinic encounter
 - Walk-in STI clinic

46

Preventive Care - Contraception

- Reasons for contraception
 - Birth control
 - Regulation of menses
 - To treat abnormal menses
 - For convenience
 - Acne treatment
- National Stats
 - COCPs – 14%
 - LARCs – 10.4%
 - Almost 1/3 of sexually active women have used emergency contraception
- Military Stats
 - 2020 SARC and LARC use similar
 - Prevalence of about 25% each
 - LARCs more prevalent in Navy and Marine Corps
- USAFA Prescriptions for 2022
 - 1066 COCPs
 - 42 emergency contraception
 - 93 LARCs
- Trainee Implications
 - Impact of pregnancy
 - Missed days of training
- USAFA Practices
 - Offer wide range of contraception in Cadet Med
 - COCPs
 - Depo Provera
 - Implant
 - IUDs
 - Emergency contraception
 - Also offered at pharmacy
 - Access to care usually same day
 - Offer walk-in contraception in AM
 - To include procedures
 - 10th MDG also has walk-in clinic once a week

47

References

- Armed Forces Health Surveillance Division. Update: Sexually transmitted infections, active component, U.S. Armed Forces, 2013-2021. *MSMR*. 2022 May 1;29(5):2-11. PMID: 36758648
- [FastStats - Contraceptive Use \(cdc.gov\)](https://www.fda.gov/oc/foia/20190801/20190801.pdf)
- Functional hypothalamic amenorrhea: Evaluation and management - UpToDate
- Huzar B and Koyunlu M. Change in use of emergency contraceptive pills in the United States from 2008-2015. *Contraception*. X, 2021, 3:100066. <https://www.sciencedirect.com/science/article/pii/S2596118121000125>
- Lottig JA, Reilman SL, Patel DM, Chughan AV, Moushian AA, Wells N. Long-acting reversible contraceptive use, active component service women, U.S. Armed Forces, 2016-2020. *MSMR*. 2021 Jul 1;28(7):60-65. PMID: 34542127
- Myrta K, E. Webber, B. J. Cropper, T. L. Tobiades, J. N. Alvarado, D. M. Dillon, C. A., ... Federick, S. P. (2015,2016). Prevalence and impact of anemia on basic trainees in the US air force. *Sports Medicine - Open*. 2(1), 1-7. doi:10.1186/s13047-016-0047-y
- National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years - United States, 2020 | [MMWR \(cdc.gov\)](https://www.cdc.gov/mmwr)
- RAUH, MITCHELL L 2,3,4, MACERA, CAROLINE A 1,2,3, TRONE, DANIEL W 1,5, SHAFFER, RICHARD A 2, BRODINE, STEPHANIE K 2,3. Epidemiology of Stress Fracture and Lower-Extremity Overuse Injury in Female Recruits. *Medicine & Science in Sports & Exercise* 38(9) p 1571-1577, September 2006. | DOI: 10.1189/d01.msr.0000237543.51295.9d
- STI Prevalence, Incidence, and Cost Estimates (cdc.gov)
- Thompson EL, Vámos CA, Vázquez-Otero C, Logan B, Griner S, Dalry EM. Trends and predictors of HPV vaccination among U.S. College women and men. *Prev Med*. 2016 May;85(2): 8. doi: 10.1016/j.ypmed.2016.02.023. Epub 2016 Feb 8. PMID: 26568893
- https://media.npr.org/assets/img/2017/09/12/GettyImages53068538_custom-4e63b1806a782f3a05ca5a33981c3c9c2987.jpg
- http://www.healthpointonline.com/uploads/3/8/16/0/3860717/female-athlete-triad_orig.jpg
- <https://poc-websites.s3.amazonaws.com/usafa.org/images/news/photos/graduation2021/photos/phot001.jpg>
- Single vaccine shot protects against cervical cancer (nature.com)
- <https://media.defense.gov/2016/jul/06/2001568706/2000/2000/Q/160630-F-49-029-148.jpg>

48

Questions?



49

Differences in Tactical Combat Casualty Care based on patient sex

Lt Col Leslie Vojta, MD, FACEP
Associate Professor, Department of Military and Emergency Medicine



50

Disclaimer

The opinions and assertions expressed herein are those of the author and do not reflect the official policy or position of the Uniformed Services University of the Health Sciences or the Department of Defense.

References to non-Federal entities or products do not constitute or imply a Department of Defense or Uniformed Services University of the Health Sciences endorsement.

This research protocol was reviewed and approved by the USU Institutional Review Board (IRB) in accordance with all applicable Federal regulations governing the protection of participants in research.



