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# Sleep problems and functioning during initial training for a high-risk occupation☆

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ABSTRACT

*Objectives:* The current study sought to characterize the sleep problems of soldiers entering Basic Combat Training and to identify the link between sleep problems and subsequent performance, psychological distress, anger reactions, and attention.
*Design:* Soldiers were surveyed at 4 time points throughout the standard 10 weeks of Basic Combat Training. Surveys were administered at weeks 1, 3, 6, and 9. Sleep problems were identified as either present or absent at each time point using a sleep problem screening questionnaire. Four sleep patterns were identified and then used to evaluate outcomes throughout training (n = 1577).
*Results:* When compared to those who never had a sleep problem ("healthy"; 60.6%), those who recovered from their initial sleep problem ("recovered"; 12.8%) started training with higher psychological distress and anger reactions and lower attention but steadily improved throughout training. Those who developed a sleep problem during training ("new onset"; 20.0%) and those who had a sleep problem throughout training ("chronic"; 6.6%) also started off significantly worse than the healthy group. The new-onset and chronic groups saw slower psychological distress improvement and a decline in attention throughout the course compared to the healthy group. The chronic group also significantly increased their anger reactions throughout training compared to the healthy group.
*Conclusion:* Sleep problems during Basic Combat Training may be an indicator for difficulties managing entry into the military. These findings highlight the importance of improving sleep health for soldiers throughout Basic Combat Training and for others with similar training in high-risk occupations.


The negative impact of sleep problems on mental health,[1–3] emotion regulation,[4] cognitive functioning,[5] and job performance[6] is well established. In high-risk occupations, like firefighting and policing, these consequences of problematic sleep can place the individual, team, and others in jeopardy.[7,8] The impact of sleep problems on the functioning and performance of individuals entering into these occupations, however, is less well understood. Identifying the link between sleep problems during initial entry into a high-risk occupation and these negative sequelae may highlight opportunities for early intervention.

The present study focuses on one particular high-risk occupation: military service.[9] Studies with soldiers have documented that sleep problems are associated with poor mental health[10] and cognitive impairment.[11] Moreover, the association between sleep problems and poor performance and health outcomes has been found to occur at multiple points throughout a soldier's career, such as during unit training events,[12] deployment,[13–15] and upon returning from deployment.[16] It is less clear, however, how sleep problems might impact the performance of new military recruits. Basic Combat Training (BCT) for new military recruits is intentionally stressful because it is designed to integrate them into military culture and prepare them physically and mentally for service. New recruits must not only master the technical tasks required of military personnel but internalize

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core professional values such as supporting other team members. As such, successful performance in BCT reflects both technical accomplishment and adherence to military values.

## Sleep and initial training

To date, few studies have documented sleep problems during BCT.[17–19] In one qualitative study, soldiers who asked about their sleep habits after at least 4 weeks of training reported reduced sleep duration compared to their sleep patterns prior to training.[17] These soldiers reported that their reduced sleep negatively impacted their cognitive and physical functioning.[17] In another study with trainees wearing actigraphs to assess their sleep, trainees who slept less reported worse mental health and performance than those who slept more.[18] Sleep problems have also been found to mediate the impact of unit cohesion on BCT graduation rates.[19]

The current study builds on these findings by examining the association of subjective sleep problems upon entry into BCT on a range of self-reported outcomes. Specifically, we examined associations between sleep health and performance, psychological distress, frequency of anger reactions, and attention, a measure of mental performance. We assessed performance as a teammate and as an individual given that several studies have documented decrements in military performance as a result of insufficient sleep.[20] Psychological distress was also assessed given that it has been previously associated with deployment-related demands[21] and sleep problems.[14–16] We also examined anger reactions, a key issue affecting military adjustment that has been previously linked to sleep problems in both military and civilian samples.[22,23] Finally, we explored the relationship between sleep problems and attention, which have also been found to be associated with one another among civilians[5] and military personnel.[11]

In addition, we assessed how sleep problems shifted over the course of training. Given previously reported changes in sleep health and sleep disruption over time in BCT,[17] the present study assessed changes in the longitudinal patterns of reported sleep problems and how they predicted soldier adjustment and performance.

Determining the impact of sleep problems early in a soldier's training has relevance to the military and its personnel. First, sleep problems that are present upon entry into training may place individuals at risk for negative health and performance outcomes, potentially contributing to the high cost of attrition from military service.[24] Second, identifying patterns associated with sleep problems at the start of BCT can help identify groups of soldiers who may be at increased risk and who may benefit from early intervention in sleep management.

