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RUNNING HEAD: STABILITY OF HARDINESS

On the Stability of Psychological Hardiness:

A Three-Year Longitudinal Study

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Abstract

More than 30 years of research has established psychological hardiness as an important individual resiliency resource. One important question still remaining is whether psychological hardiness can be trained. The present study explores this question longitudinally within the context of a three-year military academy training-program. Cadets from three different Norwegian military academies (N = 293) completed hardiness questionnaires during the first week of their training, and then again at the end of each year, resulting in a total of four waves of data. Using hierarchical linear modeling no statistically significant effect of time on hardiness scores was found. The non-significant growth parameter was examined further using Bayesian statistics as an indicator of the relative evidence for the null-hypothesis of no change over time vs. the alternative hypothesis of change. The resulting Bayes factor provided substantial support in our data for the null-hypothesis of no hardiness development during the three-year officer training-programs.

Keywords: Psychological hardiness; Military academy cadets; Hardiness training; Longitudinal; Hierarchical linear model; Bayes factor

Extreme situations like the 9/11 terrorist attack and the more recent attacks on the government quarter in Oslo and the island of Utøya in Norway on 22 July 2011 have increased public awareness of the importance that leaders and operators in services like the police, the fire department and the military have a well-developed ability to maintain effective functioning even in the face of stress and strong pressure. One line of research addressing these challenges has focused on individual levels of psychological hardiness.

Hardiness is usually defined as a combination of three related personality qualities or traits: 1) A belief in one's own ability to control or influence the course of events (*control*), 2) an internal motivation and commitment to the various areas of life, including work, interpersonal relations and self (*commitment*), and 3) an appreciation of new experiences and challenges as opportunities for learning and personal growth (challenge; Bartone, 2000; Kobasa, 1979; Maddi & Kobasa, 1984). Together, these three attributes constitute a personality style that has been associated with resilience and high performance among emergency responders under a range of stressful conditions (Alexander & Klein, 2001; Andrew et al., 2008; Barton, Vrij, & Bull, 2004; Bartone, Ursano, Wright, & Ingraham, 1989; Jimenez, Natera, Munoz, & Benadero, 2006; Martin, Marchand, & Boyer, 2009). For example, in an experimental study of police use of lethal force, Barton and associates (2004) found that officers who were low in hardiness made more erroneous decisions compared with officers high on hardiness during simulated incidents. In military groups, hardiness has been identified as significant moderator of combat-exposure stress (Bartone, 1999, 2000), as well as leader performance (Bartone, Eid, Johnsen, Laberg, & Snook, 2009).

Despite more than 30 years of research into hardiness there are still unresolved issues concerning the nature of the construct. On the one hand, it is often considered to be a stable and

trait-like personality disposition falling under the umbrella of the general trait theory of personality (e.g., Matthews, Deary, & Whiteman, 2003). For example, in a meta-analysis of personality and subjective well-being, DeNeve and Cooper (1998) subsumed hardiness under the general Extraversion factor of the Big Five Model of personality. On the other hand, several writers emphasize the flexibility of the construct. Maddi (2004, 2006) considers hardiness more in terms of a cognitive/emotional amalgam consisting of three related attitudes (i.e., commitment, control and challenge) that is learned early in life but that can still be enhanced in adulthood through training interventions. Across several studies Maddi and associates have been able to demonstrate the effectiveness of hardiness training in both students and working adults (e.g., Maddi, 1987; Maddi, Harvey, Khoshaba, Fazel, & Resurreccion, 2009; Maddi, Kahn, & Maddi, 1998). Below we provide a short overview of the existing literature and research on hardiness development.

Hardiness Development

Hardiness training programs have varied in complexity from relatively simple self-paced learning modules to more elaborate approaches that also include teachings on additional factors that can influence healthy and unhealthy reactions to stress. In one of the earliest reported efforts, Maddi (1987) describes a small-group format with multiple sessions spaced over a two- or three-month period in which focus is on the practice of three related techniques. The first technique, called *situational reconstruction*, emphasizes problem solving and aims to change the individuals' "mental models" by developing a broader perspective and a deeper understanding of a stressful circumstance. This technique is then assumed to facilitate developing and carrying out an action plan that can make a decisive difference. The second technique uses exercises of *focusing* to give trainees new emotional insight by teaching them to go beyond the usual way they interpret and label internal messages and emotional states. This technique is practiced to free

up the imagination necessary for obtaining the deeper understanding and broader perspective that situational reconstruction is aiming to give. If neither technique helps in transforming the problem under scrutiny, the training emphasis then shifts to the final technique, *compensatory self-improvement,* in which the trainee is allowed to perform the techniques of reconstruction and focusing on a related stressor. This is supposed to protect the trainee's sense of hardiness from the failed attempts, as well as teach the trainee that, although one does not control everything, it is nevertheless possible to determine what is changeable and what is not. These three techniques are practiced and used in combination as needed to transform stressful circumstances mentally and actively. Throughout this process, the trainee is also provided with feedback from the trainers.