51

What Do We Know



52

Civilian Trauma Literature



Rubenson Wahlin et al. BMC Emergency Medicine (2016) 16:6
DOI 10.1186/s12873-016-0070-9

BMC Emergency Medicine

RESEARCH ARTICLE Open Access

Do male and female trauma patients receive the same prehospital care?: an observational follow-up study

Rebecka Rubenson Wahlin^{1,2}, Sari Ponzer¹, Hanna Lövbrand¹, Markus Skrifvars¹, Hans Morten Løssus^{1,3} and Maaret Castrén^{1,4}

53

Civilian Trauma Literature

BJA


British Journal of Anaesthesia, 129 (2): 191–199 (2022)
doi: 10.1016/j.bja.2022.01.032
Advance Article Publication Date: 18 May 2022
Critical Care

CRITICAL CARE

Use of tranexamic acid in major trauma: a sex-disaggregated analysis of the Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage (CRASH-2 and CRASH-3) trials and UK trauma registry (Trauma and Audit Research Network) data

Tim Nutbeam^{1,2,3}, Ian Roberts¹, Lauren Weekes^{1,5}, Haleema Shakur-Still¹, Amy Brenner¹ and Francois-Xavier Ageron¹

¹Emergency Department, University Hospitals Plymouth NHS Trust, Plymouth, UK, ²Clinical Trials Unit, London School of Hygiene and Tropical Medicine, London, UK, ³Department of Anaesthesia, University Hospitals Plymouth NHS Trust, Plymouth, UK, ⁴Emergency Department, Lausanne University Hospital, Lausanne, Switzerland and ⁵Devon Air Ambulance Trust, Exeter, UK



54

Military Trauma Literature


Clin Orthop Relat Res (2011) 469:1956–1961
DOI 10.1007/s11999-011-1840-z

SYMPOSIUM: AAOS/ORS/ABIS MUSCULOSKELETAL HEALTHCARE DISPARITIES RESEARCH SYMPOSIUM

Mortality in Female War Veterans of Operations Enduring Freedom and Iraqi Freedom

Jessica D. Cross MD, Anthony E. Johnson MD, Joseph C. Wenke PhD, Michael J. Bosse MD, James R. Ficke MD

Published online: 10 March 2011
© The Association of Bone and Joint Surgeons® 2011



55


Military Trauma Literature

Military Medicine

Analysis of Injuries and Prehospital Interventions Sustained by Females in the Iraq and Afghanistan Combat Zones

Steven G. Schauer MD, DO, MS, Jason F. Naylor, PA-C, Adrisanna N. Long, MD, Alejandra G. Mora, MS, Tuan D. Le, MD, DrPH, Joseph K. Maddry, MD & ...show all

Pages 700-707 | Received 26 Oct 2018, Accepted 14 Dec 2018, Accepted author version posted online: 27 Dec 2018, Published online: 04 Feb 2019



56

Military Trauma Literature


ORIGINAL ARTICLES

IMAJ - VOL 24 - SEPTEMBER 2022

Is Gender a Risk Factor for Oligoanalgesia in the Military Prehospital Trauma Setting?

Shaul Gelikas MD MBA^{1,2*}, Dotan Yaari MD MHA^{1,3*}, Guy Avital MD⁴, Or Balinhoren MD⁵, and Avi Benov MD MHA⁴

*Trauma and Combat Medicine Branch, Surgeon General's Headquarters, Israel Defense Forces, Ramat Gan, Israel
Departments of ¹Internal Medicine E and ²Dermatology, Sheba Medical Center, Tel Hashomer, Israel
Divisions of ³Anesthesia, Intensive Care, and Pain Management and ⁴Oncology, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel
⁵Hacend Faculty of Medicine, Bar-Ilan University, Safed, Israel



57

Military Trauma Literature

ORIGINAL RESEARCH

The Influence of Gender Bias: Is Pain Management in the Field Affected by Health Care Providers Gender?

Ali Karas, MD¹ | Lidar Fridrich, MBA² | Irina Radomislensky, BSc^{1,3} | Guy Avital, MD^{1,4} | Sami Gendler, MD, MHA² | Jacob Chen, MD, MHA, MSc² | Shaul Gelikas, MD, MBA^{1,6} | Avi Benou, MD, MHA²



58

Question



59

Is there a difference in Tactical Combat Casualty Care provided to male vs female patients?



60

Pilot Study

U.S. Army Combat Capabilities Development
Command Soldier Center Simulation and Training Technology Center (CCDC SC STTC)

10 participants - Army cadets

Improved time to treatment from first scenario to second

Lower chest seal success on female casualty



61

USU Study

Participants - TCCC trained medical students and enlisted medics

Two patient encounters - one male, one female

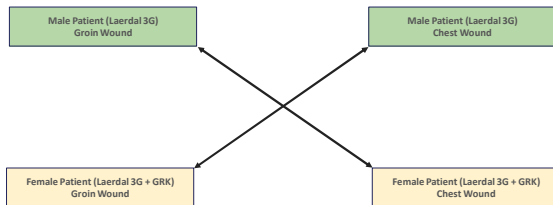
Video recorded patient encounters

Post-encounter "Think Aloud"