The present study proposes that there are 4 different sleep patterns that can be found among the BCT participants: healthy sleep, chronic sleep problems, new onset of sleep problems, and recovery from sleep problems. We hypothesize that, compared to the healthy sleep group, the other sleep groups will perform worse both as a teammate and as an individual at the end of BCT. We further hypothesize that these different groups will in turn have different growth trajectories in terms of psychological distress, anger reactions, and attention such that improvements in sleep will correspond to improvements in psychological distress, anger reactions, and attention, whereas decrements in sleep will correspond to decrements in these outcomes.

## Methods

### *Participants*

Survey data were collected from 2 BCT brigades as part of a larger study on resilience.[25] Of the 2519 soldiers eligible to participate, 87.9% consented to participation. Due to platoon restructuring, 194 soldiers could not be followed over time and were excluded,[25] leaving 2019 soldiers eligible for the current study. Those who were missing sleep data at each time point were excluded (n = 321). Therefore, the current study included 1698 participants. The sample was predominately male (62.3%), aged 17-19 (65.0%), high school educated (70.3%), and single (87.5%). See Table 1 for full demographic information.

### *Procedures*

Surveys were administered at 4 time points corresponding with the phases of BCT. During the first phase (weeks 1-3), soldiers begin basic tactical training, learning skills such as landmine defense and rappelling, and learn about Army heritage and values. During the second phase (weeks 4-6), soldiers build confidence; learn basic marksmanship; and complete training exercises, obstacle courses, and foot marches. During the final phase (weeks 7-9), soldiers master use of other weapons, negotiate a night infiltration course, and complete final training exercises and extended foot marches.[26]

The baseline survey was administered during week 1 of training (phase 1; T1). The remaining surveys were administered 3 (end of phase 1; T2), 6 (end of phase 2; T3), and 9 (end of phase 3; T4) weeks later. Consent was obtained prior to the first survey administration. Drill sergeants and training cadre were absent during the consenting process to reduce undue influence, and an ombudsman was present to address questions. The protocol was approved by the Institutional Review Board at the Walter Reed Army Institute of Research.

### *Measures*

#### *Sleep problems*

Problematic sleep was assessed using a modified version of the Insomnia Severity Index[27] The questionnaire has 4 items and has been shown to be sensitive to identifying sleep problems among military personnel.[28,29] The first 2 items assessed difficulty falling asleep and staying asleep (1 = none to 5 = very severe), the third item assessed sleep satisfaction (1 = very satisfied to 5 = very dissatisfied), and the fourth item assessed the degree to which sleep interfered with functioning (1 = not at all to 5 = very much). Responses of “moderate,” “severe,” or “very severe” for the first 2 items were coded as “1” for at risk. Responses of “dissatisfied” or “very dissatisfied” for the third item were considered at risk. Responses of “somewhat”, “much,” or “very much interfering” for the fourth item were considered at risk. The recoded scores were summed to create a composite score of 0 to 4. Scores of 3 or greater met criteria for a sleep problem.[29] Cronbach $\alpha$ was .72, .72, .75, and .80 for T1-T4, respectively.

**Table 1**
Demographics for BCT soldiers

| Variables | n (%) |
|---|---|
| Sex | |
| Female | 592 (37.7) |
| Male | 979 (62.3) |
| Age | |
| 17-19 | 1021 (65.0) |
| 20-24 | 370 (23.6) |
| 25-40+ | 179 (11.4) |
| Education | |
| Some HS/GED/HS | 1099 (70.3) |
| Some college/associates | 382 (24.4) |
| Bachelors/graduate degree | 83 (5.3) |
| Marital status | |
| Single | 1376 (87.5) |
| Married | 196 (12.5) |

HS, high school; GED, General Education Diploma.

**Table 2**
Performance as a teammate (ie, Battle Buddy) items and frequencies

| Items | % Often/much of the time |
|---|---|
| I identified a Battle Buddy who was getting stressed out. | 36.8 |
| I helped a Battle Buddy who was getting stressed out. | 38.2 |
| I helped a Battle Buddy who was feeling down. | 42.1 |
| I helped a Battle Buddy who was thinking negatively. | 40.5 |
| I helped a Battle Buddy step back and reconsider how to think about a situation. | 33.8 |
| I talked a Battle Buddy through a difficult task. | 39.1 |
| I checked whether a Battle Buddy's initial response to a stressful situation was helpful. | 30.2 |
| I helped a Battle Buddy accept the reality of being in Basic Training. | 38.7 |
| I supported a Battle Buddy by just listening to him/her talk about a stressful situation that couldn't be changed or controlled. | 50.5 |
| I helped my Battle Buddy adapt his/her coping skills to a stressful situation. | 35.8 |
| I helped my Battle Buddy keep focused on the here and now when he/she was stressed out. | 42.4 |

