



# **Bone Stress Injuries during U.S. Army Initial Entry Training: FY 2022-2023 Update**

Injury Prevention Branch, DCPH-A  
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25 July 2024

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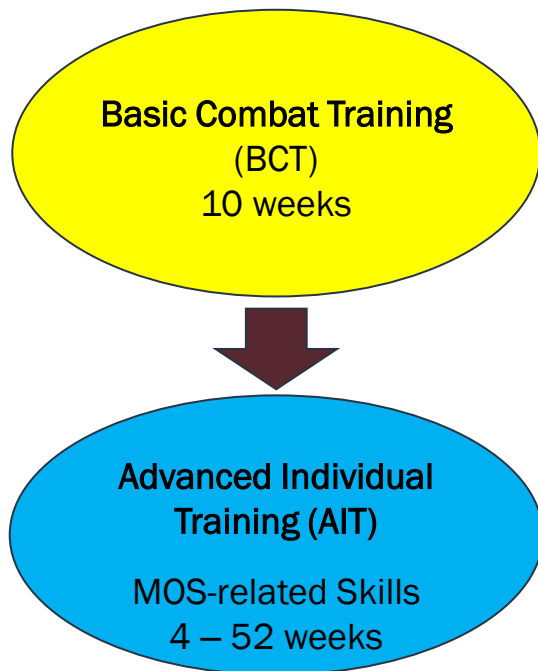
# Purpose

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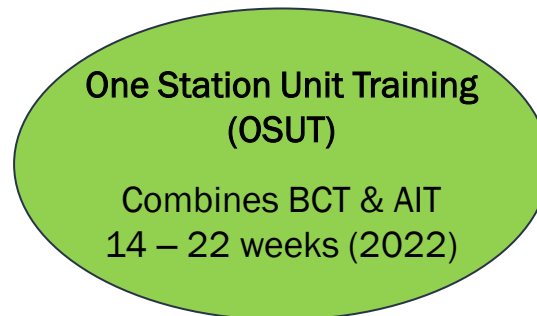
- Describe past and current bone stress injury (BSI) incidence and rates during basic combat training (BCT) and one station unit training (OSUT).
  - Compare BSI rates and trends among the BCT training centers.
  - Compare BSI rates and trends among OSUT courses.
- Describe training outcomes for trainees with a BSI during BCT and OSUT.
- Describe medical outcomes for trainees with a BSI during BCT and OSUT.



# Army Initial Entry Training (Enlisted) – Two Pathways



Men and women train together and are exposed to similar injury risk factors and hazards



11B Infantry (IN)  
11C Indirect Fire Infantry (IN)  
12B Combat Engineer (EN)  
12C Bridge Crew Member (EN)  
19D Cavalry Scout (CAV)  
19K Armor Crew Member (AR)  
31B Military Police (MP)

Source: TRADOC Regulation 350-6, Enlisted Initial Entry Training Policies and Administration



# Methods: Ongoing Injury Surveillance for BCT and OSUT

- DCPH-A's Office of Human Protection approved the Injury Prevention Branch's surveillance project (#15-427, Function II) as public health practice.
- Data sources:



<sup>1</sup>ATRRS: Army Training Requirements and Resources System

<sup>2</sup>RECMOD: Army Recruiting Information Support System Reception Module

<sup>3</sup>DMSS: Defense Medical Surveillance System maintained by Armed Forces Health Surveillance Division (AFHSD) DHA



# Methods: BSI-Specific Surveillance for BCT and OSUT

- Timeframe of surveillance: fiscal year cohorts 2018–2023 (FYs 18–23)
  - Cohorts of trainees that started training during each FY
    - ✓ Trainees were followed until discharge or graduation from BCT and OSUT
    - ✓ Trainees who graduated from BCT and OSUT were followed for an additional 60 days
- BCT and OSUT populations included Active-Duty, Reserve, and National Guard trainees
  - BCT: Forts Benning/Moore (FYs 18–20 & 23); Jackson, L. Wood, and Sill
  - OSUT:
    - ✓ Infantry (IN) 11B/C (Fort Moore)
    - ✓ Engineer (EN) 12B/C (Fort L. Wood)
    - ✓ Armor (AR) 19D/K (Fort Moore)
    - ✓ Military Police (MP) 31B (Fort L. Wood)



# Methods: BSI-Specific Surveillance

IPB used ICD-10-CM<sup>1</sup> codes M84.30– M84.38XS to identify all medical encounters for BSI

## BSI case definition

Trainee with either:

- $\geq 1$  inpatient (inpnt) encounter with BSI diagnosis, or
- $\geq 2$  outpatient (outpnt) encounters with BSI diagnosis within 7 – 90 days.

## BSI surgery case definition

BSI case with surgical intervention at BSI location.

- ICD-10 PCS<sup>2</sup> and CPT<sup>3</sup> codes indicating type and anatomic location of surgery.

<sup>1</sup>ICD-10-CM: International Classification of Diseases, Tenth Revision, Clinical Modification

<sup>2</sup>ICD-10 PCS: Procedure Coding System

<sup>3</sup>CPT: Current Procedural Terminology



# Methods: BSI ICD-10-CM Diagnosis Codes

BSI ICD-10 Codes	Anatomic Location
M84.30X*	Unspecified site
M84.311* – M84.319*	Shoulder (right, left, unspecified)
M84.321* – M84.329*	Humerus (right, left, unspecified)
M84.331* – M84.332*	Ulna (right, left)
M84.333* – M84.334*	Radius (right, left)
M84.339*	Unspecified ulna and radius
M84.341* – M84.343*	Hand (right, left, unspecified)
M84.344* – M84.346*	Fingers (right, left, unspecified)
M84.350*	Pelvis
M84.351* – M84.353*	Femur (right, left, unspecified)
M84.359*	Hip (unspecified)
M84.361* – M84.362*	Tibia (right, left)
M84.363* – M84.364*	Fibula (right, left)
M84.369*	Unspecified Tibia & Fibula
M84.371* – M84.373*	Ankle (right, left, unspecified)
M84.374* – M84.376*	Foot (right, left, unspecified)
M84.377* – M84.379*	Toes (right, left, unspecified)
M84.38X*	Other site

## Considerations Using BSI Codes:

- Insufficient central guidance for providers to select appropriate BSI ICD-10 codes.
- Codes do not identify specific location of BSI within a bone.
- Providers use different codes on subsequent encounters for the same injury (including “pain” codes).
- Unable to identify the number of different BSIs per individual.