These principles remain the core of Maddi´s approach to hardiness training and have been developed further into a more complete training program that also includes social support and effective self-care components (Maddi, 2002; Maddi et al., 2009). Trainees are taught how to improve the efficacy of their interaction network with significant others and how to take the necessary relaxation, nutritional, and exercise steps to maintain what Maddi and colleagues call an optimal level of organismic arousal for carrying out problem-solving coping while avoiding health problems. Others have also developed similar classroom-type approaches to hardiness training. Judkins and Ingram (2002) developed a training program primarily aimed at nurses and nurse managers that included education about the concept of hardiness and analyzing case studies with an emphasis on identifying threats and coping strategies. Similarly, Tierny and Lavelle (1997) developed an educational course for staff nurses that included an introduction of key hardiness concepts, detection of significant stressors, role-playing, and group feedback.

In sum, there seems to be some empirical evidence suggesting that hardiness may be malleable to the effects of training initiatives. Many studies, however, are somewhat limited in

that they have utilized a relatively short time-frame with minimal post-intervention follow-up (for a more complete review, see Bartone & Hystad, 2010). Using a short timeframe raises the possibility that some of the increases are learning effects due to test familiarization. In the study by Tierny and Lavelle (1997), for instance, levels of hardiness increased immediately following completion of the training, but returned to baseline levels six months later. Bartone and Hystad (2010) suggest that to create lasting effects, hardiness training may need to include regular follow-ups and re-training over an extended period of time. To the best of our knowledge, no studies so far have longitudinally investigated how individual levels of hardiness are influenced by long-term training interventions.

Hardiness Development and Military Experience

Based on the discussion so far, the aim of this study was to longitudinally examine the development of hardiness within the context of a three-year military academy officer-training program. Military experience represents a viable testing ground for hardiness development, because military service represents a major life transition that can have long-lasting effects on people's lives (Elder, Gimbel, & Ivie, 1991). Indeed, in most peoples´ minds, military service is a time in which young men and women are expected to mature and grow as human beings. The colloquialism that military experience builds character is also reflected in the slogans used by military forces around the world. Slogans such as "Be all you can be" in the United States and "train for the worst – become the best" in Norway both imply that military service is a time for development and growth. Despite the implied relation between military experience and character development, limited empirical work has been carried out on this subject. In one recent study, Jackson, Thoemmes, Jonkmann, Lüdtke, and Trautwein (2012) examined whether military training was related to changes in personality. Using the Big Five personality dimensions as a framework, these authors found some support for the association between military experience and

personality change. Specifically, Jackson et al. (2012) found that, compared with a group of civilian community service workers, military recruits had lower levels of Agreeableness after training.

Although there is scant research on military experience and personality development, more is known about training initiatives designed to enhance personal attributes related to resilience under stressful work environments. In a review of current evidence-based training and intervention methods to enhance resilience in the military and other high-risk occupations, Boermans, Delahaij, Korteling, and Euwema (2012) identified 19 effect-studies that were designed to strengthen either personal attributes or external resources (or both). Akin to the principles of hardiness training outlined above, these interventions utilized cognitive or knowledge-based approaches to training, in addition to more practice-based approaches. For example, most interventions focused on enhancing awareness of stress and providing strategies to combat stress such as positive reframing, which were practiced and learned through simulations, behavior-modeling, case studies, role-playing or cognitive exercises.

Only one of the studies reviewed by Boermans et al. (2012) concerned hardiness directly. Zach, Raviv and Inbar (2007) examined military officers undergoing a rigorous selection and training program for Israeli state security officers. The training course lasted nine weeks and included gradually increasing stressful exercises and simulations of real-life events. The results showed that individual hardiness levels increased following completion of the training course.

In Norway, the military academy officer training programs are not specifically designed to foster psychological hardiness; they do, however, explicitly define the development of character and mental robustness as an important end state (Olsen & Espevik, 2009). The development of mental robustness is stimulated by multiple training approaches, many of which share some similarities with the hardiness training principles outlined above. Included in these approaches

are stress exposure training that entails exposure to physical and mental stressors such as challenging field exercises in both summer and winter conditions, captivity and interrogation training, and leader challenges such as leading an infantry platoon in combat simulations or leading a crew on a ship at sea. These training experiences are framed as experience based learning-cycles that include structured feedback, individually tailored training programs, and repeated trials/experiences for the cadets to try out new strategies – all in order to facilitate further development (Olsen & Espevik, 2009). Cadets are exposed to an increasing level of difficulty and strain during the training programs to gradually develop their coping abilities. Furthermore, the cadets are provided with individualized coaching on cognitive control and coping strategies, paired with self-awareness interventions related to their present strategies, in order to increase performance during stress. Notably, in contrast to most hardiness training programs that are short-term interventions, this training is knitted into the educational training during the whole program (i.e., a three-year time span). It should also be noted that the character development training at the academies explicates the development of self-confidence and individual initiative as significant goals, goals that are achieved by positively framed coaching through gradually more challenging tasks.

With this short discussion of the educational programs in the Norwegian military as a background, one could argue that if hardiness represents a trainable competency, it would be expected to develop during three year of training. Our first research question was therefore as follows:

Research question 1: Do individual levels of hardiness increase during three years of military training?

