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Examining the Relationship Between Soldiers' Sleep, Activity, and Nutrition Behaviors and Readiness Outcomes

Public Health Assessment Division
Health Promotion and Wellness Directorate
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Purpose

Purpose: To summarize the relationship between Active Duty (AD) Soldiers' sleep, activity, and nutrition (SAN) behaviors and select injury and behavioral health outcomes.

Outline:

- Background
- Design and Methods
- Key Findings
- Recommendations
- Discussion
- Summary and Way Ahead
- Back-up Slides

Bottom Line Up Front (BLUF)

- Demographic differences were observed for SAN behaviors and the prevalence of injury and behavioral health outcomes.
- The prevalence of injury and behavioral health outcomes was *lower* among Soldiers who met sleep, activity, or nutrition targets.
- Healthy SAN behaviors appear to be protective factors for injury and negative behavioral health outcomes, even after controlling for demographic characteristics.
- Soldiers who met both sleep and activity targets may have a *lower* prevalence of injury, depression, or post traumatic stress disorder (PTSD).

These results suggest that healthy SAN behaviors, and the combination of sleep and activity, may be protective for some injury and adverse behavioral health outcomes.

Background

Background

- The U.S. Army actively promotes healthy SAN behaviors as a means for improving and maintaining Soldier health, optimizing Soldier readiness, and reducing injuries.[1]

- The Performance Triad (P3) is the Army's initiative to enhance Soldiers' readiness by encouraging the Army Family to engage in healthy SAN behaviors.

- Sufficient sleep, activity, and nutrition are associated with reduced negative health outcomes. Healthy SAN behaviors may reduce the risk of—
  - Musculoskeletal (MSK) injury.[2,3,4]
  - Developing depression, anxiety, or PTSD.[5,6,7]

Guiding Questions

- The purpose of this project was to **assess the relationship between AD Soldiers' self-reported SAN behaviors and select injury and behavioral health outcomes.** The results and conclusions outlined in this brief answer five guiding questions:

GQ1. What are the demographic and other characteristics of Soldiers who meet, and Soldiers who do not meet, the minimum recommended thresholds for sleep, activity, and nutrition behaviors?

GQ2. What is the prevalence of select injury and behavioral health outcomes for Soldiers who meet, and Soldiers who do not meet, the minimum recommended thresholds for sleep, activity, and nutrition behaviors?

GQ3. To what extent does the prevalence of select injury and behavioral health outcomes differ between groups of Soldiers with select demographic and other characteristics?

GQ4. To what extent are sleep, activity, and nutrition behaviors associated with differences in select injury and behavioral health outcomes for Soldiers?

GQ5. Is the interaction between sleep, activity, and nutrition behaviors associated with differences in select injury and behavioral health outcomes for Soldiers?

Design and Methods

Design and Methods

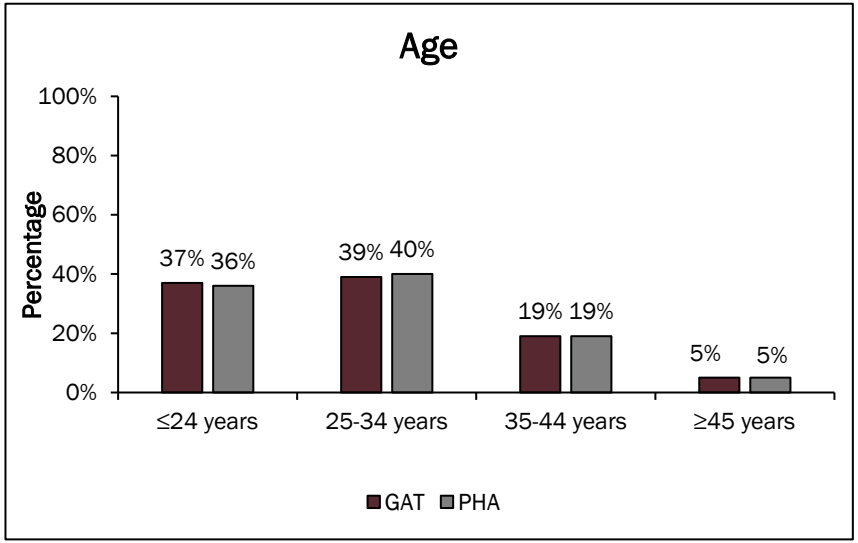
Cross-sectional Design with Secondary Data