\* Indicates that all 7<sup>th</sup> character codes (i.e., A, D, G, K, and P) are included for BSI routine healing, delayed healing, nonunion, and malunion of BSI





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## Results – Trainee Cohorts FYs 18–23



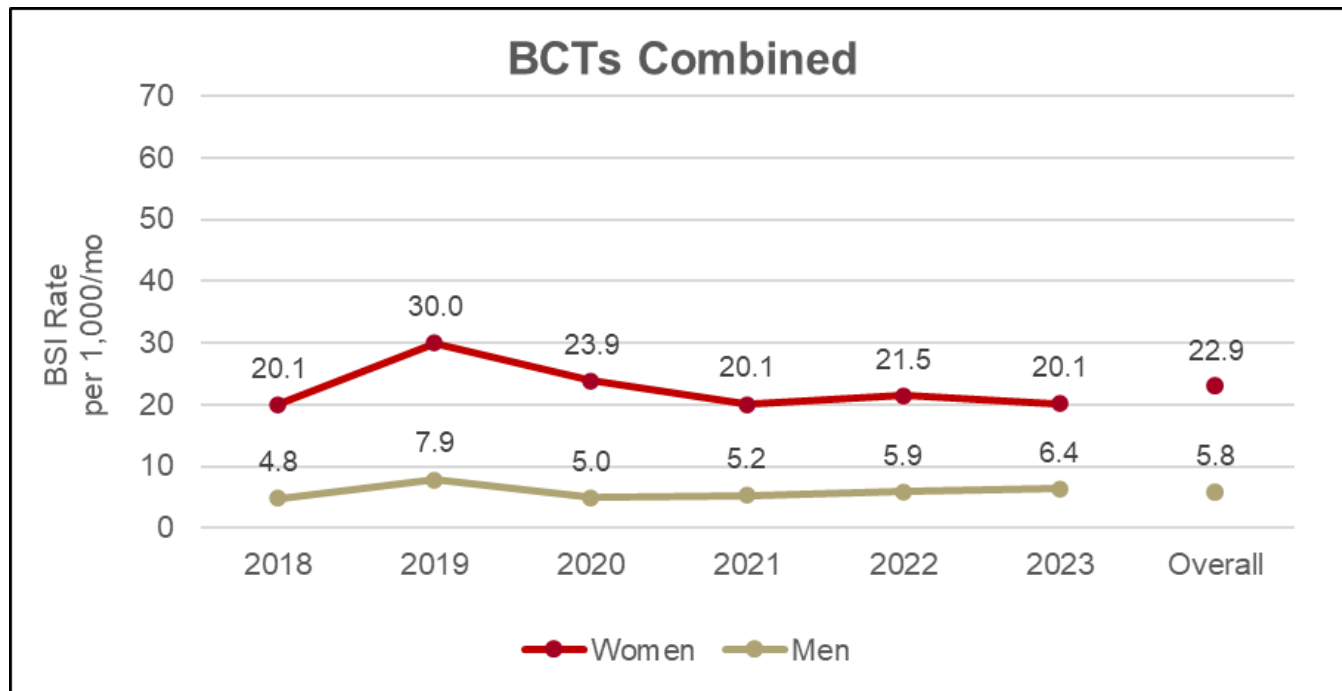
# BSI Incidence and Rates during BCT and OSUT

FY Cohort	BCT Training Center	Total Trainees		Trainees with a BSI		BSI Rate (BSI/1,000/mo)		Rate Ratio (W/M) RR (95% CI)
		Women n	Men n	Women n (%)	Men n (%)	Women	Men	
2018–2023	Moore	–	12,395	–	240 (1.9)	–	8.2	–
	Jackson	62,072	155,207	1,460 (2.4)	835 (0.5)	10.2	2.3	4.36 (4.01–4.75)
	L. Wood	19,233	59,617	1,574 (8.2)	1,057 (1.8)	34.9	7.6	4.57 (4.23–4.94)
	Sill	22,243	59,184	2,497 (11.2)	1,737 (2.9)	46.8	12.5	3.74 (3.52–3.98)
	<b>Total</b>	<b>103,548</b>	<b>286,403</b>	<b>5,531 (5.3)</b>	<b>3,869 (1.4)</b>	<b>22.9</b>	<b>5.8</b>	<b>3.93 (3.77–4.09)</b>
	<b>OSUT Course</b>							
2018–2023	IN 11B/C	1,481	87,451	242 (16.3)	3,140 (3.6)	37.4	7.9	4.71 (4.13–5.37)
	EN 12B/C	4,226	16,134	703 (19.8)	595 (4.2)	56.8	12.5	4.38 (3.93–4.88)
	AR 19D/K	933	22,502	89 (11.3)	477 (2.5)	25.7	5.8	4.37 (3.48–5.48)
	MP 31B	5,880	15,938	1,047 (17.8)	644 (4.0)	40.2	9.1	4.44 (4.02–4.90)
	<b>Total</b>	<b>12,520</b>	<b>142,025</b>	<b>2,081 (16.6)</b>	<b>4,856 (3.4)</b>	<b>40.4</b>	<b>7.8</b>	<b>5.17 (4.91–5.45)</b>

- BSI rate for OSUT Women was 1.8 times higher than the rate for BCT Women.
  - (RR (OSUT/BCT): 1.76 (1.68–1.86))
- BSI rate for OSUT Men was 1.3 times higher than the rate for BCT Men.
  - (RR (OSUT/BCT): 1.34 (1.28–1.40))



