Effects of Psychological Hardiness, Job Demands, and Job Control on Sickness Absence: A Prospective Study

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This study prospectively investigated the effects of psychological hardiness, job control, and job demands on medically certified sickness absence. Data from a questionnaire survey were combined with archival data for sickness absence among 7,239 civilian and military employees of the Norwegian Armed Forces (84.3% male, 69.8% military). A 2-component hurdle regression was used in the statistical analyses of the sickness absence data. After controlling for age, sex, and baseline absence, hardiness predicted both the likelihood of having any sickness absence (odds ratio = 0.97) and the number of absence spells (a 6.5% decrease in the expected count for 1 standard deviation change in hardiness). In addition, an interaction was found among hardiness, job control, and psychological demands. When demands were high, high job control was associated with more absence among employees with low levels of hardiness. Together, these findings point to hardiness as an important individual resource in relation to health, and that it is necessary to consider individual differences when examining the effects of work characteristics.

Keywords: psychological hardiness, sickness absence, job control, job demands, generalized linear models

It is well known that adverse psychosocial work conditions represent a major hazard to the health and well-being of workers. Psychological distress, reduced job satisfaction, severe disease, and increased health risk behavior, such as cigarette smoking and alcohol consumption, have all been associated with occupational stress (Bosma et al., 1997; Bridger, Kilminster, & Slaven, 2007; Bromet, Dew, Parkinson, & Schulberg, 1988; Mausner-Dorsch & Eaton, 2000; Rödel & Siegrist, 2006; Sargent & Terry, 1998). Moreover, work stress has been shown to influence a variety of costly organizational outcomes, including increased health care expenditure for employees (Goetz et al., 1998), higher workers’ compensation costs (Musich, Napier, & Edington, 2001), and employee absenteeism (Aldana & Pronk, 2001). In countries where employees receive sickness benefits, the expense of stress-related sickness absence can also be a substantial burden on society. Government expenditure on sickness benefits has increased steadily in Norway in recent years, and in 2011, this expenditure is estimated to approximately 36.4 billion Norwegian kroner (approximately $6.5 billion, or $1,300 per capita; Ministry of Finance, 2011).

The combined individual, organizational, and societal costs of work stress have motivated a vast amount of research, with much effort being invested in identifying stressful components in the work environment. Although many aspects of the work environment can be stressful, Karasek’s (1979) demand–control model has dominated empirical research on job stress and health since the 1980s (de Lange, Taris, Kompier, Houtman, & Bongers, 2003). In this model, the psychological work environment can be characterized by a combination of employees’ perceptions of job control and psychological demands. Job control is a function of the employees’ decision latitude, which itself comprises two distinct constructs: the breadth of skills or abilities used by the employee at work (skill discretion) and the employee’s ability to make decisions about his or her job (decision authority). Psychological job demands refer to the demands that the work environment places on the individual in terms of workload, conflicting demands, and time pressure.

According to the job strain hypothesis of the demand–control model, jobs characterized by high de-
Psychological Hardiness as a Protective Factor

Although the detrimental effects of stress on health have been thoroughly established, they vary greatly depending on how people respond to stressors (Lazarus, 1999). Not everyone succumbs to potentially stressful situations and becomes ill. In the past 30 years, a fairly extensive body of research has accumulated that demonstrates that hardiness protects against stress and predicts healthy functioning. Beneficial effects of hardiness have been found in a variety of occupational groups, including army and police officers (Barton, Vrij, & Bull, 2004; Barton, 2000), nurses (Harrisson, Loiselle, Duquette, & Semenic, 2002), university employees (Soderstrom, Dolbier, Leiferman, & Steinhardt, 2000), emergency services personnel (Alexander & Klein, 2001; Barton, Ursano, Wright, & Ingraham, 1989), and professional athletes (Golby & Sheard, 2004).

As typically defined, hardiness describes a generalized style of functioning characterized by a strong sense of commitment, control, and challenge (Bartone, 2000). Commitment refers to the ability to see the world as interesting and meaningful and to seek involvement rather than withdrawal. Control is the belief in one’s own ability to control or influence the course of events. Challenge involves seeing change and new experiences as exciting opportunities for learning and personal growth.

The manner in which hardiness confers resiliency is most likely a combination of cognitive, physiological, and behavioral processes. Starting with behavioral processes, hardiness is believed to influence the way in which people interact with their environment, encouraging effective coping with stressful circumstances (Maddi & Kobasa, 1984). The term used to describe this particular behavioral pattern is transformational coping, which involves increasing “action involvement with the stressful circumstance in order to resolve the problem through such means as positive reinterpretation, broadened perspective, deepened understanding, decisive actions, and seeking of instrumental help” (Maddi & Hightower, 1999, p. 97). Part of this transformational coping process involves mental or cognitive involvement and the interpretation or meaning that people attach to events around them and their own place in this world of experiences (Bartone, 2006; Ouellette, 1993). Individuals with high levels of hardiness believe they can control or influence events, are strongly committed to activities and their interpersonal relationships, as well as to self, in that they recognize their own distinctive values, goals, and priorities in life. People with high levels of hardiness also tend to interpret stressful events in positive and constructive ways and construe such events as challenges and valuable learning opportunities (Bartone, 2000).