The three military academies included in the present investigation have all explicated development of individual resilience and coping with stress as a significant educational aim. Still, some notable differences between the academies exist. Academy A[1] puts stronger emphasis on field training (four weeks per semester), particularly throughout the first four semesters, including high levels of stress exposure such as a parachute jump course. Academy B has a different model, where the first two semesters focus on leadership development with little emphasis on branch specialty, and comprise approximately 16 weeks of exercises including stress exposure training. Notably, the program at Academy B includes two crossings of the Atlantic Ocean on an ancient sailing ship during an 11-week period. These crossings partly take place in winter conditions and there is a continuous focus on leadership development and effective stress-management strategies. The next four semesters have more of an academic orientation, combined with 5-6 weeks of mandatory leadership exercises. Academy C also concentrate the leadership development within the first year, but with fewer and shorter field exercises embedded into the program, and also with less intensity in terms of sleep-deprivation and fatigue during the exercises compared with the other academies. In sum, it is plausible that the effect of the programs in terms of hardiness development varies between the institutions. Our second research question was therefore as follows:

Research question 2: Does the hardiness growth curves differ between the three military academies?

Methods

Participants and Procedure

This study was conducted as part of the Norwegian Military Academy Study 2007-2011. A total of 330 cadets from two different cohorts were asked to participate. A total of 293 cadets

(response rate: 88.8%) from the ages of 19 to 37 (M = 23.2, SD = 2.92) completed the self-report questionnaire at baseline (during the first week at school). The largest number of participants was from Academy B (n = 118; M_{age} = 23.26; 95.8% men), followed by Academy A (n = 104; M_{age} = 23.05; 86.5% men) and Academy C (n = 71; M_{age} = 23.21; 85.9% men). In total, the majority of cadets were men (264 men vs. 29 women). According to the longitudinal design of the study, the cadets were asked to respond to the questionnaire at three further occasions during their three year education; at the end of year one, the end of year two, and at the end of year three. At Time 2, 246 cadets responded to the questionnaire, 245 of which had also participated at T1 (16.1% drop-out). At Time 3, 155 cadets responded to the hardiness questionnaire, 141 of which had participated at T2 (42.4% drop-out from T2). Finally, 146 cadets completed the last questionnaire, 118 of which had also participated at T3 (16.3% drop-out from T3).

Cadets attending the three different military academies in Norway are selected on both physiological and psychological parameters, and the aim of the Norwegian Military Academy Study 2007-2011 was to gain comprehensive knowledge regarding the military cadets' development during the three-year military academy education program. The Norwegian Social Science Data Service approved the study, and all participants were told that participation was voluntary.

The Hardiness Measure

Hardiness was measured using a Norwegian translation (Johnsen, Eid, & Bartone, 2004) of the short form of the Dispositional Resiliency Scale reported by Bartone (1995). This 15-item instrument (rated on a four-point scale with anchors of 0 = *not at all true* and 3 = *completely true*) measures the hardiness dimensions of control, commitment and challenge, and has demonstrated adequate reliability and validity in previous studies on Norwegian samples (e.g., Eid, Johnsen, Bartone, & Nissestad, 2008; Johnsen, Eid, Pallesen, Bartone, & Nissestad, 2009). In the present

study, the Cronbach's alphas for the total hardiness scale ranged from .62 to .73. Although somewhat low, these reliability estimates are still comparable to estimates found in the literature, usually in the range between .6 and .7 (e.g., Bartone et al., 2008; Britt, Adler, & Bartone, 2001; Hystad, Eid, Laberg, & Bartone, 2011). A mean hardiness score was calculated by averaging the responses to all individual items, resulting in a hardiness score ranging between zero and three, with higher scores indicating higher levels of hardiness. Because of the low reliability of the individual hardiness dimensions only the total hardiness mean score was used.

Statistical Analyses

We performed preliminary analyses to test for possible bias due to sample attrition during the four waves of data collection. First, two one-way ANOVAs were employed to compare completers and dropouts on age and initial hardiness status. A series of χ^2-tests were next performed to compare completers and dropouts on several demographic variables.

To explore our research questions we used hierarchical linear modelling (HLM; Raudenbush & Bryk, 2002). Hierarchical linear models are interchangeably referred to as multilevel linear models, mixed models or random coefficient models (Raudenbush, 1993; Singer & Willett, 2003). A defining feature of such models is the hierarchical structure of the data, where first-level units are nested within second-level units; second-level units are nested within third-level units, and so on. For instance, soldiers (level one) can be nested within squads (level two), squads can be nested within platoons (level three), and platoons can be nested within companies (level four). When the data is longitudinal such as in the present study, with four measures on each participant, the individual participants themselves are the grouping variable and scores on the hardiness measure are nested within the participants. In other words, the individual cadet is at level two, with the repeated hardiness measures at level one. By numbering the different waves of data collection from 1 to 4, time is simply entered as a within-cadet or level

one predictor in the hierarchical linear model. Cadet-level predictors such as type of military academy are located at level two.