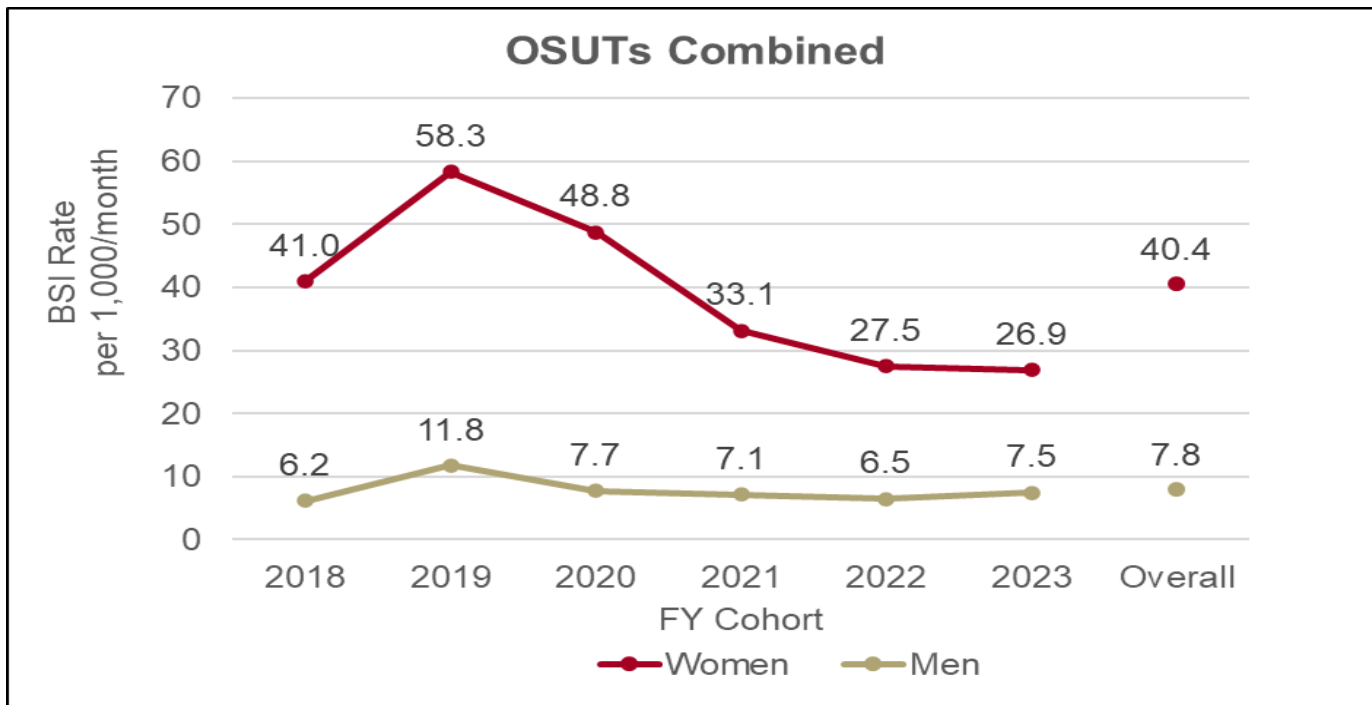
# BCT BSI Rates by Sex and Year



Rate Ratio (W/M)	
2018	4.19 (3.78–4.64)
2019	3.81 (3.51–4.13)
2020	4.82 (4.36–5.33)
2021	3.83 (3.44–4.25)
2022	3.66 (3.26–4.10)
2023	3.15 (2.81–3.65)
Overall	3.93 (3.77–4.09)



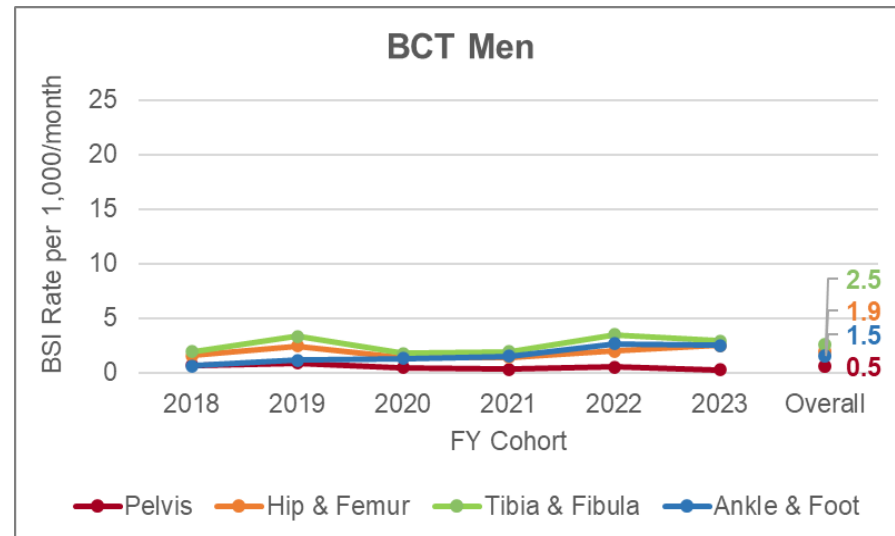
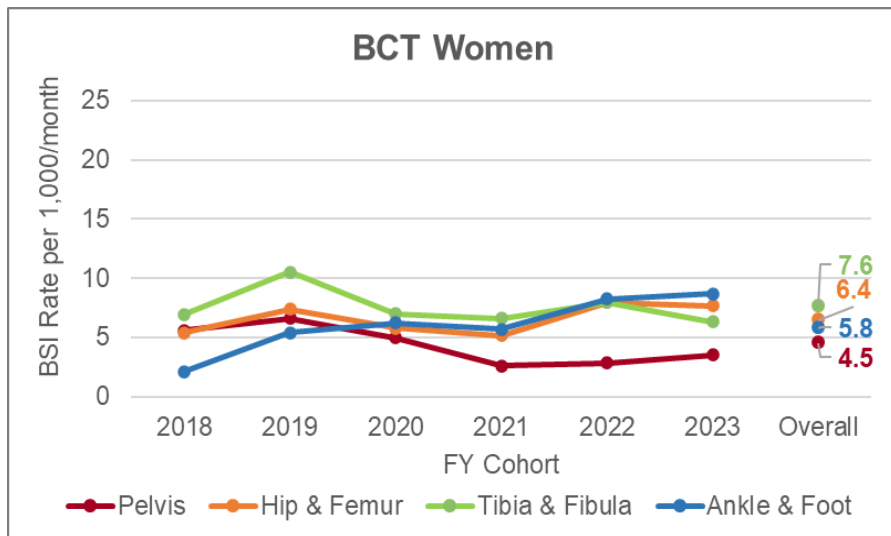
# OSUT BSI Rates by Sex and Year