These adaptive cognitions are also believed to result in lower levels of organismic strain in response to potentially threatening events (Kobasa, Maddi, Puccetti, & Zola, 1985). To illustrate, Dolbier and colleagues (2001) examined the functional efficacy of immune cells in participants low and high in hardiness. More precisely, they studied in vitro proliferation of lymphocytes in response to invading microorganisms (antigens and mitogens), a process believed to mimic the series of events that occurs in vivo following stimulation by invading microorganisms. Results from this study showed that the high-hardiness group had significantly higher mean antimitogen-induced proliferative responses. Although these results pertain to functional immune responses under nonstressful conditions, they nevertheless suggest that the adaptive appraisals that characterize hardiness may protect individuals from the immune-suppressive effects of stress and thereby may enable them to maintain a healthy status.

Based on the literature outlined above, hardiness seems to be a particularly relevant personal resource in relation to an adverse psychosocial work environment and stress-related illness. However, although previous empirical research has shown hardiness to be positively correlated with good health, some important issues still need to be addressed. In behavioral
Research, common method variance is acknowledged as a potential problem that can have a serious confounding effect on empirical results (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Of particular concern is any systematic error caused by common method variance because this can mean that there are rival explanations for the observed relationship between two constructs, potentially leading to misleading conclusions.

Indeed, some of the most ardent criticisms of hardiness research have revolved around common method variance, especially biases caused by using a common source to provide measures of both the predictor and criterion variables (e.g., Funk, 1992). One example is the concern that mood states such as negative and positive affectivity could have artificially inflated the observed relationships found between hardiness and various measures of (self-reported) health. For instance, Klag and Bradley (2004) reported that the significant negative relationship observed between hardiness and self-reported symptoms of illness was rendered nonsignificant after controlling for the effects of neuroticism. From a more psychometrical approach, Sinclair and Tetrick (2000) set out to assess the potential overlap between measures of hardiness and neuroticism. They found at least partial support for some redundancy between them, especially in the negatively worded hardiness items.

**Research Purpose**

The aim of this study was to examine the relationships among hardiness, job control, job demands, and sickness absence, and to address some of the issues raised in the literature concerning the association between hardiness and health. To do this, we obtained our measures of predictor and outcome variables from different sources. We relied on self-reported ratings of hardiness, and we obtained sickness absence data from the Norwegian Labour and Welfare Administration, a service that administers a large proportion of the most important welfare benefits and social security schemes in Norwegian society, including sickness benefits. In addition, the prospective design of our study should further limit the effects of common method variance, while also allowing for more robust causal interpretations of the results.

Based on the literature on hardiness outlined above, we proposed the following hypothesis:

**Hypothesis 1:** Psychological hardiness is negatively related to sickness absence.

In addition to this main effect, we wished to explore whether hardiness interacts with job control and demands in explaining sickness absence. Hardiness was originally defined as a moderator in the relationship between external, taxing demands and physical or psychological strain (Ouellette, 1993). Hardiness was thus conceptualized as being especially beneficial under highly stressful life events, protecting against detrimental effects on health and well-being. If hardiness, in fact, acts as a buffer between external demands and distress, it is conceivable that it could also moderate the relationship between adverse work conditions and illness. Specifically, in an environment that does not allow for large amounts of job control and places high demands on employees (job strain), the innate characteristics of hardiness will nevertheless reduce the potentially detrimental effects on health, and thus sickness absence. This led to our second hypothesis:

**Hypothesis 2:** Hardiness will act as buffer between job strain and sickness absence: In low-control and high-demand conditions, employees scoring high on hardiness will have less sickness absence compared with employees scoring low on hardiness.

**Method**

**Participants and Procedure**

Baseline data were obtained from the 2007 annual personnel survey administered by the Norwegian Armed Forces Health Register (hereinafter referred to as the “Health Register”).

The Health Register is a national register administered by the Norwegian Ministry of Defense. It was established by the Norwegian Parliament in response to public concern after soldiers reported symptoms of the so-called “Gulf War Syndrome.” The Health Register aggregates four categories of data: personal information (name, sex, age, address, etc.), administrative information (e.g., rank and type of service), health information, and environmental information (e.g., exposure to chemicals and the psychosocial work environment).

