**Determinants of vitality during a training cycle in a cohort of special-forces operators**

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**ABSTRACT**

Personnel in special operations forces (SOF) have an extremely demanding occupation, but there is little information about the factors affecting their well-being. The aim of present study was to investigate potential psychological moderators and mediators of well-being in recruits and operators of the Norwegian Navy SOF. Perceived vitality and its potential moderators and meditators were assessed in 74 male operators of the Navy SOF (age 19-36 years) before, and 35 male operators after, a six-month training cycle. The data were analyzed in two groups based on years of experience in the SOF unit (<2 y, recruits; >2 y, experienced operators). Effects were assessed as clear when their standardized magnitudes had adequate precision. At baseline, there was little difference in vitality between the groups, but the recruits worked and slept more. There was a small increase in vitality in the recruits and a small decrease in the experienced group. Further, the recruits with lower baseline vitality had greater increases. Individual changes in vitality showed a moderate positive relationship with changes in sleep quality and a small negative relationship with changes in work-home issues, but mean changes in these and other potential mediators accounted for only trivial mean changes in vitality in both groups. The recruits adapted well to the program, but the experienced operators showed a minor reduction in vitality over the six months. Helping some operators to improve their sleep and resolve their work and home issues are avenues for improving their well-being.

Keywords: psychological health, well-being, SOF and military

**Statistical analysis**

The linear mixed model procedure (Proc Mixed) in the Statistical Analysis System (SAS Institute, Cary, NC, USA) was used to analyze differences in the means and differences in the effects of covariates (moderators and mediators) between the two groups. Mean baseline characteristics of the two groups were estimated and compared with a simple model consisting of a group effect, allowing for unequal variances in the groups. A similar model was used to compare mean changes (post minus baseline) of vitality and potential mediators, with the change score as the dependent variable.

For the analysis of the effect of baseline vitality and other potential moderators on the change in vitality, the moderators were included in the previous model as numeric linear predictors interacted with the group effect (to specify a different “slope” in each group). The effect of moderators was analyzed as the difference in changes in vitality between subjects who differed by approximately two standard deviations (SD) of the moderator (without regard to the group), to represent the difference between those with a high (mean +1SD) vs a low (mean -1SD) value of the moderator (Hopkins, Marshall, Batterham, & Hanin, 2009).

Mediation was analyzed with a model consisting of the change in vitality as the dependent variable and predictor variables consisting of the group effect and the change score of the potential mediator, thereby estimating the effect of the mediator with the same slope in both groups. The effect of each mediator was analyzed as the change associated with 2 SD of the mediator. The extent to which the mediator accounted for the mean change in each group was also assessed by multiplying the slope by the mean change of the mediator in each group. Confidence limits were derived from the standard errors using a method similar to bootstrapping (Lipinska, Allen, & Hopkins, 2015).

The magnitude of a difference in means was assessed by standardization (mean change divided by baseline SD of all operators), and the resulting standardized effect evaluated with a modification of Cohen’s (1992) scale: <0.2, trivial; 0.2-0.6, small; 0.6-1.2, moderate; >1.2, large. To evaluate the importance of effects we used non-clinical magnitude-based inference instead of null-hypothesis significance testing (Hopkins, et al., 2009). Owing to the considerable number of effects investigated, uncertainty in the estimate of effects was expressed as 99% confidence limits. An effect was deemed unclear when the upper and lower confidence limits represented substantial increases and decreases, respectively. All other effects were deemed clear, and the probabilities that the true effect was a substantial increase, a trivial change, and a substantial increase were calculated via the sampling t-distribution of the effect. The effect is shown as the difference or change with the greatest probability, and the probability is shown qualitatively using the following scale: 25-75%, possibly; 75-95%, likely; 95-99.5%, very likely; > 99.5%, most likely (Hopkins et al., 2009).

**Results**

The questionnaire was completed by 74 operators at baseline and 35 after a six-month training cycle. The responses of the recruits and experienced operators and the differences between the groups are shown in Table 1. There was practically no difference between the two groups on vitality at baseline. The recruits were younger, had fewer children, slept more, spent more time away from home, and worked more.

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| Table 1. Simple statistics for dependent, moderator and mediator variables of operators in the recruits and experienced operators at baseline, and magnitude-based inferences for the difference in means.  |
|  | RecruitsMean ± SD (n=18) | Experienced operatorsMean ± SD (n=56) | Difference(recruits – operators) |
|  | Mean; 99%CL | Inferencea |
| **Dependent** |
| Vitality (1 to 7) | 5.0 ± 1.1 | 4.9 ± 1.3 | 0.1; ±0.8 | trivial |
| **Moderators** |  |  |  |  |
| Age (y) | 23.1 ± 3.6 | 29.7 ± 4.9 | -6.6; ±2.9 | large ↓\*\*\*\* |
| Number of children | 0.2 ± 0.5 | 0.7 ± 1.1 | -0.5; ±0.5 | small ↓\*\* |
| **Mediators** |  |  |  |  |
| Ability to recover (1 to 7) | 4.7 ± 0.6 | 4.6 ± 0.8 | 0.2; ±0.5 | small ↑ |
| Awareness (1 to 5) | 4.1 ± 0.5 | 3.9 ± 0.7 | 0.1; ±0.5 | small ↑ |
| Sleep quality (1 to 5) | 3.8 ± 0.5 | 3.6 ± 0.6 | 0.2; ±0.5 | small ↑ |
| Weekly sleep (1 to 5) | 3.8 ± 0.6 | 3.2 ± 0.7 | -0.6; ±0.5 | mod.↑\*\*\* |
| Weekly work hours (1 to 6) | 4.8 ± 1.2 | 3.7 ± 1.4 | 1.1; ±2.6 | mod.↑\*\*\* |
| Work-home issues (1 to 4) | 1.8 ± 0.6 | 1.8 ± 0.5 | 0.1; ±0.5 | trivial |
| Yearly days away (1 to 6) | 5.2 ± 1.0 | 4.6 ± 1.0 | 0.6; ±0.8 | small ↑\*\* |
| aMagnitude thresholds (for difference in means divided by SD of the operators): <0.20, trivial; 0.20-0.59, small; 0.60-1.19, moderate; >1.20, large.Asterisks indicate effects clear at the 99% level and likelihood that the true effect is substantial, as follows: \*possible, \*\*likely, \*\*\*very likely, \*\*\*\*most likely.  |