Rate Ratio (W/M)	
2018	6.65 (5.78–7.66)
2019	4.95 (4.48–5.48)
2020	6.31 (5.66–7.03)
2021	4.66 (4.10–5.30)
2022	4.26 (3.65–4.98)
2023	3.60 (3.07–4.23)
Overall	5.17 (4.91–5.45)



# BCT BSI Rates by Body Region, Sex, and Year



Overall BCT BSI rates were highest for the tibia & fibula followed by hip & femur for both women and men.

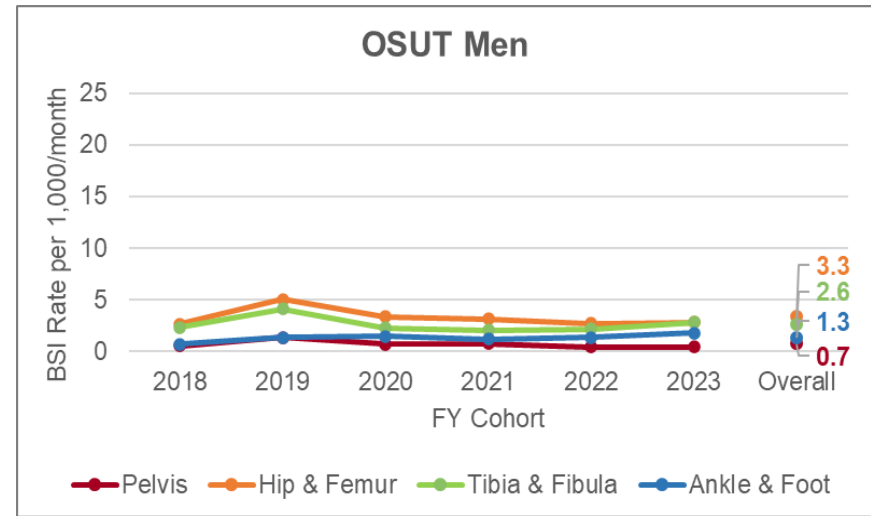
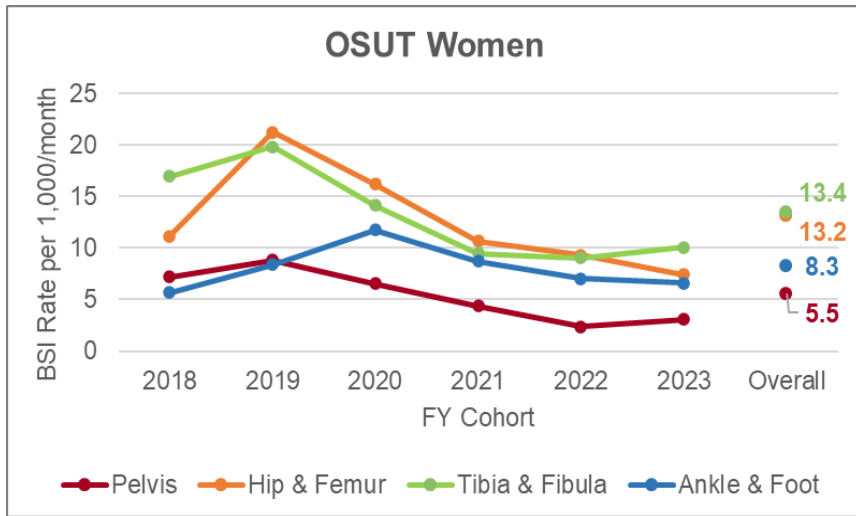
Note: Figures do not include BSIs with body region “upper extremity,” “other,” or “unspecified.”



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# OSUT BSI Rates by Body Region, Sex, and Year



Overall OSUT BSI rates were highest for the hip & femur followed by tibia & fibula for men, but tibia & fibula rates were slightly highest for women.

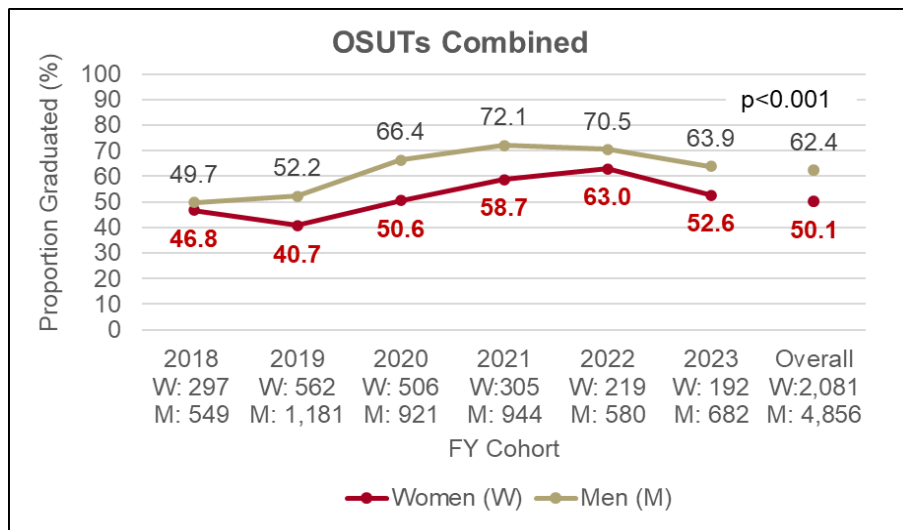
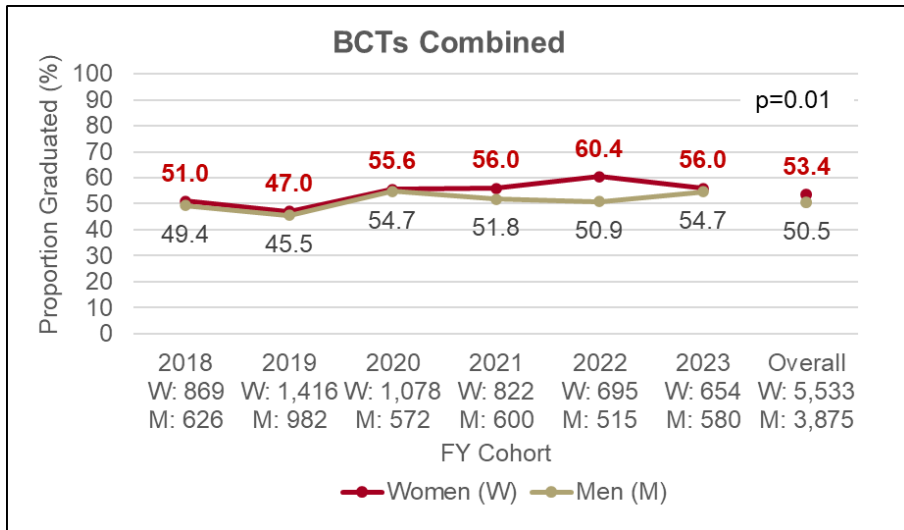
Note: Figures do not include BSIs with body region “upper extremity,” “other,” or “unspecified.”