In this study, we follow Singer and Willett's (2003) recommendations on model building and consider a taxonomy or systematic sequence of models. According to these recommendations, each model in the sequence extends a previous model in some meaningful way. The number of models, as well as which predictors to enter, is decided by a combination of substantive theory, research questions and statistical evidence. The first model to be fit is often an *unconditional means model*. This model is simply a model without any predictors, and is fitted first and foremost to partition the total variation in the outcome meaningfully and to establish a useful baseline to compare subsequent models with. The next model we estimated was an *unconditional growth model*, so called because the level one predictor time is the only predictor included. This model also addressed our first research question whether individual levels of hardiness increase during three years of military training. To address our second research question, whether hardiness growth curves differ between the three military academies, military academy was entered as two dummy-coded level two predictors in a separate model. The respondents' age was included in this model to control for a general maturity effect on hardiness.

Finally, our fourth and last model introduced missing-data pattern as an additional control. An attractive feature of HLM when it comes to longitudinal analysis is that participants are not assumed to be measured at the same number of time points (Hedeker & Gibbons, 1997), but rather, can be measured at different time points. Thus, participants who might have missing data are retained and the estimations are performed on the time observations that are present. Moreover, information about dropout can be entered into the regressions as model covariates in an approach often referred to as *pattern-mixture models* (Little, 1995). This approach involves dividing participants into groups on the basis of their missing-data pattern. Based on the missing-

data pattern in our data, three different groups could be identified: 1) Participants who had completed hardiness measures at all four time points (n = 106), 2) participants who had participated at three time points (n = 72) and 3) participants who had participated at two or only one time-point (n = 116). These groups were then entered into the regression as three dummy-coded variables where the first group (participation at all time points) served as reference.

Should the regression coefficient for time turn out to be non-significant, this growth parameter will be followed up with Bayesian statistics. Traditional hypothesis testing is somewhat limited when is comes to interpreting statistically non-significant results. In general, a non-significant result can mean either that there is evidence for the null-hypothesis or, alternatively, that the data are just too insensitive in distinguishing the null- from the alternative hypothesis. However, traditional hypothesis testing in itself cannot automatically be used to distinguish between these two alternatives and thereby make inferences about the null-hypothesis. That is, no conclusion follows automatically from a statistically non-significant result (Dienes, 2011, 2014). In other words, a statistically non-significant growth parameter for hardiness could mean that there is evidence for the null-hypothesis of no growth, or, alternatively, that the data are just too insensitive in distinguishing the null- from the alternative hypothesis of growth. This is where the Bayes factor can prove to be useful (Dienes, 2014). In short, the Bayes factor (B) is an indicator of the relative evidence for one theory over another. By comparing an alternative hypothesis of hardiness growth to the null-hypothesis of no growth, the Bayes factor can tell us that the data are B times more likely under the alternative than the null. A Bayes B greater than 3 or less than 0.33 represents substantial evidence for the alternative- and null-hypothesis, respectively, while anything between these values is taken to mean that the data are insensitive (Dienes, 2014).

Results

Attrition Analysis

INSERT TABLE 1 ABOUT HERE

Table 1 presents hardiness scores and number of participants at each time point for the three academies. Two one-way ANOVAs were employed to compare participants who had participated at all data collection points with those who had participated at three time points, and those who had participated at two or one time point on age and initial hardiness status. The results from these tests indicated no statistically significant difference between completers and dropouts on age ($F[2, 291] = 0.34$, $p = .715$) or initial hardiness status ($F[2, 290] = 1.03$, $p = .359$).

A series of χ^2-tests were next performed to compare completers and dropouts on sex, marital status, and education. Again, no statistically significant differences emerged on marital status ($\chi^2[4, N = 294] = 2.647$, $p = .618$) or the percentage of women among completers and dropouts ($\chi^2[2, N = 294] = 5.343$, $p = .069$). Finally, the percentage of participants with a university education was lower among completers (13.2%) than in the two other groups (18.1% for cadets who had participated three times and 26.1% for cadets who had participated two or one time), a difference that was "borderline" statistically significant, $\chi^2(2, N = 293) = 5.958$, $p = .051$.

Hardiness Development

INSERT TABLE 2 ABOUT HERE

As stated in the methods section, our analyses follow a systematic sequence of hierarchical linear models, starting with the unconditional means model. The result of this model can be seen in Model 1 in Table 2. Of primary interest in this model are the variance components presented at the bottom of the table. The Level-1 variance component (σ_ε^2) is the within-person variance, or the scatter of each persons´ data around his/her own mean, while the Level-2 variance component (σ_0^2) is the between-person variance, or the pooled scatter of the person-specific means around the grand mean. Both of these variance components are statistically significant from zero, indicating that participants´ hardiness levels vary over time and that participants differ from each other in hardiness levels.

The next step was to enter time as a predictor in the unconditional growth model (Model 2 in Table 2). The intercept shown in Model 2 in Table 1 indicates that overall initial hardiness status was 1.57, while the γ_{10} parameter suggest that hardiness decreased by 0.005 each year, although this slope parameter was not statistically significant (95% C.I. = -0.017 - 0.006). Thus it appears that hardiness levels did not change over the course of a three-year military academy officer-training program. This inference is further supported by the Pseudo R_ε^2 value that indicates that only 4% of the within-person variation in hardiness is associated with time.