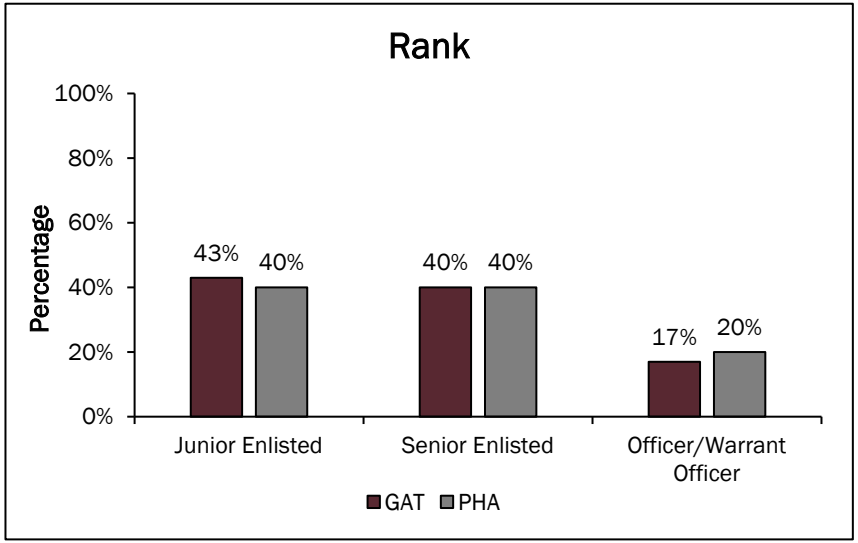
Data Sources	Metrics	Population	Timeline
Global Assessment Tool (GAT)	• Sleep, Activity, Nutrition • Limited duty (LIMDU) because of MSK injury • Depression • Hazardous alcohol consumption	AD Army Soldiers GAT (*N* = 174,351) and/or PHA (*N* = 322,491)	Calendar Year 2018 (01 January 2018 – 31 December 2018)
Periodic Health Assessment (PHA)	• Sleep, Activity, Nutrition • Profile or limited duty for muscle pain • Depression • Hazardous alcohol consumption • PTSD • Life stressors		
Defense Manpower Data Center (DMDC)	• Sex • Age • Rank • Race • Marital status		

Key Findings

Demographics

The majority of Soldiers were **male, younger than 35 years of age, Junior or Senior Enlisted, White, and married.**





GAT: *N* = 174,351; PHA: *N* = 322,491

Key Findings: GQ1

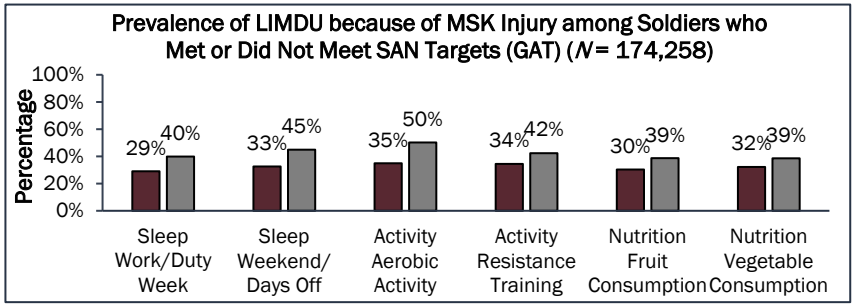
The **demographic and other characteristics of Soldiers who met the minimum recommended thresholds for SAN behaviors were consistent** across demographic groups for many SAN behaviors.