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# BCT and OSUT Graduation for BSI Cases by Year and Sex



Risk Ratio Women (BCT/OSUT): 1.04 (1.01–1.07);  $p=0.01$

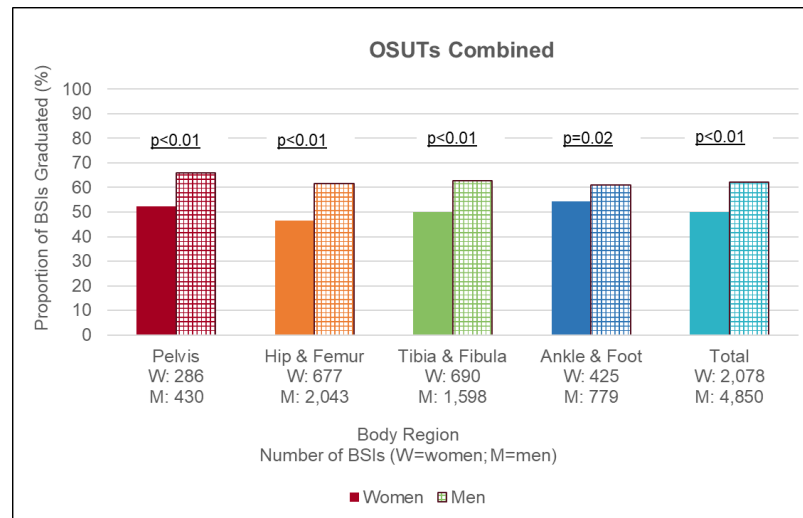
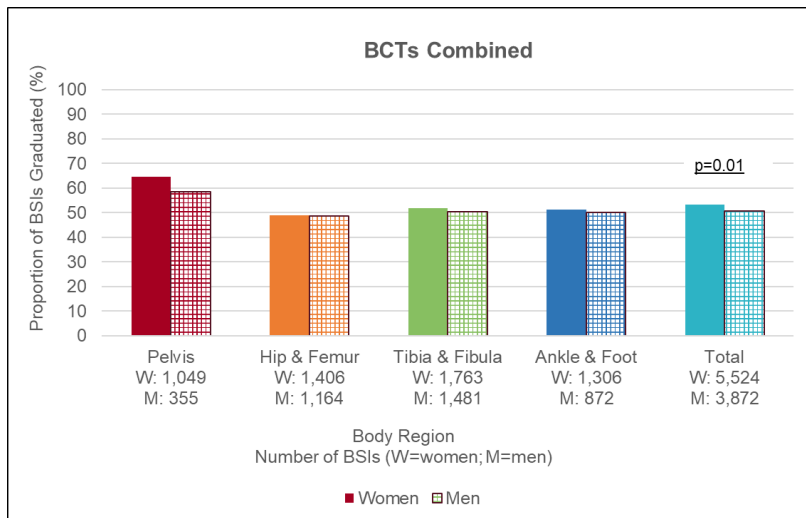
Risk Ratio Men (OSUT/BCT): 1.25 (1.20–1.30);  $p<0.001$

Note: Numbers on the x-axis for Women (W) and men (M) represent the total number of BSI by FY cohort



# Graduation by BSI Body Region, Sex, and Training Type<sup>1,2</sup>

## FYs 18–23 Overall



- OSUT men with a BSI were statistically significantly more likely to graduate than women with the same BSI body region (except for ankle & foot BSIs)
- There was no statistically significant difference for men and women in BCT

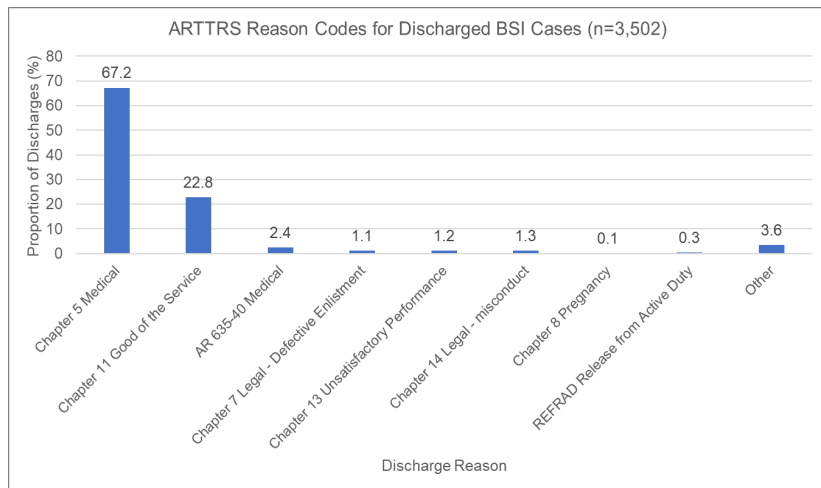
<sup>1</sup>Numbers on the x-axis for women (W) and men (M) represent the total number of BSI cases by body region