In Model 3, we tested whether type of military academy could explain any variations in initial hardiness status or in the growth parameter. Age of participants was included as a control variable in this analysis. The results indicate that the average initial hardiness score for participants with a mean age (age was centered around its mean before entered into the analysis)

from Academy A (the reference group) was 1.52. Further, the results show that participants from Academy B had a statistically significant higher initial hardiness status than participants from Academy A (γ_{01} = .098, p < .001), and that the growth parameter for Academy C was significantly different from zero (γ_{12} = -.042, p =.015). The latter result indicates that participants from Academy C decreased in their hardiness levels over the three years of military training.

In Model 4, the missing-data pattern was included as a covariate. Echoing the results from the attrition analysis, completers did not differ from dropouts on initial hardiness status, γ_{04} = -0.01, p = .743 and γ_{05} = 0.011, p = .709, for participants who participated at three time points and participants who participated at one or two time points, respectively. The slope for participants who participated at one or two data collections was, however, negative and statistically significant different from zero, γ_{15} = -0.068, p = .003. By and large, the addition of the missing-data patterns did not affect the coefficients for academy; Academy B still had a statistically significant higher initial hardiness status and the growth parameter for Academy C was still negative and significantly different from zero.

The slope for Academy C is presented in Figure 1, along with the slopes for Academies A and B. As can be seen from the figure, whereas cadets from Academy A on average had a slight increase in hardiness scores, cadets from Academy C (as well as Academy B) on average had a decrease in hardiness scores over three years. The confidence interval bands included in Figure 1 also show that we cannot be sure that the slopes for the three different academies are different from each other.

INSERT FIGURE 1 ABOUT HERE

Follow-Up Analysis of the Hardiness Growth Parameter

In this study we wanted to explore the development of hardiness within the context of a three-year military academy officer-training program. Faced with a non-significant growth parameter of γ_{10} = -0.005, the problem is how to interpret this result. In the methods section we argued that Bayesian statistics can prove useful in this regard. Consequently, we used an online calculator provided by Dienes (http://www.lifesci.sussex.ac.uk/home/Zoltan_Dienes/inference/bayes_factor.swf) to compute the Bayes factor associated with our data. Calculating a Bayes factor involves specifying predictions for the competing theories, and in the case of the null-hypothesis, this is fairly easy (i.e., the population value of the growth parameter is 0). The most difficult part in calculating the Bayes factor is determining a plausible prediction for the alternative theory, that is, for the alternative hypothesis of hardiness growth. Akin to determining power in a power analysis, this entails defining a minimal, typical or maximum value of an effect size (i.e., how much is hardiness likely to increase each year during the three-year training program). We drew on the results reported by Zach et al. (2007) for a reasonable value[1] of the effect and used a half-normal distribution[2] to represent the predictions of the alternative hypothesis (see Dienes, 2014, for a discussion of alternative distributions that can be used to represent the predictions). The resultant Bayes factor was 0.04, providing substantial support in our data for the null-hypothesis of no hardiness development during the three-year officer-training programs.

Discussion

The aim of this paper was to explore whether individual levels of hardiness increased during three years of military training. We argued that although the service academies do not have an explicit focus on hardiness, the training programs nevertheless constitute a good

naturalistic setting to explore this issue, because these programs explicitly define the development of mental robustness as an important end state and represent a prolonged training-period of stress exposure and feedback tailored to increase resilience and military leadership competencies (Olsen & Espevik, 2009). The results from our hierarchical linear models showed that on average time did not significantly predict hardiness scores. Our follow-up analysis of the hardiness growth parameter using Bayes factor further showed that our data strongly supported the null-hypothesis of no growth. In what follows, we discuss our null-result in more detail.

Except from the study by Zach et al. (2007) that found an increase in hardiness levels among Israeli officers following a rigorous military training regimen, little empirical work has been conducted on hardiness development in military settings. Because the training programs at the service academies used in our study were not specifically designed to foster psychological hardiness, our results are inconclusive with regards to hardiness training. Hardiness training seems to be possible within a military setting as demonstrated by Zach et al., but did not take place in the three academies in our study. This may suggest that the Norwegian military academies should re-evaluate their basic assumptions related to training of robustness in officers. It could mean that more cognitive approaches, focusing on features like automatic taught patterns and emotional regulation related directly to the hardiness construct ought to be further developed and implemented in the training.

Another explanation for the lack of consistency between the two studies is that the Zach et al. (2007) study used a pretest-posttest design. It is possible that the increase in hardiness levels that were found among Israeli military officers were temporary and artificial effects caused by the successful completion of a highly stressful, yet also relatively short, training course. However, to model change, you need longitudinal data with three or more waves of data. As far as we know, ours is the first study to explore this issue using a longitudinal design. That being

said, in hindsight it is easy to realize that an additional wave of date collection some time after the completion of the training would have been highly beneficial to our study. One could image that given the intensity of the programs, any growth in hardiness might not be apparent until some time after the completion of the stressful programs. A follow-up 6 to12 months after completion would also have allowed us to further scrutinize the trend of the slopes for Academy A and C that are apparent in our data.