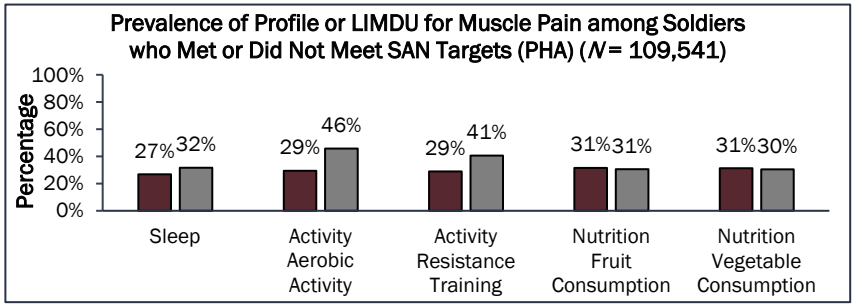
	Sex	Age	Rank	Race	Marital Status
	**A similar percentage of male and female** Soldiers met the sleep and aerobic activity targets. **A greater percentage of male Soldiers** met the resistance training target. **A greater percentage of female Soldiers** met the nutrition targets.	**A greater percentage of Soldiers younger than 35 years** met the resistance training target. **A greater percentage of Soldiers older than 24 years of age** met the vegetable consumption target.	**A greater percentage of Officers/Warrant Officers** met the sleep and nutrition targets.	**A greater percentage of White or American Indian/Alaska Native Soldiers** met the sleep, and aerobic activity targets. **A greater percentage of White Soldiers** met the vegetable consumption target.	**A greater percentage of Soldiers who were never married** met the sleep targets. **A similar percentage of Soldiers** met the activity targets across marital status groups.

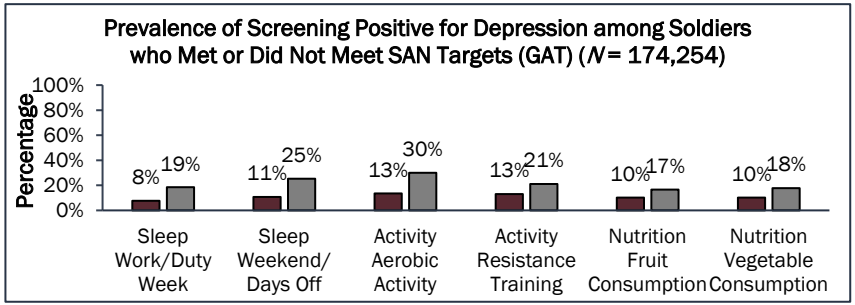
GAT: *N* = 174,351; PHA: *N* = 322,491

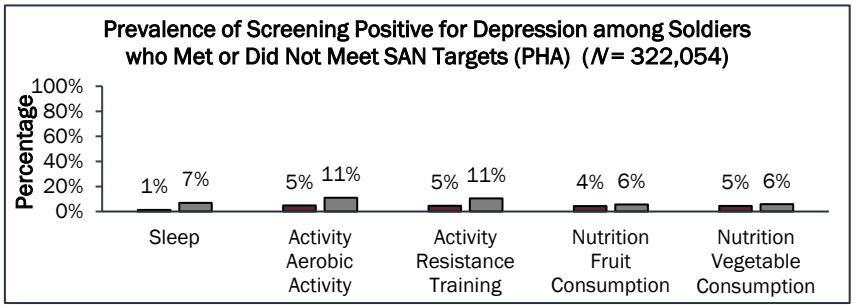
Key Findings: GQ2

The prevalence of select injury and behavioral health outcomes was *lower* among Soldiers who met sleep, activity, or nutrition targets in both the GAT and PHA.