*Performance*

Performance as a teammate was measured using 11 items developed for this study. At T4, participants were asked to rate how often they provided support to unit members (or "battle buddies") during training (1 = Not applicable/No opportunity to 6 = Much of the time). See Table 2 for all items and frequencies of "Often" and "Much of the time" endorsement. Scores were summed such that higher scores indicated greater team performance. Cronbach $\alpha$ was .96.

Individual performance was measured in terms of graduation from BCT. Pass or fail ratings were provided by official records.

*Psychological distress*

Psychological distress was assessed using the 6-item K6 Scale.[30] Participants were asked how often in the past 30 days they felt various symptoms of distress such as feeling "nervous," "hopeless," or "restless or fidgety" (0 = None of the time to 4 = All of the time). Higher scores indicated worse psychological distress. Cronbach $\alpha$ was .72, .79, .82, and .85 for T1-T4, respectively.

*Anger reactions*

Anger reactions were assessed with 4 items used in studies with military samples (eg, Thomas et al[31]). Participants reported how often in the past 7 days they engaged in the following items: (*a*) Get angry at someone and yell or shout at them; (*b*) Get angry with someone and kick or smash something, slam the door, punch the wall, etc; (*c*) Get into a fight with someone and hit the person; and (*d*) Threaten someone with physical violence (0 = Never; 1 = One time; 2 = Two times; 3 = Three or four times; 4 = Five or more times). Higher scores indicated more anger reactions. Cronbach $\alpha$ was not calculated because the items were formative rather than reflective.

*Attention*

Attention, a component of mental performance, was assessed using a single item drawn from the Positive States of Mind scale.*,[32] The item and response options were edited for clarity. Participants were asked to rate their ability to "Feel able to focus on a task you want or need to do, without your mind wandering" over the last week (1 = Not at all to 4 = A lot). Higher scores indicated greater attention.

* The original item asks individuals to rate their ability to experience "feeling able to attend to a task you want or need to do, without many distractions from within yourself" with a 4-response option scale (1 = Unable to have it to 4 = Have it well).

*Data analysis*

Descriptive statistics were computed to examine demographic variables among those who started BCT. Sleep patterns were then evaluated to classify soldiers into 1 of 4 sleep groups. Soldiers who scored below the cutoff for sleep problems at each time point were classified as "Healthy" (n = 955; 60.6%). Soldiers who started with a sleep problem but recovered by week 6 and remained problem-free were classified as "Recovered" (n = 203; 12.8%). Soldiers who began BCT without a sleep problem but developed a problem over the course of the training (eg, at T2 or T3) were classified as "New Onset" (n = 315; 20.0%). Finally, soldiers who had the presence of sleep problems at each time point were classified as "Chronic" (n = 104; 6.6%). To optimize the number of statistical comparisons, we focused on those groups comprising at least 5% of the sample. Thus, those who did not recover from their initial sleep problem until week 9 (n = 45, 2.7%) and those who had a sleep problem at the beginning and intermittently throughout training (n = 76, 4.5%) were excluded.

We conducted an analysis of covariance to assess the relationship among sleep groups and performance as a teammate, and a logistic regression model assessed individual performance (ie, graduation status), both of which were on measured at a single time point at the end of BCT.

Finally, latent growth models were used to assess the growth trajectories of each of our sleep groups for psychological distress, anger, and attention.[33] Latent growth models were estimated using the lavaan package for the R Statistical Platform.[34] For each of the 3 models, linear growth was hypothesized, and models with fixed and random intercepts and slopes were estimated. Consistent with standard practice,[35] goodness of fit for each model as a whole was evaluated using multiple statistics, including $\chi^2$ goodness of fit, the root mean square error of approximation (RMSEA), the standardized root-mean square residual (SRMR), the Comparative Fit Index (CFI), and the Tucker Lewis Index (TLI).[33,35] To compensate for the non-normal distribution of residuals in our 3 dependent variables (ie, psychological distress, anger reactions, and attention), all latent growth models were estimated with a maximum likelihood estimator with robust standard errors (ie, the MLR estimator), which provides a more conservative assessment of model fit and has been shown to be robust against violations of normality.[36]