Military personnel in general, and the participants in our study in particular, are a highly selected group of individuals. Previous studies have found that hardiness predicts completion of military selection courses in both Norway and the United States (Bartone, Roland, Picano, & Williams, 2008; Hystad et al., 2011), and it is thus possible that a substantial proportion of our participants already had very high levels of hardiness at the start of the three-year training period. Consequently, our inability to find a statistically significant growth parameter could be the result of a ceiling effect. Yet the results from the unconditional growth model showed that the mean hardiness score at the start of the training program was 1.57 (see Model 2 in Table 1). With a theoretical hardiness range of 0 to 3, a mean of 1.57 more or less represents the middle-point and a ceiling effect can therefore be ruled out as an explanation. Comparing this mean to normative hardiness scores further supports this assertion. Although not directly comparable because the normative data is based on a slightly different hardiness scale, a mean of 1.57 is actually in the lower quartile of hardiness compared with other samples (P. T. Bartone, personal communication, October 2, 2009).

The question of whether hardiness can be developed or is a more enduring and stable personality style is not only of theoretical interest, but could be of great practical importance as well. A multitude of studies have shown that hardiness represents an important quality in individuals' mastering of challenging crisis situations (Alexander & Klein, 2001; Andrew et al.,

2008; Bartone et al., 1989). This is particularly important for officers who have leadership responsibilities in combat, where their decisions and actions may represent a matter of life or death for people involved. In such situations, several writers emphasize the ability to maintain calm and to keep an outward focus on the situation rather than an inward focus driven by fear and a sense of hopelessness, as a precondition for effective operational leadership (Kolditz, 2007; Olsen & Espevik, 2009). It follows that if hardiness is a stable individual disposition, the most important step to increasing hardiness in organizations would seem to be through recruitment and selection mechanisms. If, on the other hand, it is flexible and trainable, then training and educational interventions could be important additional tools to enhancing hardiness in organizations. Our results are inconclusive with regards to hardiness training in general, but provide initial evidence that military training as it is currently practiced in the Norwegian military, is not sufficient to increase levels of psychological hardiness over time. It is important to emphasize that the training programs of the academies included in our study were not explicitly designed to target psychological hardiness, and our results should therefore not be taken to mean that interventions specifically aimed at increasing hardiness levels could not be effective. Still, the training programs do include hard physical and mental challenges over a long time span, based on an assumption that such hardship will increase robustness in the officers.

A second question guiding this research was whether the regression slopes would differ across the three different military academies. Although our results are inconclusive as to whether the academies differed from each other, they did show that one of the academies had a statistically significant regression slope. Somewhat surprisingly, though, was it that the hardiness scores for this academy seemed to decrease during the three-year military academy officer-training program. This result opens up the possibility that hardiness can also diminish or be depleted during the course of an intensive training academy. According to the principles of

hardiness training introduced by Maddi (1987) that were outlined in the introduction, compensatory self-improvement was used a technique partly to protect trainees' sense of hardiness from failed attempts to transform stressors. Perhaps such compensatory processes were lacking from Academy C's training, causing many of the cadets to re-evaluate their sense of hardiness after failing to successfully cope with some of the stressful training exercises. An alternative and somewhat related explanation could be that cadets started out with somewhat unrealistic self-perceptions of their own psychological hardiness scores, and that the rigorous training program in this academy functioned as a reality check, bringing hardiness levels down to more realistic levels. Given that the training programs of this academy included less field exercises involving mental and physical hardship, it is possible that the cadets lacked experiences that fundamentally challenged their coping abilities and thus changed their cognitive patterns in terms of hardiness development.

Limitations, Recommendations for Future research, and Conclusion

As with most longitudinal research, dropout was a significant problem in the current study. Of the initial pool of participants who agreed to partake in the study, some cadets withdrew their consent during the study period and some were sick, injured or otherwise absent during single tests or entire test periods. In our study, there was a pronounced drop in participants from T2 to T3 (42.4%), markedly higher than in any of the other measurement occasions. At this point in the training, however, several of the cadets were transferring geographical location for their further education, while others were absent from the academies due to exercises at sea and land. The significant drop in participants from T2 to T3, as well as attrition in the other time points, can therefore to some degree be attributed to difficulties in gathering the respondents in time for testing. That being said, we would recommend future research to include some means of follow-up for those who leave the academy or are otherwise absent during the test periods,

because although completers and dropouts might not differ at the start of the longitudinal research, they may very well do so at the data points where there are no data. Also, because growth might not occur until after the training experiences have ended, we would like to extend this recommendation to include follow-up data collections some time after the training has ended, allowing future research to project hardiness growth following the completion of training.