In May 2007, 15,410 employees were requested by e-mail to respond to a questionnaire that examined health and psychosocial factors at work. A total of 7,555 questionnaires were returned (response rate 49.3%). Due to missing information for some or all of the study variables, our sample size was reduced to 7,254 (84.3% men, M_age = 40.8 years, age range: 20–72 years). The sample included both civilian (30.2%) and military (69.8%) employees. When
asked to state their main occupational responsibilities, 25.5% stated administration, 13.3% indicated logistics, and 22.5% identified themselves as active duty soldiers. The remaining 38.7% were divided between maintenance (8.8%); information and communication technology (8.6%); teaching (6.7%); medical service (2.6%); taking an education (2.2%); building and construction (0.6%); and other/none of the above (7.9%).

Measurement Constructs and Instruments at Baseline

The personnel survey included measures covering a wide range of domains. Of particular relevance to the present study were measures of hardiness and work-related variables such as job control and demands.

Hardiness. Hardiness was measured using a Norwegian adaption of the Dispositional Resiliency Scale (DRS; Hystad, Eid, Johnsen, Laberg, & Bartone, 2010). The DRS has previously been identified as the best available measure of hardiness (Funk, 1992), and the Norwegian version is based on Bartone’s (1995) short 15-item version (DRS-15). In previous studies, the Norwegian DRS has demonstrated good stability over time, with a 4-week test–retest reliability coefficient of $r = .77$ (Hystad, Eid, Johnsen, Laberg, & Bartone, 2009) and a 1-year test–retest coefficient of $r = .68$ (Hystad, 2010). The DRS-15 consists of 15 statements requiring respondents to indicate agreement on a 4-point scale (not at all true to completely true). An example item is, “Most of my life gets spent doing things that are meaningful.” To create hardiness scores, six negatively keyed statements are reversed, and all items are added. In addition to a total score, three subscale scores can be created by adding the relevant five items for each of the facets: commitment, challenge, and control. In the current study, only the total hardiness score was used (Cronbach’s alpha $= .79$).

There is some debate in the literature about whether it is appropriate to combine multifaceted constructs such as hardiness into single, composite measures (see, e.g., Carver, 1989; Funk, 1992). According to Funk (1992), combining hardiness dimensions into a single scale can be justified if they are logically and empirically related. To this end, Hystad and colleagues (2010) have demonstrated that a hierarchical model provides a superior fit to the data compared with a three-factor model. In their study, the three hardiness dimensions loaded onto a single latent hardiness factor, with loadings ranging from .62 to .70. Moreover, they provided justification for using a total score for the item set as an indicator of hardiness by showing that the general hardiness factor explained more than two thirds of the variance accounted for by the model.

Work factors. The personnel survey included several items covering aspects of job control and demands, as well as questions related to physical aspects of the work environment. To arrive at measures for use in subsequent analyses, we randomly split the sample split into two equal halves ($n = 3,627$). An exploratory factor analysis (EFA; principal axis factoring) was performed on the first subsample in which we tried to identify meaningful work factors. The second subsample was then used in a confirmatory factor analysis (CFA) to validate the factors extracted from the exploratory analysis.

A total of 21 items were included in the EFA and analyzed using SPSS 15. The analysis revealed six factors with eigenvalues exceeding 1, which, combined, explained 68.6% of the variance. It is well known that the Kaiser’s eigenvalues-greater-than-1 criterion tends to overestimate the numbers of factors to extract (see, e.g., Zwick & Velicer, 1986). As the sixth factor in our analysis made a relatively small contribution to the cumulative explained variance (4.9%), we applied an additional extraction rule, namely Velicer’s (1976; Velicer, Eaton, & Fava, 2000) minimum average partial test, which has proven superior to both Kaiser’s criterion and the scree plot test (Zwick & Velicer, 1986). The number of factors according to this test was five; we therefore proceeded to extract five factors with oblique rotation.

The rotated factor solution resulted in three factors that could meaningfully be interpreted as job control (four items), psychological demands (six items), and physical work demands (five items) that all had factor loadings in the range .56–.91. The remaining items were divided between two factors that could not be interpreted in a meaningful and coherent way.

This three-factor solution was then validated in a CFA using maximum likelihood estimation with EQS 6 (Bentler, 2001). The goodness-of-fit indices indicated that this model was not a very good fit to the actual data (comparative fit index [CFI] = .86; goodness-of-fit index [GFI] = .87; root mean square error of approximation [RMSEA] = .104, 90% CI [.101, .107]; and standardized root mean square residual [SRMR] = .097). However, the Lagrange multiplier (LM) test provided by EQS also indicated that
the model fit could be improved if some parameters were respecified. More precisely, the LM test supported the specifications of error covariance between two item pairs belonging to the Psychological Demands factor and one item pair belonging to the Physical Demands factor. There is some controversy surrounding the issue of correlated residuals (see, e.g., Cortina, 2002), but such correlations are often justified because they represent nonrandom error due to method effects (Byrne, Baron, & Campell, 1993). Considering that the unaccounted for covariance in question was most likely due to a method effect stemming from content overlap between the three item pairs, we considered it to be theoretically justified to allow for correlations between the error terms.

