JOB CHARACTERISTICS, ILL HEALTH AND NEGATIVE WORK-HOME INTERFERENCE IN THE MINING INDUSTRY

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ABSTRACT

The objective of this research was to test a structural model including job demands, job resources, ill health and negative work-home interference (WHI). Random samples ($N = 320$) were taken from employees working in the mining industry. The results indicated that job demands and job resources had an impact on ill health, and that ill health was associated with negative WHI. It was also found that job demands had a direct relationship with negative WHI, in addition to the indirect relationship through ill health. Job resources were not related not negative WHI.

Keywords:
Job demands, job resources, somatic complaints, insomnia and anxiety, exhaustion, negative work-home interference

The South African mining industry forms the hub of our country's economy and without it, many individuals and families would be stranded. However, it is at the same time an environment in which many people's lives are put at risk due to the nature of the job. The work in a mine is challenging and those working in physical environments (i.e. processing plants and underground) naturally require some degree of physical fitness and strength (Singer, 2002; Wynn, 2001). Furthermore, employees work with explosives, test geological formations, operate load-haul-dump machines, scraper winches, heavy-duty machines and maintain mining machinery in conventional mines. The equipment and techniques used are varied and complex, with many areas requiring significant safety and skills training (Calitz, 2004).

Employees are also exposed to harsh working conditions that include mining underground with temperatures in excess of 28 degrees Celsius, long working hours, sometimes unsafe working conditions, highly unionised environments and enormous pressure to perform. The consequences of high environmental heat loads can be expressed in terms of impaired work capacity, errors of judgement, and the occurrence of heat disorders, especially heat stroke that is often associated with severe and irreversible tissue damage and high mortality rates (Calitz, 2004). With more than one hundred miners killed every year in the South African mining industry, this industry has proven to have the highest rates of fatal occupational injuries (McGwin et al., 2002). For example, it has been found that the effects of lumbar curvature on low back pain risk factors for repetitive musculoskeletal disorders in the neck and the upper limb are common among industrial workers, and most pronounced among women (Arvidsson, Akesson & Hansson, 2003).

Exposure to these types of job characteristics could have serious implications for the health of employees. In fact, a number of studies found demands and resources in the job setting to be the most important predictors of adverse health outcomes such as burnout and psychosomatic health complaints (Demerouti, Bakker, Nachreiner & Schaufeli, 2001; Houkes, Janssen, De Jonge & Bakker, 2003; Houkes, Janssen, De Jonge & Nijhuis, 2001a, 2001b; Janssen, De Jonge & Bakker, 1999; Peeters, Montgomery, Bakker & Schaufeli, 2005). Furthermore, several negative outcomes are associated with stressful job characteristics and ill health, including a concept that became increasingly important to consider in Occupational Health Psychology, namely negative work-home interference (WHI). According to Bakker and Geurts (2004), job demands that require too much effort and the lack of job resources to fulfil job requirements could not only lead to constant overtaxing and in the long term to health problems,

but could also negatively interfere with the home situation. For example, when negative load reactions have built up at work as a result of high demands and insufficient resources, it could affect one's energetic and physical state at work, and as a result, one's functioning and need for recovery in the non-work (home) domain is influenced.

Employees suffering from stress-related illnesses and who experience conflict between the work and home domains as a result of stressful aspects in the job setting are not only a social concern for companies, but the organisation also suffer considerable financial and turnover problems (Greenhaus, Collins, Singh & Parasuraman, 1997; Lewis & Cooper, 2005). The consequences associated with ill health and negative WHI include increased absenteeism, workplace injuries, increased health care costs, violence, drug and alcohol abuse, lower productivity as well as turnover and litigation problems (Geurts & Demerouti, 2003; Ho, 1997; Managing Corporate Stress, 1998; Sauter et al., 2003). Focusing on ill health and WHI is therefore not only a corporate responsibility, but will have a strategic payoff.

Based on this line of reasoning, the objective of this study is to develop and test an explanatory structural model that depicts the manner in which job characteristics, ill health and WHI are 'causally' related in order to gain an understanding of why employees in the mining industry may suffer from ill health and negative WHI.

Job characteristics, ill health and negative WHI
Several theoretical models exist that could be used to improve our insights into job stress and the negative implications thereof, including the Job Demands-Resources (JD-R) model (Bakker, Demerouti, De Boer & Schaufeli, 2003; Demerouti et al., 2001) and the Effort-Recovery (E-R) model (Meijman & Mulder, 1998).