This study was guided by the two general research questions whether hardiness levels developed during three years of military training and whether there would be any differences between the three academies. Although we found no changes in hardiness levels as a whole, our unconditional means model confirmed that there was individual variance in hardiness levels over time. An important follow-up and next step would be to detect those subgroups of individuals who do show an increase in hardiness during their military training. This information could be used to identify who benefits from military training in terms of hardiness development, and whether there are any aspects of their training that can help explain why these subgroups increase while others do not. This in turn, could help tailor the existing officer development programs in ways that more explicitly emphasizes the qualities associated with hardiness.

The reliability estimates for the total hardiness measure in the current study were modest, ranging between .62 - .73. The estimates for the individual dimension of challenge, control and commitment were even lower. A lot can be said about the limitations of Cronbach´s alpha as an estimate of reliability and internal consistency (see e.g., Sijtsma, 2009, for a discussion on this topic), but the low values for the individual dimensions nevertheless prevented us from exploring potential growth in the dimensions and instead concentrate on the total hardiness score. It should also be pointed out that the hardiness measure used in this study was an earlier version of the Norwegian hardiness scale that has since been revised due to demonstrated problems with some of the subscales (Hystad, Eid, Johnson, Laberg, & Bartone, 2010). It is nevertheless possible that

some hardiness dimensions are more readably trainable than others; control, for instance, may be more of a trait whereas commitment and challenge may vary with respect to specific situations and thus reflect more state-variance. As an extension of this line of reasoning, it is also quite possible that fluctuations in the three dimensions cancelled each other out, causing the overall hardiness score to appear stable. How the different dimensions of hardiness differ in respect to stability and trainability is an interesting avenue for future research and researchers should consider using one of the longer hardiness scales (e.g., the 30- or 45-item version of the Dispositional Resiliency Scale; Bartone et al., 1989) that can give more reliable scales for commitment, control, and challenge when exploring this issue.

Conceptually, psychological hardiness is a set of personality characteristics that develops early in life and is reasonably stable over time and across situations (Bartone et al., 2009; Kobasa, 1979; Maddi & Kobasa, 1984). Still, although considered stable, it is not immutable and can be continually shaped by experience and social context throughout the lifespan (Bartone & Barry, 2011). However, outside of training programs specifically intended to increasing hardiness, little is known about how hardiness is shaped by experience and social context. This study was a first step in exploring the issue of hardiness development using a longitudinal design, and using military training as a naturalistic setting in which to investigate development. Our results showed that, on average, the growth parameter of hardiness over a three-year period was not statistically significant form zero. Combined with a Bayes factor strongly supporting the null-hypothesis of no change, our results thus seem to support that military training as it is currently practiced in the Norwegian military is not sufficient to increase levels of psychological hardiness.

Endnotes

[1] To protect the anonymity of the different academies they are referred to as Academy A, Academy B and Academy C throughout the text.

[2] Based on the results reported in Zach et al. (2007) we used a 0.09 increase in hardiness each year as a plausible effect.

[3] In the current context there are two distributions that could have been used to represent the predictions of the theory; a normal and half-normal distribution. According to Dienes (2014) both distributions tend to result in similar Bayes factors, but the half-normal distribution considers values close to zero as the most plausible, making it harder to distinguish the alternative form the null. Thus, if the Bayes factor does indeed distinguish the two theories using a half-normal distribution, our conclusion is all the more strengthened. For this reason the half-normal distribution is recommended as a useful default. Also, if the null is supported with a half-normal distribution it is certainly also supported with a full normal distribution.

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Table 1

Hardiness Means, Standard Deviations and Number of Participants for all Academies Across Time Points

	Time 1		Time 2		Time 3		Time 4	
	Mean (*SD*)	*N*	Mean (*SD*)	*n*	Mean (*SD*)	*n*	Mean (*SD*)	*n*
Academy A	1.54 (0.19)	104	1.49 (0.20)	79	1.54 (0.21)	56	1.62 (0.23)	44
Academy B	1.64 (0.21)	118	1.58 (0.25)	104	1.57 (0.26)	65	1.63 (0.24)	76
Academy C	1.59 (0.21)	71	1.48 (0.27)	63	1.46 (0.26)	34	1.53 (0.28)	26

Note. Hardiness range: 0 - 3

Table 2

Results From Hierarchical Linear Modelling Predicting Changes in Hardiness Scores Over Three Years.

		Parameter	Model 1: Unconditional Means	Model 2: Unconditional Growth	Model 3: Academy & Age	Model 4: Academy, Age & Missing pattern
Fixed Effects						
Initial status,	Intercept	γ_{00}	1.56*** (0.011)	1.57*** (0.012)	1.52*** (0.020)	1.52*** (0.025)
π_{0i}	Academy		–	–	–	–
	Academy B	γ_{01}			0.098*** (0.027)	0.10*** (0.028)
	Academy C	γ_{02}			0.040 (0.032)	0.044 (0.032)
π_{1i}	Intercept	γ_{10}		-.005 (.006)	0.012 (0.010	0.016 (0.011)
	Academy B	γ_{11}			-0.022 (0.013)	-0.022 (0.014)
	Academy C	γ_{12}			-0.042* (0.017)	-0.038* (0.017)
	Age	γ_{13}			0.002 (0.002)	0.002 (0.002)
	Missing data pattern		–	–	–	–
	3 time points	γ_{14}				0.004 (0.013)
	1-2 timepoints	γ_{15}				-0.068** (0.023)
Variance Components						
Level 1	Within-person	σ_{ε}^2	.028 (.002)	.026 (.002)	.026 (.002)	.026 (.002)
Level 2	Initial status	σ_0^2	.027 (.003)	.021 (.006)	.019 (.006)	.02 (.006)
	Rate of change	σ_1^2		.001 (.001)	.001 (.001)	.001 (.001)
	Covariance	σ_{01}		.001 (.002)	.001 (.002)	.001 (.002)