A closer inspection of the item pair belonging to the Physical Demands factor made it clear that these two questions essentially addressed the same phenomenon. The only difference was that one inquired about exposure to a cold and humid environment, whereas the other inquired about a cold environment alone. Given this substantial amount of overlap, we decided to drop the latter item instead of including an error correlation. This was also true for one of the item pairs in the Psychological Demands factor. In addition, the two items in question exhibited relatively low factor loadings (.32 and .27) and tended to cross-load onto the Job Control factor. Both were therefore dropped from the model.

The model was then rerun with three items dropped and the error covariance between two psychological demands items freely estimated, resulting in an acceptable fit to the data (CFI = .93, GFI = .95, RMSEA = .072, 90% CI [.068, .076]; and SRMR = .086). Accordingly, our final measures of job control and demands included four items each for job control, psychological demands, and physical demands (see Table 1). All items were rated on a 4-point scale ranging from very often to almost never. Items within each factor were reverse scored and aggregated into composites, so that high scores equal high levels of job control, psychological demands, and physical demands.

### Measurement of Sickness Absence

The policies that govern an employee’s rights to sickness absence and related benefits in Norway can be divided into two broad categories. First, everyone who has been working for their current employer for at least 2 months can personally inform their employer about absence from work due to sickness or injury without a doctor’s certificate and receive sickness benefit. The general rule is that these self-certified sickness absences can be used for 3 consecutive days and up to 4 times during a 12-month period. In some instances, they can be extended to 8 consecutive days for a total of 24 days in a 12-month period.

Second, any absence in excess of the periods covered by employees’ right to self-certified sickness absence has to be accompanied by a medical certificate from a doctor to qualify for benefits. The employee then needs to visit a doctor, who decides whether there are sufficient medical reasons for continued absence from work. The doctor also makes a tentative diagnosis based on the International Classification of Primary Care (ICPC-2; World Organization of Family Doctors, n.d.). Examples of generic codes from the ICPC-2 are “General or unspecified” (code A), “Musculoskeletal” (code L), “Psychological” (code P), and “Social problems” (code Z).

<table>
<thead>
<tr>
<th>Work factor: Item and reliability measure</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job control (Cronbach’s ( \alpha = .77 ))</strong></td>
<td></td>
</tr>
<tr>
<td>1. I have the freedom to influence my own work pace.</td>
<td>.84</td>
</tr>
<tr>
<td>2. I can personally decide when to take breaks from work.</td>
<td>.65</td>
</tr>
<tr>
<td>3. I have a personal say in the amount of work I have to do.</td>
<td>.65</td>
</tr>
<tr>
<td>4. I have general freedom to decide and plan my own work day.</td>
<td>.51</td>
</tr>
<tr>
<td><strong>Psychological demands (Cronbach’s ( \alpha = .85 ))</strong></td>
<td></td>
</tr>
<tr>
<td>1. Is your job characterized by a great amount of time pressure?</td>
<td>.87</td>
</tr>
<tr>
<td>2. Is your job generally stressful and hurried?</td>
<td>.79</td>
</tr>
<tr>
<td>3. Do you think that you have too much to do?</td>
<td>.70</td>
</tr>
<tr>
<td>4. Is your work piling up?</td>
<td>.61</td>
</tr>
<tr>
<td><strong>Physical demands (Cronbach’s ( \alpha = .71 ))</strong></td>
<td></td>
</tr>
<tr>
<td>1. I have to work with my hands above shoulder height.</td>
<td>.75</td>
</tr>
<tr>
<td>2. I work at the upper limit of my physical capacity.</td>
<td>.63</td>
</tr>
<tr>
<td>3. My job requires me to work in painful positions.</td>
<td>.58</td>
</tr>
<tr>
<td>4. In my work I am exposed to a cold and humid environment.</td>
<td>.58</td>
</tr>
</tbody>
</table>

**Note.** All factor loadings are standardized and statistically significant at \( p < .05 \). The model includes an error correlation between psychological demands items 3 and 4.
The Health Register retrieved information about sickness absence from the Norwegian Labour and Welfare Administration and linked it to the 2007 survey data using each employee’s personal identification number. This personal identification number is a unique 11-digit number assigned by the Norwegian state to all citizens. It consists of the individual’s date of birth (six digits) and an additional personal code (five digits). The total number of medically certified sickness absence spells in the period January 1, 2008, to December 31, 2008, was used as the outcome variable in this study. In addition, information about sickness absence during 2007 was retrieved and used as a control variable.