Changes in vitality and in the possible mediators are shown in Table 2. There was a small increase in vitality in the recruits and small decrease in the experienced operators, the mean difference being small-moderate (0.8, 99% confidence limits ±0.5). Although there were some substantial changes in the mediators in both groups, only the changes in the experienced operators were clear. Some of the differences between the changes in the mediators were small, but none was clear. The effects were unclear, which means they could have been substantially negative, trivial, or substantially positive. We therefore did not think that there was sufficient precision in the estimates to justify including them here, other than to indicate that the observed magnitudes were at most small.  Including them would also detract from the more interesting results in the table.

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| Table 2. Changes in dependent and potential mediator variables in the recruits and experienced operators, and magnitude-based inferences for the changes and for the difference in the changes.  |
|  | Recruits (n=14) |  | Experienced operators (n=21) |
|  | Mean ± SD; ±99%CL | Inferencea |  | Mean ± SD; ±99%CL | Inferencea |
| **Dependent** |
| Vitality (-6 to 6) | 0.5 ± 0.9; ±0.4 | small ↑\*\* |  | -0.3 ± 0.8; ±0.3 | small ↓\* |
| **Mediators** |  |  |  |  |  |
| Ability to recover (-6 to 6) | 0.3 ± 0.7; ±0.5 | small ↑ |  | 0.3 ± 0.4; ±0.3 | small ↑\*\* |
| Awareness (-4 to 4) | 0.1 ± 0.4; ±0.3 | trivial |  | -0.2 ± 0.6; ±0.3 | small ↓\* |
| Sleep quality (-4 to 4) | 0.0 ± 0.8; ±0.7 | trivial |  | 0.2 ± 0.5; ±0.3 | small ↑ |
| Weekly sleep (-4 to 4) | 0.0 ± 0.7; ±0.5 | trivial |  | 0.1 ± 0.7; ±0.5 | trivial |
| Weekly work hours (-5 to 5) | -0.2 ± 1.9; ±1.5 | trivial ↓ |  | -0.5 ± 1.5; ±1.0 | small ↓\*\* |
| Work-home issues (-3 to 3) | -0.1 ± 0.4; ±0.3 | small ↓ |  | -0.0 ± 0.4; ±0.2 | trivial |
| Yearly days away (-5 to 5) | -0.3 ± 1.2; ±1.0 | small ↓ |  | -0.3 ± 0.9; ±0.7 | small ↓\* |
| aFor explanation of inferences, see Table 1. |

The effects of possible moderators on vitality are shown for the two groups, while effects of mediators are shown for the total sample in Table 3. Baseline vitality in the recruits was the only clear moderator, and the effect remained clear when compared with that in the more experienced operators (-2.1, 99% confidence limits ±1.8; large). For a recruit with a low baseline value (2.0 units), the moderating effect accounted for a predicted very large increase (3.0; 99% confidence limits ±2.0), while a recruit with a high baseline (6.0) experienced a predicted small decrease (0.4; ±0.9).

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| Table 3. Effect of moderatorsa and mediatorsb on vitality.  |
|  | Mean; ±99%CL | Inferencec |
| Moderators in the recruits (n=14) |
|  | Baseline vitality | -2.1; ±1.5 | large ↓\*\*\*\* |
|  | Age | -0.9; ±1.9 | mod.↓ |
|  | Number of children | -1.3; ±2.4 | mod.↓ |
| Moderators in the experienced operators (n=21) |
|  | Baseline vitality | -0.2; ±1.0 | trivial |
|  | Age | -0.1; ±1.2 | trivial |
|  | Number of children | -0.1; ±1.0 | trivial |
| Mediators (n=35) |
|  | Awareness |  0.3; ±0.8 | small ↑ |
|  | Ability to recover | -0.2; ±1.0 | trivial |
|  | Sleep quality |  0.9; ±0.9 | mod.↑\*\*\* |
|  | Weekly sleep |  0.5; ±0.9 | small ↑ |
|  | Weekly work hours |  0.2; ±0.9 | trivial |
|  | Work-home issues | -0.6; ±0.9 | small↓\*\* |
|  | Yearly days away |  0.2; ±0.9 | trivial |
| aEffects shown are the differences in the change in vitality between operators who differed at baseline by 2 SD of vitality (2.5 units), by 10 y of age, and by 2 children. Effects of age and number of children were adjusted for baseline vitality but not for each other.bEffects shown are the differences in the change in vitality associated with a 2-SD difference in the change in the mediator. Mediators were evaluated without adjustment for moderators.cFor explanation of inferences, see Table 1. |

Changes in sleep quality and work-home issues were the only potential mediators that had clear linear relationships with changes in vitality (moderate and small respectively; Table 3). Changes in the mean of all the potential mediators were associated with only trivial mean changes in vitality in both groups, and most of these effects were clearly trivial at the 99% level. These data are therefore not shown.

**References**

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