For each growth model, the interval between time points was equal; therefore, the factor loadings started at 0 for T1 and ended with 3 for T4. Each model was constrained by the following time-invariant covariates that were regressed onto the model intercept and slope: sex (with male sex as the reference group), age (with younger than 20 years as the reference group), educational attainment (with GED or high school diploma as the reference group), and marital status (with single as the reference group). Additionally, sleep group membership was dummy-coded and regressed onto the model intercept and slope, with the healthy sleep group serving as the reference group. Therefore, for each model, latent intercepts and slopes represent baseline values and longitudinal trajectories for young, male, high-school educated, unmarried soldiers with healthy sleep (ie, the reference group) for the specified model outcome; coefficients for the models' covariates predicting intercept and slopes can then be interpreted as indicating the direction and magnitude with which membership in a particular nonreference group (eg, female sex, college educated, married status, and problematic sleep trajectories) accounts for deviation in baseline values or growth trajectories from the reference group.

All statistical analyses were completed using base package functions the R Statistical Platform.[37]

## Results

For the overall frequency of sleep problems throughout BCT along with the outcome variables at each time point, see Table 3. At baseline,

the mean composite sleep scores for the recovered group (mean [*M*] = 3.37, SD = .49), new-onset group ($M = 1.27$, SD = .77), and the chronic group ($M = 3.61$, SD = .49) were each significantly higher than that of the healthy-sleep group ([$M = 0.81$, SD = .82 ;] $F_{3,1552} = 955.49$, $P < .001$; each post hoc Tukey test $P < .001$).

*Performance as a teammate*

For support of one's Battle Buddy, there were no significant differences in terms of sleep groups ($F_{3,1517} = 1.26$, $P = .286$, $\eta_p^2 = .002$). Age ($F_{2,1517} = 0.35$, $P = .707$, $\eta_p^2 = .0009$), education ($F_{2,1517} = 2.31$, $P = .100$, $\eta_p^2 = .003$), and marital status ($F_{1,1517} = 0.001$, $P = .972$, $\eta_p^2 = .000$) were also not significant. Sex was the only significant predictor of performance as a teammate ($F_{1,1517} = 58.86$, $P < .001$, $\eta_p^2 = .036$) such that male recruits reported providing less Battle Buddy support than female recruits. See Table 4 for Battle Buddy support for each sleep group.

*Individual performance*

Relative to the referent groups, there were no significant differences found in terms of graduation rates (Nagelkerke $R^2 = .022$). In terms of sleep, relative to the healthy sleep group, the recovered group did not graduate at a significantly different rate (adjusted odds ratio [AOR] = 1.249, 95% confidence interval [CI]: 0.611-2.902). This pattern was true for the new-onset (AOR = .986, 95% CI: .560-1.824) and chronic group (AOR = .474, 95% CI: .243-1.002) as well. See Table 4 for the graduation rates for each sleep group.

*Psychological distress*

The latent growth model assessing psychological distress demonstrated acceptable fit (Table 5). The fixed latent intercept for psychological distress, reflecting the mean baseline value for the reference group, was 3.94 (SE = 0.84) with a random intercept of 6.29 (SE = 0.49). The fixed latent slope for psychological distress, reflecting the mean growth trajectory for the reference group, was −1.82 (SE = 0.34), with a random slope of 0.47 (SE = 0.12), indicating a predicted mean decrease in psychological distress among the reference group over the course of BCT.

Female sex ($b = 0.69$, SE = 0.18, $P \le .001$), age between 20 and 24 years ($b = -0.63$, SE = 0.27, $P = .018$), age more than 25 years ($b = -1.29$, SE = 0.37, $P = .001$), and some college education ($b = -0.54$, SE = 0.25, $P = .034$) were all significant predictors of the model intercept such that female recruits were predicted to have greater psychological distress at baseline compared to male recruits and older recruits and recruits with some education beyond high school were predicted to have less psychological distress at baseline as compared with the reference group. Soldiers in the recovered group ($b = 2.81$, SE = 0.29, $P \le .001$), new-onset group ($b = 1.86$, SE = 0.24, $P \le .001$), and chronic–sleep problem group ($b = 4.78$, SE = 0.45, $P \le .001$) were likewise estimated to have significantly higher levels of psychological distress at baseline as compared with the reference group, with the chronic-sleep group showing the highest levels of psychological distress at baseline.