Met SAN Target Did Not Meet SAN Target

Key Findings: GQ3

Injury and behavioral health outcomes **statistically differed by sex, age, rank, race, and marital status.**

	Sex (Ref = Male)	Age (Ref = ≤ 24 years)	Rank (Ref = Junior Enlisted)	Race (Ref = White)	Marital Status (Ref = Never Married)
Injury Outcomes					
LIMDU because of MSK Injury (GAT: *N* = 166,629)	Female ↑	>24 years ↑	Senior Enlisted Officer/Warrant Officer ↓	Black or African American ↑	Married ↑ Previously Married ↑
Profile or LIMDU for Muscle Pain (PHA: *N* = 102, 269)	Female ↑	>24 years ↑	Senior Enlisted Officer/Warrant Officer ↓	Black or African American ↑ Native Hawaiian or Other Pacific Islander ↑	Married ↑ Previously Married ↑
Behavioral Health Outcomes					
Depression (GAT: *N* = 166,625, PHA: *N* = 307,385)	Female ↓↑	>35 years ↑ >24 years ↑	Senior Enlisted Officer/Warrant Officer ↓↓	Asian or Pacific Islander ↑↑ Black or African American	Married ↓↑ Previously Married ↓↑
Hazardous Alcohol Consumption (GAT: *N* = 100,914, PHA: *N* = 200,847)	Female ↑↓	>24 years ↓↓	Senior Enlisted Officer/Warrant Officer ↓	American Indian/Alaska Native ↑ Asian or Pacific Islander ↓↓ Black or African American Native Hawaiian or Other Pacific Islander ↑	Married ↓↓ Previously Married
PTSD (PHA: *N* = 18,897)	Female ↑	>24 years ↑	Senior Enlisted Officer/Warrant Officer ↓	Asian or Pacific Islander Black or African American Native Hawaiian or Other Pacific Islander ↑	Married ↑ Previously Married ↑
Life Stressors (PHA: *N* = 307,364)	Female ↑	>24 years ↑	Senior Enlisted Officer/Warrant Officer ↓	American Indian/Alaska Native Asian or Pacific Islander Black or African American ↑	Married ↑ Previously Married ↑

GAT PHA ⇧ Higher odds, relative to reference group ⇩ Lower odds, relative to reference group

Adjusted for sex, age, rank, race, marital status, and BMI (GAT injury only)

Key Findings: GQ4

Healthy SAN behaviors may be **protective against injury and adverse behavioral health outcomes, even after controlling for demographics.**

	Sleep (Ref = did not meet sleep targets)	Activity (Ref = did not meet activity targets)	Nutrition (Ref = did not meet nutrition targets)
Injury Outcomes			
LIMDU because of MSK Injury (GAT: *N* = 161,649 – 161,653)	↓	↓	↓
Profile or LIMDU for Muscle Pain (PHA: *N* = 102, 211 – 102,217)	↓	↓	↑
Behavioral Health Outcomes			
Depression (GAT: *N* = 166,616 – 166,620, PHA: *N* = 304,946 – 304,958)	↓ ↓	↓ ↓	↓ ↓
Hazardous Alcohol Consumption (GAT: *N* = 100,910 – 100,914, PHA: *N* = 199,337 – 199,341)	↓ ↓	↓ ↓	↓ ↓
PTSD (PHA: *N* = 18,758 – 18,760)	↓	↓	↑
Life Stressors (PHA: *N* = 304,900 – 304,909)	↓	↓	↓

GAT PHA ↑ Higher odds, relative to reference group ↓ Lower odds, relative to reference group

Adjusted for sex, age, rank, race, marital status, and BMI (GAT injury only)

Key Findings: GQ5

Some interactions between SAN behaviors were **statistically associated with being on profile or limited duty because of MSK injury or muscle pain, screening positive for depression, and experiencing PTSD symptoms.**

	Sleep x Activity	Sleep x Nutrition	Activity x Nutrition	Sleep x Activity x Nutrition
Injury Outcomes				
LIMDU because of MSK Injury (GAT: *N* = 161,638)	★	★	★	★
Profile or LIMDU for Muscle Pain (PHA: *N* = 102,192)	*ns*	*ns*	☆	*ns*
Behavioral Health Outcomes				
Depression (GAT: *N* = 166,605, PHA: *N* = 304,905)	★	*ns*	★ ☆	*ns*
PTSD (PHA: *N* = 18,758)	☆	*ns*	*ns*	*ns*