62

Study Design



63

SIMETRI Gender Retrofit Kit



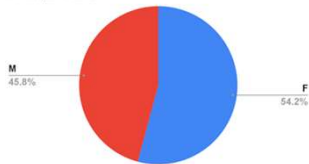
64



65

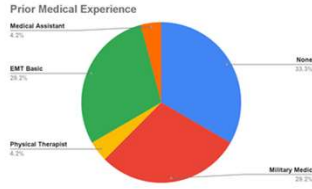
Demographics

Participant Gender



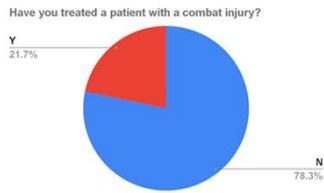
66

Demographics



67

Demographics



68

Results

Quantitative results:

Data analysis is ongoing

Faster medical care on second scenario, regardless of gender



69

Results

Qualitative results:

Emerging Themes

Confidence in the MARCH algorithm of TCCC

Uncertainty in care of manikin (regardless of manikin gender)

Uncertainty in disrobing the female manikin to assess for chest wound



70

Female Chest Wound

13 participants cared for female patient with a chest wound

3 participants did not fully disrobe the patient and find the wound

1 delayed exposure of wound

1 participant placed a chest seal over clothing



71

Interpretation

Was the simulation adequate? Is the manikin unrealistic?

Does training performance compare with real life actions?

Are participants uncomfortable exposing the female patients breasts?

Over 20% of participants did not expose the female chest wound (included experienced medics)



72

Next steps

USU Research Team - perform observational study at an upcoming TCCC course, include an intervention reviewing how to expose patients to find injuries
Encourage operational medical units to completely simulate medical care (all steps) and include female simulators



73

References

Bell L, Thomson R, Mazzeo M, Pike W. Same Injury, Different Outcome? Investigating Hesitation while Treating Female Casualties. *Interference/Industry Training, Simulation, and Education Conference (ITSEC)*. 2020.

Cross JD, Johnson AE, Wenke JC, Bossa ML, Fiske JR. Mortality in female war veterans of operations enduring freedom and Iraq Freedom. *Clin Orthop Relat Res*. 2011 Jul;469(7):1556-61. doi: 10.1007/s11959-011-1840-z.

Defense Manpower Data Center. Active Duty Military Personnel by Service by Rank/Grade (Updated Monthly). Retrieved 23 January 2023 from <https://dmdc.dod.mil/News/Top-Story/Data-reports/Service-Reports>

Gelinas S, Yaari D, Avital G, Bainshten O, Benov A. Is Gender a Risk Factor for Oligoneuria in the Military Prehospital Trauma Setting? *Jir Med Assoc*. 2022 Sep;24(9):612-618.

Karaz A, Fridrich L, Radomislensky L, Avital G, Gendler S, Chen J, Gelinas S, Benov A. The Influence of Gender Bias in Pain Management in the Field Affected by Health Care Provider's Gender? *Prehosp Disaster Med*. 2022 Oct;37(5):638-644. doi: 10.1017/S1049023X2200111X. Epub 2022 Aug 4.

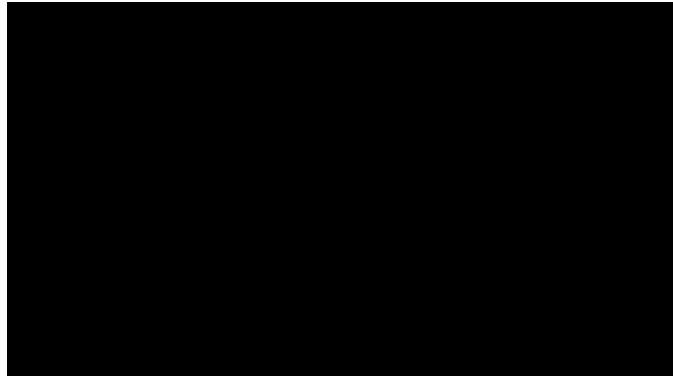
Nutbeam T, Roberts L, Weekes L, Shakur S, Brennan A, Agerton FX. Use of tranexamic acid in major trauma: a sex-disaggregated analysis of the Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage (CRASH-2) and CRASH-3 trials and UK trauma registry (Trauma and Audit Research Network) data. *Br J Anaesth*. 2022 Aug;129(2):191-199. doi: 10.1096/bja.2022.09.031. Epub 2022 May 18.

Rubenson Wahlén R, Ponszer S, Löfdstrand H, Skrifvars M, Lössius HMA, Cashin M. Do male and female trauma patients receive the same prehospital care? an observational follow-up study. *BMC Emerg Med*. 2022 Jan 19;21(6). doi: 10.1186/s12873-022-0070-9.

Schauer SG, Nayyar JF, Long AN, Mora AG, Lu TD, Muddry JK, April MD. Analysis of Injuries and Prehospital Interventions Sustained by Females in the Iraq and Afghanistan Combat Zones. *Prehosp Emerg Care*. 2019 Sep-Oct;33(5):700-707. doi: 10.1080/10903127.2018.1560840. Epub 2019 Feb 4.



74



75