Of the demographic variables, only female sex ($b = 0.21$, SE = 0.07, $P = .004$) was a significant predictor of the latent slope such that female sex was associated with a slower longitudinal decrease in psychological distress over the course of BCT as compared with the male sex. Soldiers categorized as recovering from sleep problems ($b = -0.50$, SE = 0.11, $P \le .001$) likewise were predicted to have a significantly steeper decline in psychological problems as compared to the reference group. However, soldiers in the new-onset group ($b = 0.42$, SE = 0.10, $P \le .001$) and the chronic–sleep problem group ($b = 0.65$, SE = 0.18, $P \le .001$) were predicted to have slower declines in psychological distress over the course of BCT as compared to the reference group (Fig. 1A).

**Table 3**
Frequencies and means for sleep problems, psychological distress, anger reactions, attention, and performance

| | T1 | T2 | T3 | T4 |
|---|---|---|---|---|
| | n (%) | n (%) | n (%) | n (%) |
| Sleep problems | 499 (25.7%) | 476 (24.8%) | 401 (20.8%) | 345 (18.6%) |
| | *M* (SD) | *M* (SD) | *M* (SD) | *M* (SD) |
| Psychological distress | 11.26 (3.82) | 11.84 (4.33) | 10.81 (4.15) | 9.78 (4.11) |
| Anger reactions | 1.81 (2.16) | 2.20 (2.27) | 2.10 (2.28) | 2.18 (2.49) |
| Attention | 2.73 (0.84) | 2.82 (0.86) | 2.86 (0.88) | 2.89 (0.90) |
| Performance | – | – | – | 44.86 (11.73) |

T2 = Time 2; T3 = Time 3; T4 = Time 4; M = Mean; SD = Standard deviation; Performance here refers to performance as a teammate; – denotes that performance items were not measured at T1-T3.

**Table 4**
Sleep group comparisons in performance outcomes

| Sleep group | Performance as a teammate *M* (SD) | Graduation rate (%) |
|---|---|---|
| Healthy | 44.71 (11.86) | 94.9 |
| Recovered | 45.99 (10.68) | 95.9 |
| New onset | 44.88 (11.74) | 94.7 |
| Chronic | 43.91 (12.39) | 89.5 |

*Anger reactions*

The latent growth model assessing anger reactions demonstrated good fit (Table 5). The fixed latent intercept for anger reactions was 1.21 (SE = 0.50) with a random intercept of 2.44 (SE = 0.23). The fixed latent slope for psychological distress was −0.17 (SE = 0.21) with a random slope of 0.20 (SE = 0.04), indicating a predicted mean decrease in anger reactions among the reference group over the course of BCT.

Age more than 25 years ($b = -0.73$, SE = 0.20, $P < .001$) was the only significant demographic predictor of the model intercept such that older recruits were predicted to have less anger reactions at baseline as compared with the reference group. Soldiers in the recovered group ($b = 0.62$, SE = 0.18, $P \le .001$) and chronic–sleep problem group ($b = 1.16$, SE = 0.25, $P \le .001$) were likewise estimated to have significantly higher levels of anger reactions at baseline as compared with the reference group, with the chronic-sleep group showing the highest levels of anger reactions at baseline.

Of the demographic variables, only age between 20 and 24 years ($b = -0.13$, SE = 0.05, $P = .016$) was a significant predictor of the latent slope such that older recruits had a steeper longitudinal decrease in anger reactions over the course of BCT as compared with the reference group. Soldiers categorized as recovering from sleep problems ($b = -0.15$, SE = 0.07, $P = .034$) likewise were predicted to have a significantly steeper decline in anger reactions as compared to the reference group. However, soldiers in the new-onset group ($b = 0.26$, SE = 0.06, $P \le .001$) and the chronic–sleep problem group ($b = 0.30$, SE = 0.12, $P = .009$) were predicted to have a gradual increase in anger reactions over the course of BCT as compared to the reference group (Fig. 1B).

*Attention*

The latent growth model assessing attention demonstrated good fit (Table 5). The fixed latent intercept for attention was 3.68 (SE =