Reference Groups: Did not meet SAN targets

Adjusted for sex, age, rank, race, marital status, and BMI (GAT injury only)

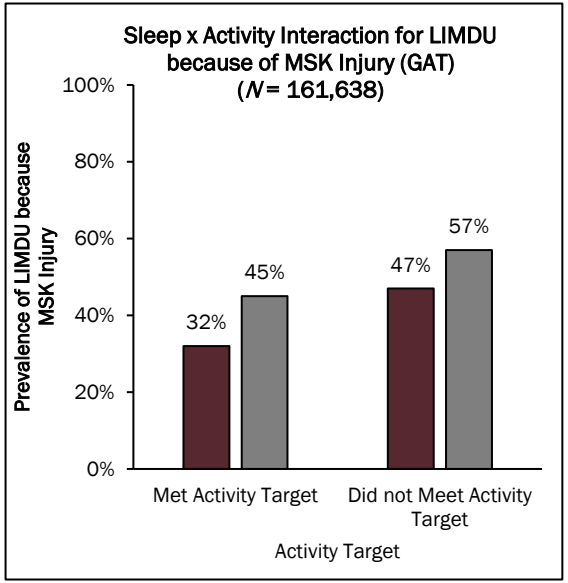
GAT PHA

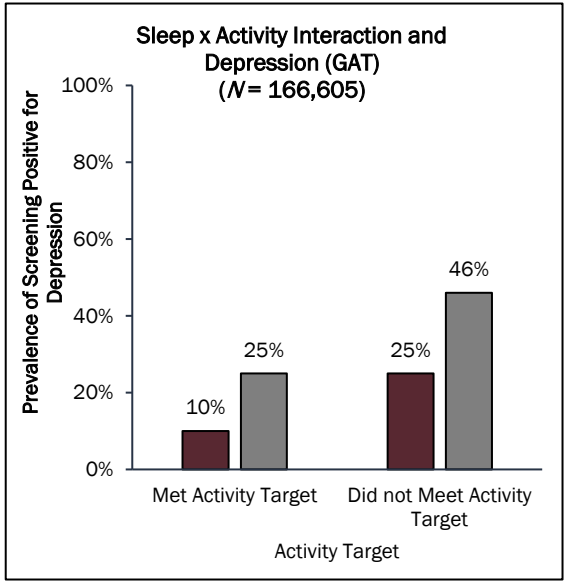
☆ Statistically significant association ($p < .05$)

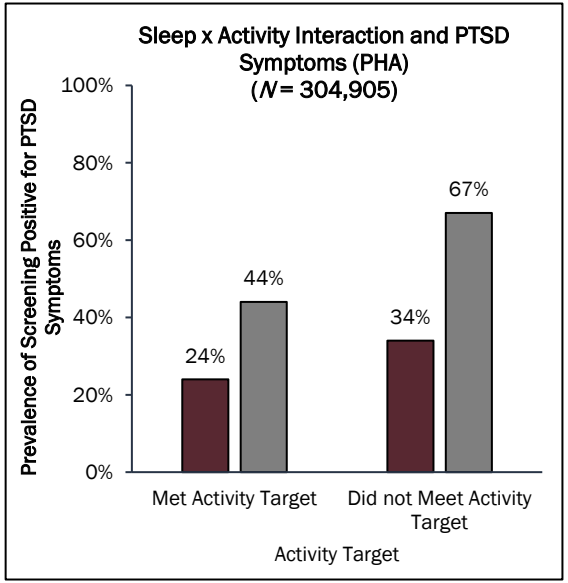
ns = not statistically significant

Key Findings: GQ5 (continued)