Although the absence information retrieved included some information about the generic ICPC-2 codes, we were not able to distinguish exactly how many absence spells were caused by which code. However, because classifications according to ICPC-2 code Z could potentially include absences necessitated by caring for an ill child, we decided to exclude 15 participants associated with this code from further analyses.

Data Analytic Approach

A number of problems arise when sickness absence data are analyzed using standard ordinary least squares (OLS) regression. OLS regression makes certain assumptions related to the model, such as normality of the residuals. Sickness absence, however, is rarely normally distributed, but it tends to be positively skewed. It is therefore very likely that the residuals will also be skewed. Data that violate the assumptions of the model can produce incorrect standard errors and often artificially low p values, increasing the chance of Type I errors. A common remedy for this problem is to opt for a transformation of the absence variable, such as the square root or natural log, that could lead to normally distributed residuals. However, transformations can be problematic in relation to sickness absence data, especially if they include an excessive number of zeros (i.e., no sickness absence). A large proportion of a study sample is likely to have no sickness absence, resulting in data that are inflated toward zero, and no transformation is able to even this out.

Generalized linear regression models have gained in popularity in recent years. Generalized linear models are extensions of OLS regression to variables that have specific nonnormal distributions (for detailed accounts, see Cameron & Trivedi, 1998; Fox, 2008). One example is the Poisson probability distribution, which has several characteristics that make it attractive for sickness absence data. Most important, the mean of the distribution strongly controls the shape of the distribution, so that, when the mean is close to zero, the distribution is positively skewed. As the mean increases, the Poisson distribution increasingly resembles the normal distribution. The Poisson distribution more closely approximates the actual distribution of real sickness absence; we therefore chose to use it as the basis for our analyses.

However, there are situations in which actual data do not accord with all the assumptions of the standard Poisson model. First, the Poisson distribution assumes that the mean and variance are equal (Cameron & Trivedi, 1998). In practice, data often exhibit more variability than expected from the model, resulting in variance that exceeds the mean, a condition known as overdispersion (Cameron & Trivedi, 1998). A second problem arises when there are more values of zeroes in the outcome variable than expected from the Poisson distribution. To deal with these potential problems, we considered extensions of the standard Poisson regression.

The negative binomial (NB) regression model is a direct extension of the Poisson model that takes overdispersion into consideration (Cameron & Trivedi, 1998; Gardner, Mulvey, & Shaw, 1995). Another model class capable of capturing both overdispersion and excess zeroes is the hurdle model (Mullahy, 1986; Zeileis, Kleiber, & Jackman, 2008). Hurdle models are two-component models that employ a truncated count component, such as Poisson or NB, for positive counts, and a hurdle component to model zero versus larger counts, most often using a binomial model. To determine which regression best fit our data, we computed and compared all three models on the basis of various fit statistics.

All regression analyses were performed using the R system for statistical computing (R Development Core Team, 2009) and the packages “pscl” (Jackman, 2008; Zeileis et al., 2008) and “MASS” (Venables & Ripley, 2002).

1 The Health Register often collects data from multiple sources, and personal identification numbers make it possible to link data from different registers and ensure that the correct combined information is stored for each individual. It should be pointed out that the Health Register does not report data at the individual level. To ensure confidentiality, data are always anonymized when reported.
Results

Table 1 presents our measures of job control and demands derived from EFA and CFA, and Table 2 presents zero-order correlations, means, and standard deviations, where appropriate, for all variables included in the study.

Factors Associated With Sickness Absence

To examine the influence of hardiness and work factors on sickness absence, we estimated separate Poisson, NB, and hurdle regression models. We started by comparing the standard Poisson model with its NB extension to determine whether the latter was a better representation of the data (i.e., whether the Poisson model exhibited evidence of overdispersion). The Poisson and NB models are nested, that is, they differ only in terms of the dispersion parameter, which is freely estimated in NB regression. Their relative merits can therefore be assessed by the likelihood ratio test. This test statistic is twice the difference in log-likelihood between two nested models and has a chi-square distribution with degrees of freedom equal to the difference in the number of parameters between the models (1 df in this case, corresponding to the freely estimated dispersion parameter in the NB model). The results from the likelihood tests strongly favored the NB over the standard Poisson model, $\chi^2(1, N = 7,239) = 4314.6$, $p < .001$.

Next, we estimated a hurdle NB regression, which incorporates excess zeroes, and compared the result with the standard NB regression to arrive at the final model that best represented our data. This comparison was based on Akaike’s (1973) information criterion (AIC) and Vuong’s (1989) $V$ statistic. Both the AIC and $V$ statistic are measures of fit used to evaluate nonnested models that cannot be compared with standard likelihood ratio tests. Under the null hypothesis that two models are indistinguishable, the $V$ statistic is asymptotically normally distributed. Thus, a large, positive $V$ statistic is evidence of the superiority of the first model (the standard NB), whereas a large, negative $V$ statistic is evidence of the superiority of the second model (the hurdle NB). The AIC is similar to other measures of fit in that the model with the smallest value represents the best fitting model. Based on these two criteria, the hurdle model was deemed to be the best representation of the data, with a resulting $V$ statistic of $-5.51$ ($p < .001$) and an AIC value of 11,712.28 compared to 11,842.00 for the standard NB model.