**Table 5**
Model fit statistics and growth parameter estimates

| | | Intercept | | Slope | | |
|---|---|---|---|---|---|---|
| | | Est. | SE | Est. | SE | |
| Psychological distress | Male vs female | −.688*** | .181 | −.206** | .072 | Fit statistics |
| | Age 17-19 vs 20-24 | −.626* | .265 | −.083 | .092 | $\chi^2_{(23)} = 354.089$; $P < .001$ |
| | Age 17-19 vs 25+ | −1.290*** | .372 | .141 | .144 | CFI = .892; TLI = .803 |
| | HS vs associates | −.535* | .253 | .099 | .093 | RMSEA = .101; SRMR = .041 |
| | HS vs bachelors | −.670 | .381 | .129 | .161 | Growth estimates |
| | Single vs married | −.177 | .300 | .112 | .124 | Fixed intercept = 3.944 |
| | Healthy vs recovered | 2.810*** | .290 | −.499*** | .109 | Random intercept = .841 |
| | Healthy vs new onset | 1.862*** | .238 | .420*** | .100 | Fixed slope = −1.818 |
| | Healthy vs chronic | 4.784*** | .453 | .649*** | .184 | Random slope = .341 |
| Anger reactions | Male vs female | .177 | .102 | −.027 | .042 | Fit statistics |
| | Age 17-19 vs 20-24 | −.233 | .138 | −.129* | .054 | $\chi^2_{(23)} = 75.887$; $P <$; .001 |
| | Age 17-19 vs 25+ | −.725*** | .198 | −.116 | .082 | CFI = .974; TLI = .952 |
| | HS vs associates | −.194 | .134 | −.003 | .052 | RMSEA = .043; SRMR = .021 |
| | HS vs bachelors | −.344 | .198 | .063 | .090 | Growth estimates |
| | Single vs married | −.130 | .160 | −.025 | .072 | Fixed intercept = 1.746 |
| | Healthy vs recovered | .623*** | .178 | −.152* | .072 | Random intercept = .499 |
| | Healthy vs new onset | .165 | .129 | .258*** | .057 | Fixed slope = −.166 |
| | Healthy vs chronic | 1.163*** | .249 | .304** | .116 | Random slope = .206 |
| Attention | Male vs female | .117** | .038 | .042* | .018 | Fit statistics |
| | Age 17-19 vs 20-24 | .118* | .054 | −.023 | .026 | $\chi^2_{(23)} = 37.258$; $P <$; .001 |
| | Age 17-19 vs 25+ | .152 | .083 | −.020 | .040 | CFI = .988; TLI = .977 |
| | HS vs associates | .131* | .054 | −.022 | .027 | RMSEA = .020; SRMR = .014 |
| | HS vs bachelors | .067 | .096 | .080 | .047 | Growth estimates |
| | Single vs married | .115 | .063 | −.035 | .031 | Fixed intercept = 3.676 |
| | Healthy vs recovered | −.369*** | .056 | .060* | .027 | Random intercept = .183 |
| | Healthy vs new onset | −.284*** | .046 | −.064** | .022 | Fixed slope = .200 |
| | Healthy vs chronic | −.540*** | .072 | −.079* | .034 | Random slope = .085 |

For sex, male was the referent; for age, 17-19 was the referent; for education, some high school/general education diploma/high school was the referent; for marital status, single was the referent; for the sleep groups, healthy was the referent Est = Estimate; SE = Standard error; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = Root-mean square error of approximation; SRMR = Standardized root-mean square residual;.

0.18) with a random intercept of 0.13 (SE = 0.03). The fixed latent slope for attention was 0.20 (SE = 0.09) with a random slope of 0.02 (SE = 0.01), indicating a predicted mean increase in attention among the reference group over the course of BCT.

Female sex ($b = -0.12$, SE = 0.04, $P = .002$), age between 20 and 24 years ($b = 0.12$, SE = 0.05, $P = .030$), and some college education ($b = 0.13$, SE = 0.05, $P = .015$) were all significant predictors of the model intercept such that female recruits were predicted to have less attention compared with male recruits and older recruits, and recruits with some education beyond high school were predicted to have more attention at baseline as compared with the reference group. Soldiers in the recovered group ($b = -0.37$, SE = 0.06, $P \leq .001$), new-onset group ($b = -0.28$, SE = 0.05, $P \leq .001$), and chronic–sleep problem group ($b = -0.54$, SE = 0.07, $P \leq .001$) were likewise estimated to have significantly lower levels of attention at baseline as compared with the reference group, with the chronic-sleep group showing the lowest levels of attention at baseline.

Of the demographic variables, only female sex ($b = -0.04$, SE = 0.02, $P = .004$) was a significant predictor of the latent slope such that female sex was associated with a slower longitudinal increase in attention over the course of BCT as compared with the reference group. Soldiers categorized as recovering from sleep problems ($b = 0.60$, SE = 0.03, $P = .027$) likewise were predicted to have a significantly steeper incline in attention as compared to the reference group. However, soldiers in the new-onset group ($b = -0.06$, SE = 0.02, $P = .004$) and the chronic–sleep problem group ($b = -0.08$, SE = 0.03, $P = .019$) were predicted to have slower inclines in psychological distress over the course of BCT as compared to the reference group (Fig. 1C).