<sup>2</sup>p-values show only statistically significant differences in graduation between sexes

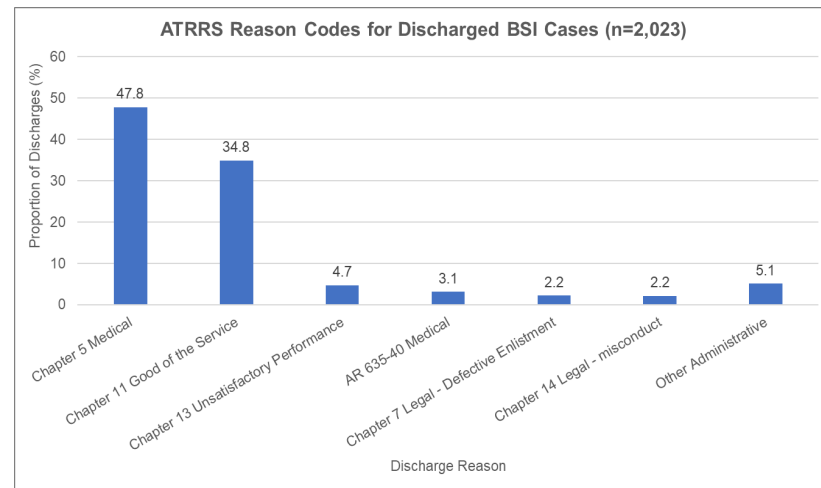




# ATRRS Reasons for BSI Discharges from BCT and OSUT



- **BCT ATRRS reason codes**
  - 90% discharged for “existed prior to service” or “good of the service”
  - AR 635-40 disability evaluation: n=85 (2.4% of discharges)



- **OSUT ATRRS reason codes**
  - 83% discharged for “existed prior to service” or “good of the service”
  - AR 635-40 disability evaluation: n=63 (3.1% of discharges)



# BSI Surgery Cases during BCT and OSUT

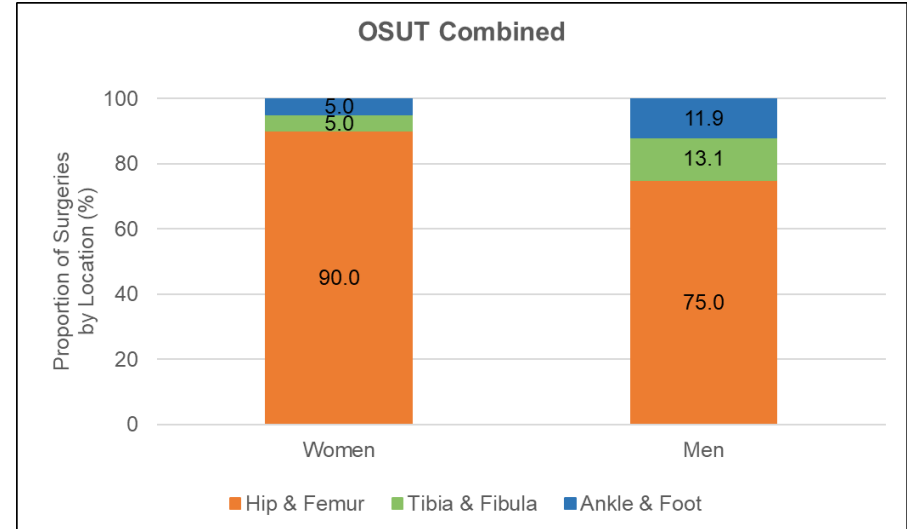
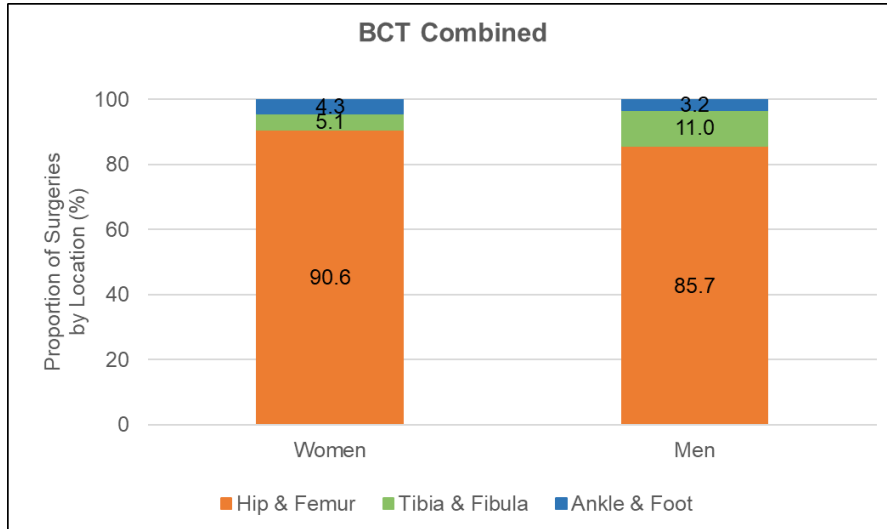
FY Cohort	BCT Center	Total BSI Cases		BSI Cases with Surgery during BCT	
		Women n	Men n	Women n (%)	Men n (%)
2018–2023	Benning	–	240	–	3 (1.3)
	Jackson	1,460	838	81 (5.5)	91 (10.9)
	L. Wood	1,574	1,057	22 (1.4)	17 (1.6)
	Sill	2,499	1,737	22 (0.9)	28 (1.6)
	<b>Total</b>	<b>5,533</b>	<b>3,875</b>	<b>125 (2.3)</b>	<b>139 (3.6)</b>