Table 3 presents the results from the hurdle regression. The variables age, absence at baseline, and sex were entered as control variables in this analysis. Age was positively related to the likelihood of having one or more absence spells, and absence at baseline was positively related to both the likelihood and the number of absence spells. Sex, too, was related to both the likelihood and number of absence spells. Compared with women, male employees were less likely to have had sickness absence and had fewer absence spells. The variables, physical demands and hardiness, significantly predicted the likelihood of having one or more absence spells during 2008. By exponentiating the coefficient shown in Table 3, hardiness ($e^{-0.026}$)
was associated with a 0.97 decrease in the odds of having at least one absence spell. This obtained odds ratio indicates that, for each 1-point increase in hardness scores, the probability of having one or more absence spells during 2008 decreased by approximately 2.6%. Similarly, a 1-point change in physical demands was associated with a 1.04 increase in the odds, or a 4.2% rise in the probability, of having at least one absence spell.

As can be seen in the count portion of Table 3, hardness and physical demands also significantly predicted the number of absence spells during 2008. In addition, the coefficient for job control reached statistical significance in this part of the model. These coefficients can also be interpreted in terms of percentage change (Long, 1997, pp. 224–225). We used the formula provided by Long (1997) to calculate the percentage change in expected absence spells for 1 standard deviation of change in hardness. The result of this computation showed that, for 1 standard deviation increase in hardness, an employee’s expected number of spells decreased by 6.5%, holding all other variables constant. Similar calculations for standard deviation increases in physical demands and job control resulted in 7.1% and 8.7% increases in mean absence spells, respectively.

Psychological Hardness as a Moderator

To test our second hypothesis, we followed the instructions for testing three-way interactions suggested by Aiken and West (1991). These require not only the inclusion of the cross-product term representing the interaction between all three predictors (i.e., hardness, job control, and job demands), but also the inclusion of all two-way interactions involving the predictors (e.g., between control and demands, or between hardness and demands). To minimize problems of multicollinearity, we centered all predictors around their means prior to computing the interaction terms.

The results relating to the zero hurdle part of the regression revealed no significant interactions. However, the coefficient associated with the three-way interaction among hardness, psychological demands, and job control was statistically significant in the count portion ($B = -.002$, $Z = -2.308$, $p = .021$). To interpret this interaction, it was graphically displayed by setting the values of the predictor variables (hardiness, control, and demands) at 1 standard deviation below and 1 standard deviation above the mean. Regression lines were then estimated by entering these values in the regression equation. Figure 1 shows the effects of psychological demands and job control at low and high levels of hardness, while holding all other predictors at their mean. For employees with high levels of hardness, perceptions of high job control seemed to have a positive effect. For these individuals, psychological demands did not increase the number of absence spells under conditions of high job control. For employees with low levels of hardness, on the other hand, the effect of high job control was reversed. The effect of psychological demands on absence increased under conditions of high job control, but not under conditions of low control.

### Table 3

*Summary of Hurdle Regression Predicting the Probability of Having Any Sickness Absence (Zero Hurdle Portion) and the Number of Absence Spells During 2008 (Counts Portion)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Zero hurdle portion of model</th>
<th>Counts portion of model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>$SE$</td>
</tr>
<tr>
<td>Age</td>
<td>.010</td>
<td>.003</td>
</tr>
<tr>
<td>Baseline absence</td>
<td>.554</td>
<td>.029</td>
</tr>
<tr>
<td>Sex</td>
<td>.650</td>
<td>.074</td>
</tr>
<tr>
<td>Physical demands</td>
<td>.041</td>
<td>.015</td>
</tr>
<tr>
<td>Psychological demands</td>
<td>.005</td>
<td>.011</td>
</tr>
<tr>
<td>Job control</td>
<td>-.010</td>
<td>.012</td>
</tr>
<tr>
<td>Hardiness</td>
<td>-.026</td>
<td>.006</td>
</tr>
</tbody>
</table>

**Note.** Log-likelihood for model = −5,839. $\theta$ for model = 1.53. Akaike’s information criterion for model = 11,712.28. $N = 7,239$. $B =$ unstandardized coefficient; $\theta =$ overdispersion parameter. Women = 0, men = 1. Intercepts not included in model. 

* $p < .05$. ** $p < .01$. *** $p < .001$. 