## Discussion

The current study was designed to examine the link between sleep problems and adjustment during initial occupational training in terms of performance, psychological distress, anger reactions, and attention.[1–6] In studying a military sample going through BCT, this research sought to build on previous work[17–19] demonstrating the relationship between sleep problems and outcomes central to initial training for a high-risk occupation. In the present study, most of the soldiers experienced healthy sleep throughout training, and 12.8% recovered from their initial sleep problem. In contrast, 1 in 5 soldiers developed a sleep problem over the course of BCT, and 1 in 15 had a sleep problem throughout the training period. Findings from the present study suggest sleep problems affect a substantial proportion of soldiers in BCT. These sleep problems signal difficulties in managing entry into the military, which in turn have implications for the individual and the larger organization.

The results also suggest that if a sleep problem can be resolved during training, then the risk conferred for psychological distress, anger reactions, and attention may be mitigated. Those in the recovered group had more severe psychological distress, anger reactions, and attention at baseline compared to the healthy sleep group, although improved over the course of BCT at a faster rate than the healthy sleep group. These results suggest that BCT instructors should identify those who start with a sleep problem and track them throughout training to encourage healthy sleep. An intervention to improve sleep may be needed if sleep problems persists.

In contrast, those who started BCT without a sleep problem but later developed one were found to be at an increased risk for psychological distress, anger reactions, and attention relative to those with healthy sleep. Although their sleep problems did not emerge until later, these soldiers had significantly worse psychological distress and attention at baseline compared to the healthy-sleep group. Moreover, the new-onset soldiers showed a slow decline in psychological distress, a steady increase in anger reactions, and a slower increase in attention compared to the healthy-sleep group. Therefore, BCT instructors should identify soldiers who develop a sleep problem