Soldiers who **met both sleep and activity targets may have a *lower* prevalence of being on limited duty because of MSK injury, screening positive for depression, or experiencing PTSD symptoms.**







Met Sleep Target Did Not Meet Sleep Target

Recommendations

Recommendations to Improve Soldiers' SAN Behaviors

- Recommendation: Promote SAN behaviors, independently and in combination, as protective factors for injury and behavioral health.
  - Army leaders should **promote SAN behaviors as protective factors for Soldier readiness.**

- Recommendation: Provide focused support to demographic groups who do not meet SAN targets and experience negative injury and behavioral health outcomes.
  - Army leaders should take **tailored and specific actions to support Soldiers who consistently do not meet SAN targets and/or have higher prevalence of injury and negative behavioral health outcomes.**

Recommendations for Future Study

- Recommendation: Continue to explore SAN synergy with objective data.
  - The DCPH-A should conduct additional studies to continue exploring the association between the synergy of SAN behaviors and outcomes of interest for Soldier readiness.
- Recommendation: Design studies with different methodologies.
  - The DCPH-A should design additional studies with different methodologies to account for potential confounders and the co-occurrence of SAN behaviors and outcomes of interest.
- Recommendation: Expand the assessment of SAN behaviors beyond the Army to other DoD Services.
  - The DCPH-A should assess SAN behaviors across all DoD Services to better understand these health-promoting behaviors in other military populations.

Discussion

Discussion: GQ1

GQ1: What are the demographic and other characteristics of Soldiers who meet, and Soldiers who do not meet, the minimum recommended thresholds for sleep, activity and nutrition behaviors?

The demographic and other characteristics of Soldiers who met SAN targets were **consistent across demographic groups for many behaviors**. The distribution of Soldiers meeting SAN targets was inconsistent across demographic groups for aerobic activity and resistance training (age and rank), fruit consumption (age, race, and marital status), and vegetable consumption (marital status).

So What?

The demographic differences observed for SAN behaviors were comparable to the 2022 Health of the Force Report, suggesting the **need to provide focused support to demographic groups who do not meet SAN targets**.

Discussion: GQ2

GQ2: What is the prevalence of select injury and behavioral health outcomes for Soldiers who meet, and Soldiers who do not meet, the minimum recommended thresholds for sleep, activity and nutrition behaviors?

The prevalence of select injury and behavioral health outcomes was ***lower*** **among Soldiers who met sleep, activity, or nutrition targets**.

So What?

These findings are consistent with the literature that suggests healthy SAN behaviors may protect against injury and adverse behavioral outcomes. Thus, Army leaders **may promote healthy SAN behaviors to reduce the prevalence of injury and adverse behavioral health outcomes among Soldiers.**

Discussion: GQ3

GQ3: To what extent does the prevalence of select injury and behavioral health outcomes differ between groups of Soldiers with select demographic and other characteristics?

Injury and behavioral health outcomes statistically differed by sex, age, rank, race, and marital status. **Higher rank may be protective against injury, depression, PTSD, and experiencing major life stressors.**

So What?

The demographic differences observed for injury and behavioral health outcomes suggest the **need to provide focused support to demographic groups who experience injury and adverse behavioral health outcomes**.

Discussion: GQ4

GQ4: To what extent are sleep, activity and nutrition behaviors associated with differences in select injury and behavioral health outcomes?

Healthy SAN behaviors may be protective against injury and adverse behavioral health outcomes, even after controlling for demographics. Soldiers who met sleep or activity targets were *less likely* to report being on profile or limited duty because of MSK injury or muscle pain, screen positive for depression, PTSD, or unhealthy alcohol use, or report experiencing major life stressors.

So What?

These findings are consistent with the literature that suggests healthy SAN behaviors, independent of demographic characteristics, may be associated with injury and behavioral outcomes. Army leaders **may emphasize the importance of healthy sleep and activity behaviors to strengthen Soldier readiness**.