272 HYSTAD, EID, AND BREVIK
The aim of this study was to explore the relationships between psychological hardiness, characteristics of the work environment, and sickness absence. In our sample of employees from the Norwegian Armed Forces, hardiness predicted both the likelihood of having sickness absence and the number of absence spells. To the best of our knowledge, this study is the first to prospectively demonstrate a relationship between hardiness and medically certified sickness absence. The only other prospective study that we are aware of failed to find significant associations (Greene & Nowack, 1995). Greene and Nowack (1995) did not take the nonnormality of the data into account, however, which may explain their failure to find effects. Two further studies have investigated related outcome variables. Manning and Fusilier (1999) explored the relationships between hardiness and health care utilization (i.e., contact with health care providers and the actual dollar cost of services rendered) 12 months after their survey. Their starting point was that increased life stress is associated with greater health care use, and the results revealed that participants who were high in hardiness tended to have lower health care costs and claims than participants who were low in hardness. Tang and Hammontree (1992) examined self-reported absenteeism among police officers and found an interaction between police stress and hardiness. However, this effect did not support their stress-buffering hypothesis, as hardiness appeared to have an effect only on absenteeism when the level of police stress was low. That is, hardy officers who experienced high levels of stress reported higher levels of absence during the ensuing 6 months compared with hardy officers with low levels of stress. Police officers low in hardiness displayed a high rate of absenteeism regardless of their levels of stress.

Consequently, the results from the present research extend previous research on hardiness and health by demonstrating a prospective link between hardiness and an objective measure of health outcome (i.e., sickness absence). Apart from the theoretical interest of identifying individual characteristics that are associated with good health, our research could have practical implications as well. An explicit focus on the individual resources of a workforce could yield huge benefits, both in terms of individual health and in terms of cost savings related to reduced absenteeism. In a summary of interventions to reduce job stress and improve workers’ health, the U.S. National Institute for Occupational Safety and Health proposed four different levels and categories of prevention: (1) legislative/policy interventions, (2) organization-level interventions, (3) job- and task-level interventions, and (4) individual-level interventions (Murphy & Sauter, 2004). One strategy for dealing with workplace stressors at the individual level has been to provide employees with health promotion or stress management programs. In this context, hardiness training could be an efficient approach to providing employees with strategies for coping with...
stress and reducing the health impact of stressors. True, hardiness is most often conceptualized as an individual disposition developed early in life that is reasonably stable over time (Maddi & Kobasa, 1984), but there is also research suggesting that it could be trained and enhanced (Maddi, Harvey, Khoshaba, Fazel, & Resurreccion, 2009; Maddi, Kahn, & Maddi, 1998). Although hardiness training is still at an early stage, there is preliminary evidence indicating that it might produce health and performance benefits (Maddi, 1987; Maddi et al., 1998).

However, there is one important point to bear in mind regarding stress management and training. Although individual-level training to increase stress resiliency is important, to be most effective, such efforts should be grounded in a broad understanding of the full range of factors that have a bearing on work stress and resiliency outcomes. As Landsbergis (2009) pointed out, if not accompanied by appropriate changes in, for instance, the work environment, any “benefits that may have been gained from a stress management program are likely to be eroded, if not entirely undone” (p. 201).

Interaction Between Job Control, Job Demands, and Hardiness

Of the work factors used in our study, physical demands and job control were significant predictors of sickness absence. They both predicted the number of absence spells, while physical demands also predicted the likelihood of having at least one sickness absence. The positive association between physical demands and sickness absence is not surprising. It corroborates previous research demonstrating detrimental effects of physical demands on both well-being and sickness (e.g., de Jonge, Dollard, Dormann, Le Blanc, & Houtman, 2000; Vanroelen, Levecque, Moors, Gadeyne, & Louckx, 2009; Voss, Floderus, & Diderichsen, 2001). More surprising was the finding that high levels of control were associated with an increase in absence. Although this result was somewhat unexpected, it is not completely unprecedented. For example, Rafferty, Friend, and Landsbergis (2001) found a positive, albeit nonsignificant, association between decision authority and the emotional exhaustion component of burnout. Similarly, among information technology consultants, a measure of job autonomy was positively, but again nonsignificantly, related to perceived stress (Wallgren & Hanse, 2007). Our result begs the question of whether high levels of job control are necessarily always positive. In addition to the ability to make decisions about work, high levels of job control could also entail uncertainty, high responsibility on the job, or longer working hours. In light of this, it is maybe not so surprising that high levels of control were positively associated with employees’ sickness absence in our study.