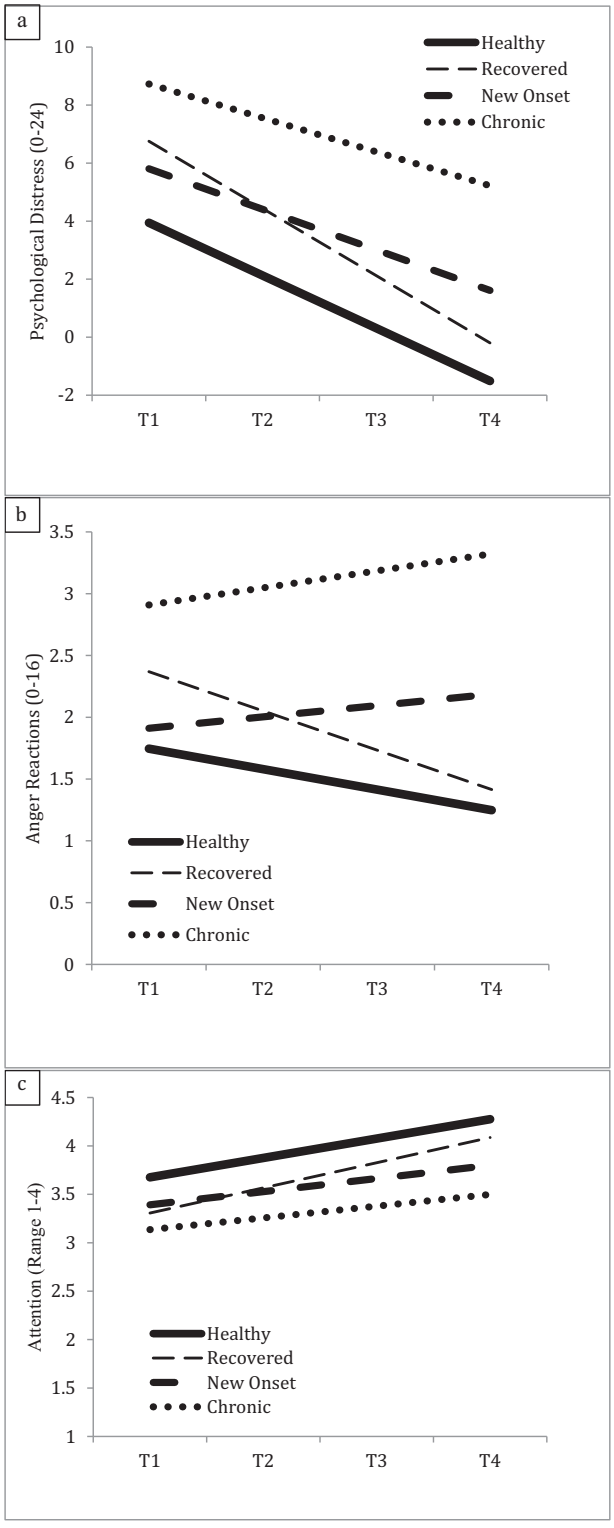


**Fig. 1.** Sleep group comparisons in (A) psychological distress, (B) anger reactions, and (C) attention throughout BCT. T2 = Time 2; T3 = Time 3; T4 = Time 4; See Table 3 for analysis of significant group differences. Latent linear growth trajectories estimating longitudinal data may exceed the possible range of the scale; scale axes have been modified to reflect the full range of estimated latent growth trajectories over time.

early in training to intervene and potentially avoid the development of subsequent problems.

Those who entered BCT with sleep problems and maintained them throughout BCT showed the greatest risk. Soldiers in the chronic–sleep problem group started out with the highest level of psychological distress and anger reactions, and the lowest level of attention. Throughout BCT, these soldiers also deteriorated significantly relative to the healthy sleep group. These results confirm the well-known consequences associated with chronic sleep problems[11] and also underscore the importance of identifying these soldiers early in training to address their sleep health.

Although there were clear links between sleep problems, psychological distress, anger reactions, and attention, performance as a teammate and as an individual did not significantly differ across groups. Indeed, by the end of BCT, all 4 groups reported similar levels of providing unit members support and graduated at similar rates after controlling for sex, age, education, and marital status. It may be that although sleep problems interfere with psychological distress, anger reactions, and attention, sleep problems do not as readily interfere with the enculturation process as operationalized by taking care of fellow service members.[38] These results are promising, as acceptance of a core organizational value appears independent of sleep problems.

We also identified key demographic variables that impacted the outcomes in the present study. Female recruits were worse off in terms of psychological distress and attention compared to the male recruits, although they reported providing more support for battle buddies than their male counterparts. Moreover, the youngest and less educated recruits fared more poorly compared to the older and more educated recruits with respect to psychological distress, anger reactions, and attention. Further research is needed to better understand the dynamics of these demographic differences and what can be done by individuals, teams, and leaders to address greater risks associated with certain groups.

The present study has a number of strengths, including the examination of sleep problem patterns over time and a robust sample; however, there are limitations. First, the measures of sleep, team performance, psychological distress, anger reactions, and attention were self-report, potentially leading to biased reporting. In an effort to reduce any potential influence on soldier responses, unit leaders were not present during completion of the surveys. Second, the study did not assess sleep duration, which can be a predictor of sleep problems, although it was expected given the strict environment of BCT that there would be few individual differences in opportunity to sleep. Third, although the study assessed the presence or absence of sleep problems throughout BCT, we did not examine why some soldiers developed a sleep problem and others did not. Crowley and colleagues[17] provided some evidence that speaks to environmental or individual factors that may affect sleep during BCT, but these details were beyond the scope of the present study. Fourth, we measured performance as a teammate using a measure developed for this study that has not been previously validated, although the items exhibited face validity and good reliability. Finally, we measured attention using only a single item from the Positive States of Mind questionnaire.

Future research should assess the degree to which the relationship between sleep problems and psychological distress, anger reactions, and other health-related indices might be bidirectional. Future research should also focus on the new-onset group. Despite starting BCT without a clearly defined sleep problem, their mean sleep score at the baseline was significantly higher than the healthy-sleep group, suggesting that there may have been some indication of an emerging sleep issue in this group. Further investigation into the presence of subthreshold sleep problems at the start of BCT, the development of sleep problems following the start of BCT, and how psychological distress and attention fuel such problems may help identify potentially at-risk soldiers.

Given the importance of reducing sleep problems in a high-risk occupational context,[11] future research should assess factors

influencing sleep health over the course of initial training, such as adjustment worries, cadre attitudes toward sleep,[39] and the sleep environment in the training milieu.[17] Early intervention strategies that address sleep during the initial phases of BCT should also be developed and assessed. Such strategies could include screening for initial sleep problems, providing sleep hygiene education or actigraph-measured feedback[40] to new soldiers, and training drill sergeants in managing sleep.[39] Future research should also focus on understanding how the different phases of BCT could influence sleep health. Finally, the present study should be replicated in high-risk occupations such as police and fire fighters to determine if other periods of initial training provide a similar window of opportunity to address sleep problems and improve recruit adjustment and performance.

## Conflicts of Interest

None of the authors have any relevant conflicts of interest to report.

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