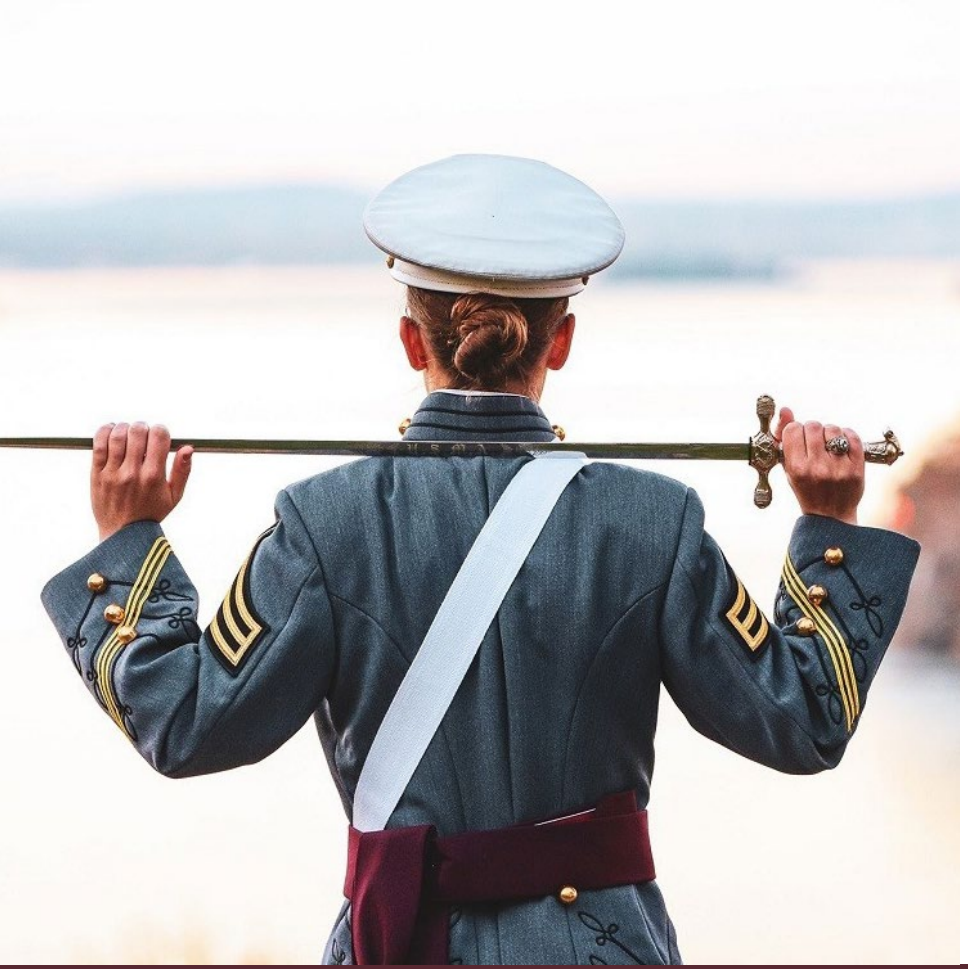
Discussion: GQ5

GQ5: Is the interaction between sleep, activity and nutrition behaviors associated with the differences in select injury and behavioral health outcomes for Soldiers?

Soldiers who **met both sleep and activity targets may have a *lower* prevalence of being on limited duty because of MSK injury, screening positive for depression, or experiencing PTSD symptoms.** The synergy of SAN behaviors was not associated with unhealthy alcohol use or experiencing major life stressors.

So What?

The combination of SAN targets, such as sleep and activity, may be associated with injury and behavioral health outcomes. **Additional studies with different methodologies are needed** to explore the temporal association between the synergy of SAN behaviors and outcomes of interest for Soldier readiness.



Summary and Way Ahead

Summary

Demographic differences were observed for SAN behaviors and the prevalence of injury and behavioral health outcomes; however, **healthy SAN behaviors appear to be protective factors for injury and negative behavioral health outcomes, after controlling for demographic characteristics.** Additionally, **the prevalence of injury, depression, and PTSD was lower** among Soldiers who met combinations of recommended SAN targets.