The negative effect of job control should also be interpreted in relation to the three-way interaction among demands, control, and hardiness. Although the interaction found did not support our hypothesis, it nevertheless underscores the importance of individual styles of adaptation to particular features of the job environment. Past research may to some extent have neglected the role played by workers’ individual characteristics and even overstated the motivating and healthful aspects of job control at the expense of its potential negative effects. In other words, for job control to be helpful, there needs to be a match between job control and personal beliefs regarding control opportunities (Meier, Semmer, Elfering, & Jacobshagen, 2008). If the work environment offers control opportunities, and the individual is convinced about his or her ability to make use of that control, such a match exists. If, however, an individual with low personal control beliefs experiences high-control opportunities in the work environment, there is a mismatch between the environment and personal preferences, and job control may be potentially threatening or stressful. Indeed, there is evidence suggesting that having high levels of control over one’s work can make some people more vulnerable to stress. For example, de Rijk, Le Blanc, Schaufeli, and de Jonge (1998) demonstrated that individual variations in active coping influenced whether job control had positive or negative health effects. In their study, job control moderated the effect of job demands on the emotional exhaustion component of burnout for nurses who scored high on active coping. For nurses who scored low on active coping, on the other hand, the opposite was true, as job control tended to reinforce the increase in emotional exhaustion due to job demands. Similar results were found by Meier et al. (2008) in relation to locus of control and self-efficacy.

Our results show that psychological demands in the work environment had a stronger negative impact on employees with low levels of hardiness under conditions of high, as opposed to low, job control. Consequently, our results corroborate the important role that individual characteristics play in relation to aspects of the job environment, particularly the demand–control relationship. Hardiness refers in part
to one’s belief in the ability to control or influence the course of events. To this end, individuals with high hardness are able to mobilize sufficient personal resources and choose the appropriate coping strategies in a given situation. Individuals with low hardness, on the other hand, do not have the level of confidence required to cope actively with the situation. Among employees with low hardness, having high job control may actually be stressful because it places them in a psychologically difficult position. High job control combined with a lack of confidence in one’s ability to mobilize personal capabilities can lead to expectations of failure, frustrations, and self-blame, and in the end predispose them to various forms of illness. Lack of control, in contrast, may be beneficial because it enables situational attributions and prevents self-blame.

Our results also reveal a tendency for low job control to have a negative effect on individuals high in hardness. Low job control was associated with a slight increase in absence spells under conditions of high psychological demands. As in the case of high job control–low hardness, this represents a mismatch between environmental opportunities to exert control and personal preferences and beliefs about exercising control. As Meier et al. (2008) have suggested, situations in which individuals are constrained from exercising their control preferences are likely to be perceived as stressful.

The results concerning the work factors must be interpreted with caution because they were not established scales but variables derived for the present study. The notion of unfair comparisons comes to mind. According to Cooper and Richardson (1986), tests of comparative effects are unfair if variables are not measured with equivalent strength, that is, if they are not “operationalized, manipulated, or measured with equal care and fidelity…” (p. 179). Although we tried to apply rigorous statistical procedures to obtain the best possible measures of work characteristics, these variables cannot, of course, compare with the psychometric care and empirical tests that lie behind current measures of hardness. For these reasons, greater trust should be placed in the results pertaining to hardness than those pertaining to the work factors.

Strengths, Limitations, and Conclusions

The primary strength of the present study is that we used different sources for the predictor and criterion variables. By using objectively recorded rather than self-reported sickness absence, we limited bias due to shared method variance and response sets. In addition, the prospective design of the study allowed for more substantial causal inferences about the positive effects of hardness on health and absence.

Apart from the limitations regarding the measurement of the work factors discussed above, the present study has two more limitations that are worth mentioning. First, our study population consisted exclusively of employees of the Norwegian Armed Forces, and more research in other organizations is needed to generalize the results to other occupations. On the other hand, it can also be argued that the armed forces encompass a diversity of occupational groups (e.g., health and information technology workers), making the results more generalizable.

Second, the effect sizes found for the relationships among hardness, job characteristics, and sickness absence were somewhat low. The odds ratios obtained for the focal variables were all close to 1.00, indicating that the strength of the associations was not large. This is probably because of the complexity of sickness absence, which is influenced by a vast variety of factors, both inherent to and extraneous to the workplace. Organizational features, demographic and socioeconomic aspects, leisure time activities and lifestyle, as well a wide range of other factors, are known to affect absence. To gain a deeper understanding of the mechanisms through which hardness has an effect on sickness absence, future research should explore the moderating role of hardness in relation to outside forces known to influence absenteeism.

In conclusion, our hypothesis that hardness would be negatively related to sickness absence was supported. Given its prospective nature, and the fact that we used an objectively recorded criterion variable, the present study consolidates hardness as an important and pertinent construct in the stress–health field. The results regarding our second hypothesis were more equivocal. Hardiness did not act as a buffer between job strain and absence. However, a significant three-way interaction was found among hardness, job demands, and job control that underlines the importance of hardness in relation to these job characteristics. For employees with low hardness, job control seemed to have detrimental effects: When job demands were high, high job control was associated with more absence among employees low in hardness. This suggests that it is necessary to consider individual differences when examining the effects of work characteristics.
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