FY Cohort	OSUT Course	Total BSI Cases		BSI Cases with Surgery during OSUT	
		Women n	Men n	Women n (%)	Men n
2018–2023	IN 11B/C	242	3,140	3 (1.2)	52 (1.7)
	EN 12B/C	703	595	7 (1.0)	12 (2.0)
	AR 19D/K	89	477	2 (2.2)	9 (1.9)
	MP 31B	1,047	644	6 (0.6)	7 (1.1)
	<b>Total</b>	<b>2,081</b>	<b>4,856</b>	<b>18 (0.9)</b>	<b>80 (1.6)</b>

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# Body Region of BSI Surgery Cases during BCT and OSUT



## Follow-up of BSI Cases 1–60 Days after BCT Graduation

FY Cohort	BCT Center	BSI Cases Graduated BCT		≥1 BSI Med.Visit 1–60 Days after Graduation		Surgery 1–60 Days after Graduation		Discharged 1–60 Days after Graduation	
		Women	Men	Women n (%)	Men n (%)	Women n	Men n	Women n	Men n
2018-2023	Moore	–	169	–	50 (29.6)	–	0	–	0
	Jackson	1,003	566	551 (54.9)	185 (32.7)	8	2	0	1
	L. Wood	847	596	376 (44.4)	219 (36.7)	1	0	1	2
	Sill	1,103	625	393 (35.6)	176 (28.2)	3	1	25	18
	<b>Total</b>	<b>2,953</b>	<b>1,956</b>	<b>1,320 (44.7)</b>	<b>630 (32.2)</b>	<b>12</b>	<b>3</b>	<b>26</b>	<b>21</b>

Note: Outcomes 1–60 days after BSI cases graduated from BCT (i.e., outcomes during AIT).



# New (1<sup>st</sup>) BSI Cases 1–60 Days after BCT Graduation

FY Cohort	BCT Center	New BSI Case		BSI Surgery	
		1-60 Days after Graduation		1–60 Days after Graduation	
		Women n (%)	Men n (%)	Women n	Men n
Overall 2018–2023	Moore	–	44 (0.4)	–	1
	Jackson	965 (1.6)	550 (0.4)	23	7
	L. Wood	334 (1.7)	305 (0.5)	12	5
	Sill	339 (1.5)	255 (0.4)	15	4
	<b>Total</b>	<b>1,638 (1.6)</b>	<b>1,154 (0.4)</b>	<b>50</b>	<b>17</b>

Note: BCT trainees with no BSI medical encounter during BCT but were had a BSI case within the first 60 days after graduation, during AIT.

### Body Region of New BSI Cases

Body Region	Women n (%)	Men n (%)
Pelvis	288 (17.8)	46 (4.4)
Hip & Femur	632 (39.0)	274 (26.2)
Tibia & Fibula	469 (29.0)	517 (49.5)
Ankle & Foot	231 (14.3)	207 (19.8)
<b>Total</b>	<b>1,638</b>	<b>1,154</b>

Note: Other and unspecified are not included.

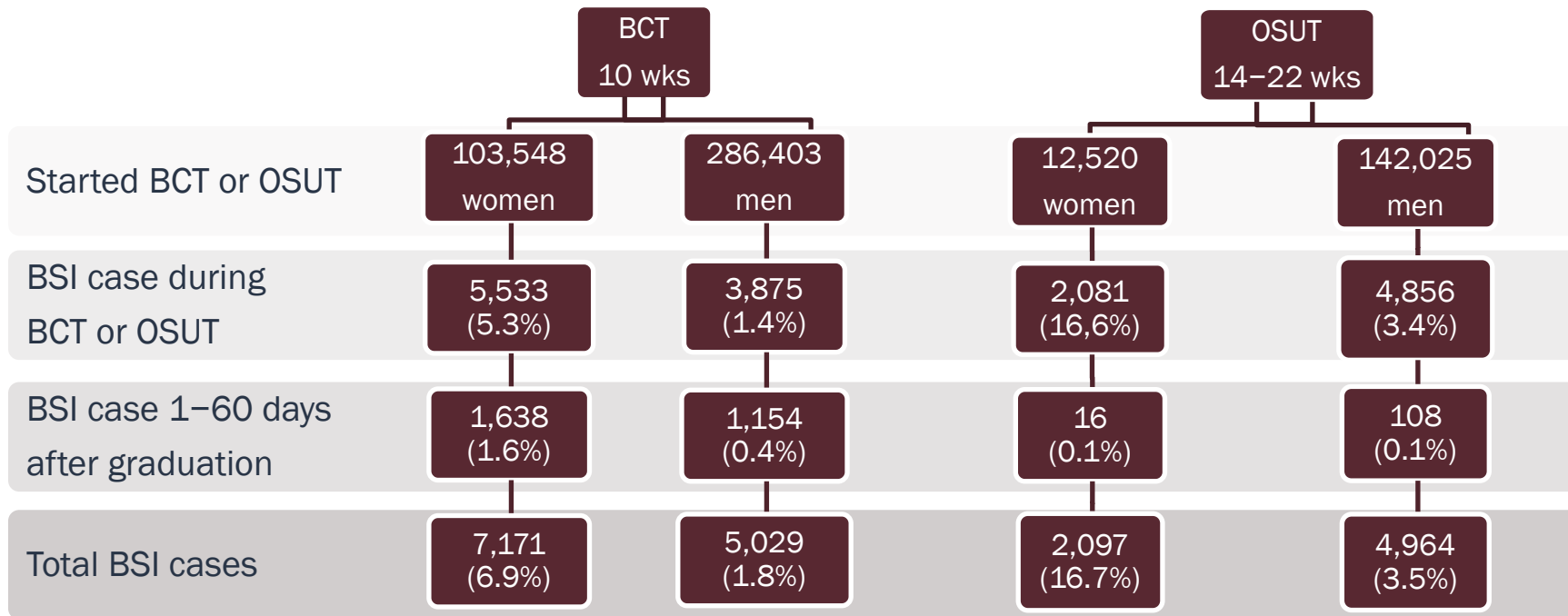
### Body Region for BSI Surgery Cases

Body Region	Women n (%)	Men n (%)
Hip & Femur	44 (88.0)	12 (63.2)
Tibia & Fibula	5 (10.0)	4 (21.1)
Ankle & Foot	1 (2.0)	3 (15.8)
<b>Total</b>	<b>50</b>	<b>17</b>