Collectively, these results suggest that the **synergy of SAN behaviors may be protective for some injury and adverse behavioral health outcomes.**

Way Ahead

- The P3 initiative has been instrumental to raise awareness about the importance of healthy SAN behaviors among Army Soldiers. As a Defense Health Agency organization, the **DCPH-A is uniquely positioned to promote healthy SAN behaviors for other DoD Services.**

- Further exploration is needed to—

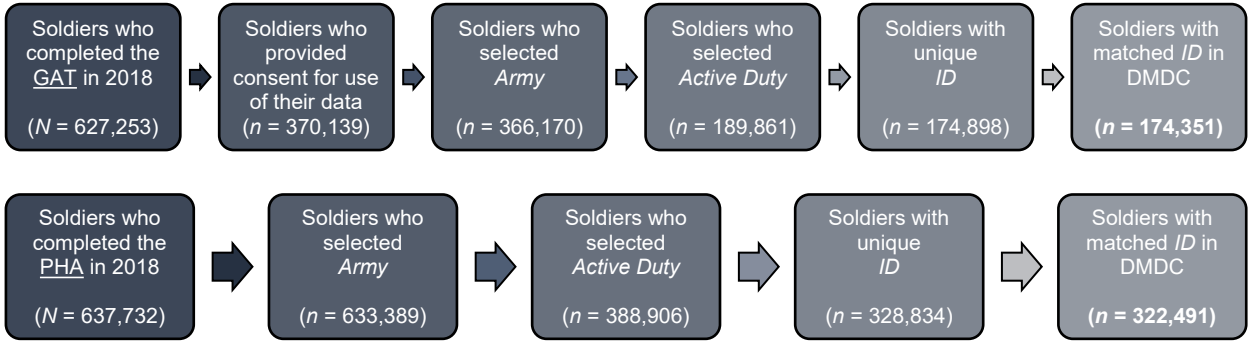
  - Understand SAN behaviors and readiness outcomes in other military populations.

  - Explore temporal associations between SAN behaviors and readiness outcomes across the DoD.

Back-up Slides

Population and Sample

- The eligible population included U.S. Army AD Soldiers who completed the GAT (*N* = 189,861) or PHA (*N* = 388,906) between 1 January and 31 December 2018.
- The following inclusion criteria yielded the target sample for analyses:



- The final sample for this project included 174,351 Soldiers who completed the GAT and 322,491 Soldiers who completed the PHA.

Analyses

Guiding Questions	Analyses
1. What are the demographic and other characteristics of Soldiers who meet, and Soldiers who do not meet, the minimum recommended thresholds for sleep, activity, and nutrition behaviors?	**Frequencies:** Percentage of Soldiers by demographic groups who met SAN targets
2. What is the prevalence of select injury and behavioral health outcomes for Soldiers who meet, and Soldiers who do not meet, the minimum recommended thresholds for sleep, activity, and nutrition behaviors?	**Frequencies:** Prevalence of injury and behavioral health outcomes among Soldiers who met SAN targets
3. To what extent does the prevalence of select injury and behavioral health outcomes differ between groups of Soldiers with select demographic and other characteristics?	**Multivariable Logistic Regression Models:** Injury and behavioral health outcomes regressed on demographics characteristics
4. To what extent are sleep, activity, and nutrition behaviors associated with differences in select injury and behavioral health outcomes for Soldiers?	**Hierarchical Logistic Regression Models:** Injury and behavioral health outcomes regressed on SAN domains, controlling for demographic characteristics
5. Is the interaction between sleep, activity, and nutrition behaviors associated with differences in select injury and behavioral health outcomes for Soldiers?	**Hierarchical Logistic Regression Models:** Injury and behavioral health outcomes regressed on SAN domain interactions, controlling for demographic characteristics

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