Pseudo R^2 Statistics and Goodness-of-fit

$R^2_{y,\hat{y}}$		.00	.04	.04
R^2_{ε}		.04	.04	.04
R^2_0			.09	.04
R^2_1			.14	.05
Deviance	-250.601	-258.538	-277.15	-287.122
AIC	-244.601	-246.538	-253.15	-255.122
BIC	-230.401	-218.137	-196.349	-179.387

Note. Table entries represent unstandardized parameter estimates with standard errors in parentheses. $R^2_{y,\hat{y}}$ = Total outcome variability explained. R^2_{ε} = Proportion within-person variability explained (by time). R^2_0 = Proportion variability in initial status explained. R^2_1 = Proportion variability in rate of change explained. AIC = Akaike information criterion. BIC = Bayesian information criterion.

* $p < .05$. ** $p < .01$.

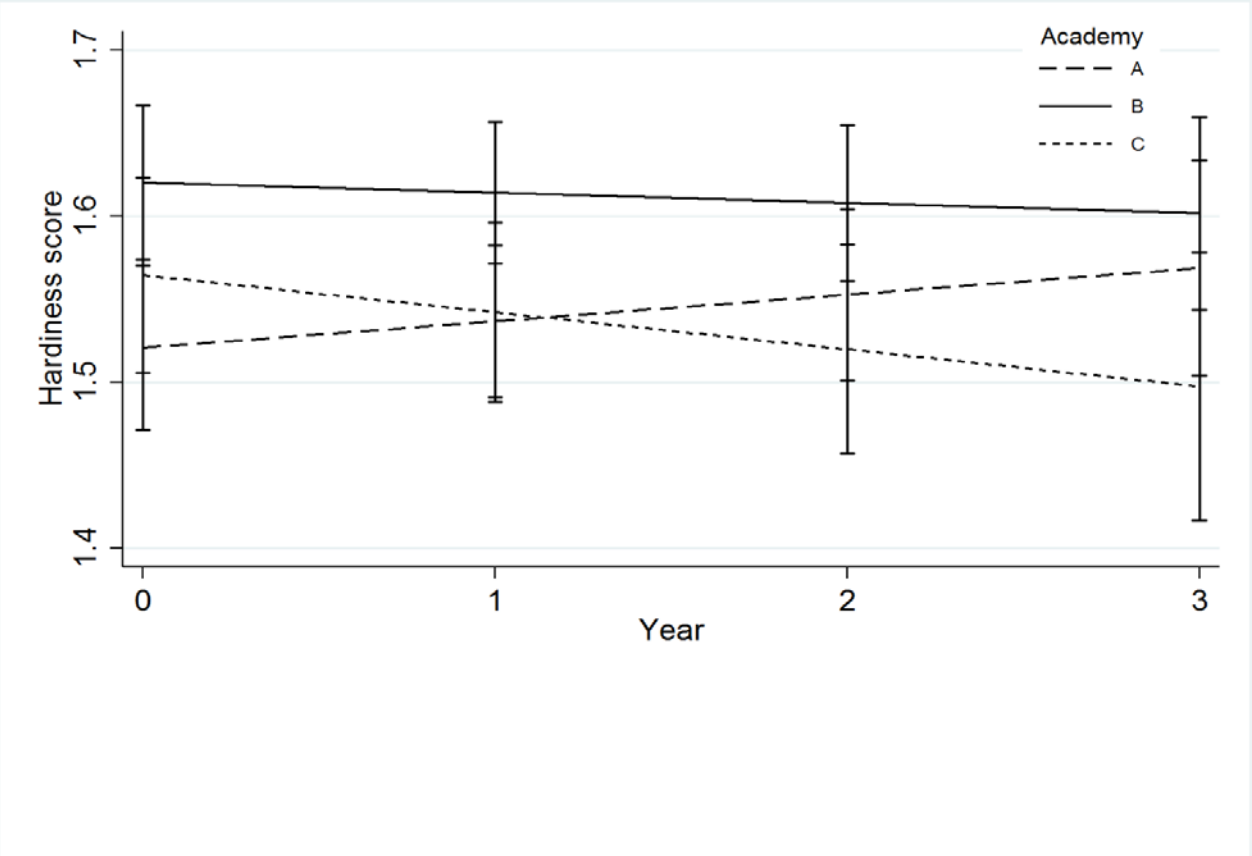

Figure 1. Regression slopes for the three different Norwegian military academies with 95% confidence intervals. Academies have been anonymized.