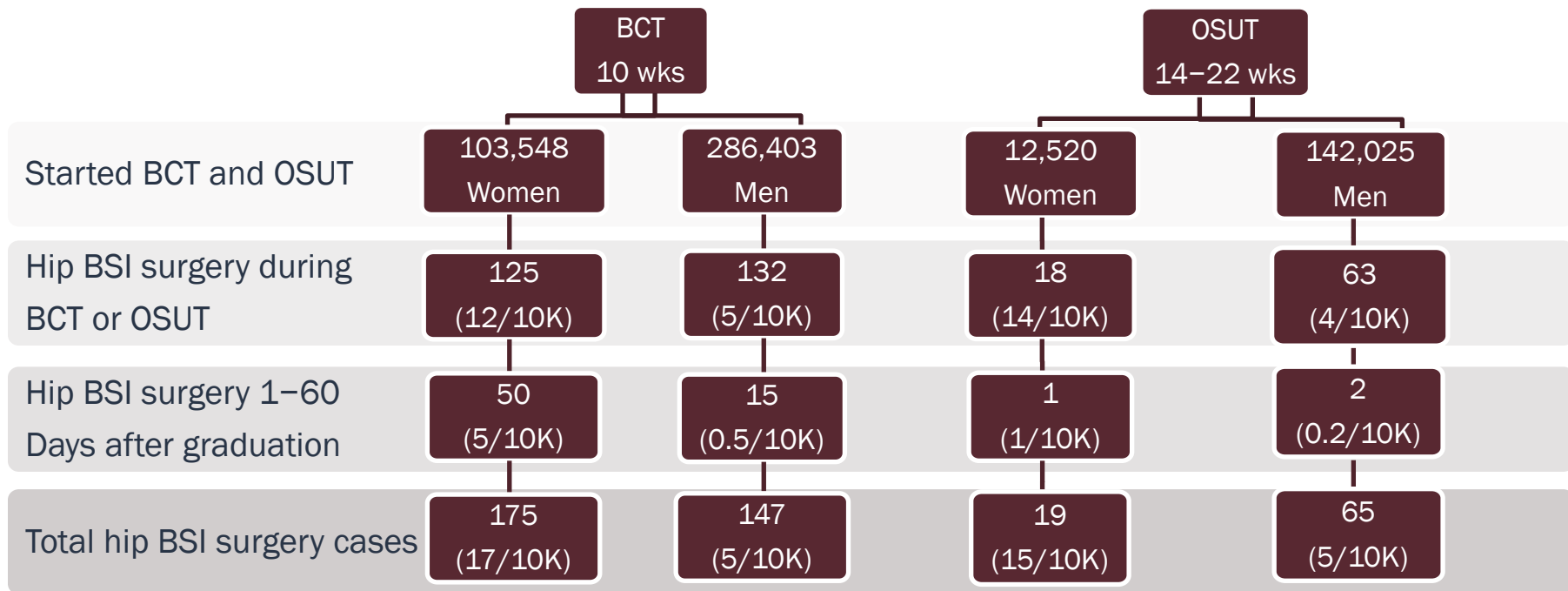


# BSIs Cases during BCT/OSUT and 1–60 days after Graduation<sup>22</sup>

## Case Definition: 1 inpnt or ≥2 outpnt BSI encounters



# Hip BSI Surgery Cases during BCT/OSUT and 1-60 days after Graduation, FYs 18-23 Overall



## Summary – BSI Cases among Trainee Cohorts FY 18–23

- Overall (FY 18–23 cohorts) BSI case incidence ( $\geq 1$  BSI) (case def:  $\geq 2$  outpnt enc.)
  - BCT+60 days: 6.9% and 1.8% of women and men, respectively (hip BSI surgery: W: 175; M: 147)
  - OSUT+60 days: 16.7% and 3.5% of men and women, respectively (hip BSI surgery: W:19; M: 65)
- Incidence and rates vary by year and BCT center or OSUT course
  - Rates in BCT men have been increasing since FY20, but have remained level in OSUT men
  - Rates in BCT women remain steady, while rates in OSUT women have been declining since FY19
- Overall, BCT and OSUT graduation trended higher FY 19–23
  - BCT graduation is higher for women compared to men (53% vs. 51%,  $p=0.01$ )
  - OSUT graduation is higher for men compared to women (62% vs. 50%,  $p<0.001$ )
- Following graduation from BCT, 45% of women with BSI case during BCT had another BSI 1-60 days after; 32% of men BCT graduates had a follow-on visit





# BSI Guidelines for Clinical Practice and the Discharge Process

- Clinical practice guidelines for diagnosing, coding, and treating trainees with BSIs. Previous versions include:
  - April 2004 MEDDAC Fort Jackson MACH Commander Memorandum: Recommendation for Hip Pain Clinical Practice Guidelines.
  - October 2010 OTSG/MEDCOM Policy Memo 10-073 “Soldiers with Stress Fractures”.
  - August 2016 MEDDAC Fort Benning, CMO Policy Memorandum #2 – Management of Bone Stress Injuries and Femoral Neck Stress Injury Management Criteria.
  - Dembowski et al. Military Medicine. Injury Surveillance and Reporting for Trainees with Bone Stress Injury: Current Practices and Recommendations. 2018 Nov 1;18311-12);e-e461.
- Process guidelines when trainees with BSIs are discharged:
  - March 2009: OTSG/MEDCOM Policy Memo 09-017 Active Duty Personnel with Stress Fractures.
  - DoDI 6130.03, volume 2 Medical Standards for Military Service: Retention, paragraph 5.18 (lower extremity).



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## Questions and Discussion



# POCs, Injury Prevention Branch, DCPH-A

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