According to the JD-R model, every occupation has its own specific job characteristics, but it is still possible to model these characteristics in two broad categories, namely job demands and job resources. Job demands refer to those physical, psychosocial or organisational aspects of the job that require sustained physical and/or mental effort and are associated with certain physiological and or psychological costs. Job resources refer to those physical, psychosocial or organisational aspects of the job that may be functional in meeting task requirements (job demands), and may thus reduce the associated physiological and/or psychological costs, and at the same time stimulate personal growth and development. These resources can be located in the tasks itself (e.g. performance feedback, autonomy, skill variety),

as well as in the context (e.g. organisational resources such as career opportunities and job insecurity) and in social resources (e.g. supervisor support) (Demerouti et al., 2001).

In addition, the JD-R model proposes that employee health and well-being are the result of two relatively independent processes (Bakker et al., 2003; Demerouti et al., 2001). In the first process, demanding aspects of work (e.g. work overload) lead to constant overtaxing and in the long term to health problems (e.g. chronic fatigue, burnout). In the second process, the availability of job resources may help employees to cope with the demanding aspects of their work and simultaneously stimulate them to learn from and grow in their job, which may lead to motivation, feelings of accomplishment, and organisational commitment.

A useful model that can be used to illustrate the underlying mechanism of the process between that of job demands, job resources, ill health and negative WHI is the Effort-Recovery (E-R) model of Meijman and Mulder (1998). This model suggests that high job demands endanger people's health in particular if they cannot recover during working and non-working hours. In case people's time and energy resources are depleted due to ever increasing demands (particularly if this situation exists in both the work and home domain), serious conflicts can evolve between work and family roles. According to the E-R model, exposure to workload requires effort, which is associated with short-term psycho-physiological reactions (e.g. accelerated heart rate, increased hormone secretion, and mood changes). In principle, these reactions are adaptive (e.g. providing information on the effort that is needed to perform the task) and reversible (i.e. when the exposure to workload ceases, the functional systems that were activated will stabilise again). However, should the opportunity for recovery after being exposed to high workloads be insufficient, the psychobiological systems are activated again before having been able to stabilise at a baseline level. Consequently, the individual still in a suboptimal state, is forced to invest additional effort to perform adequately when confronted with (new) task demands, resulting in an increased intensity of the negative load reactions and making even higher demands on the recovery process.

In line with E-R theory, negative spillover has detrimental health effects when recovery opportunities between successive exposure periods are insufficient in terms of quantity (recovery time is too short, e.g. due to persisting demands) and/or quality (e.g. individuals unwind slowly and remain activated (sustained activation) after the exposure period, Ursin, 1980). Thus, an accumulative process may yield a draining of one's energy and a state of breakdown or exhaustion (e.g. Sluiter, 1999; Ursin, 1980). Under unchanged conditions, these symptoms may develop into manifest health problems (cf. Kompier, 1988; Sluiter, 1999).

The theoretical perspectives offered by the JD-R and E-R models are also relevant in studying the effect of job demands and a lack of job resources on ill health, and the spillover of negative load effects that have built up during working hours to the non-work situation. The central idea is that job demands that require too much effort and the lack of job resources to fulfil the job requirements will have adverse effects on the health of employees, and consequently, spill over to the home domain.

With regard to the above relationship and in conjunction with the models discussed earlier, there would appear to be a strong relationship between job characteristics (i.e. demands and resources) and ill health (i.e. exhaustion, somatic complaints, and anxiety and insomnia). Indeed, several studies reported that job demands (e.g. cognitive, emotional, and physical demands) and a lack of job resources such as job autonomy (or job control), skill variety, feedback and social support are the most important predictors of adverse health outcomes like burnout

(Houkes et al., 2003; Houkes et al., 2001a, 2001b; Janssen et al., 1999; Schaufeli & Enzmann, 1998). Furthermore, studies conducted by De Jonge, Janssen and Van Breukelen (1996) as well as by Demerouti et al. (2001) showed that available job resources and particularly high job demands were related to emotional exhaustion and psychosomatic health complaints. The first hypothesis is therefore that job demands (*Hypothesis 1a*) and a lack of job resources (*Hypothesis 1b*) will directly impact on ill health, which includes somatic complaints, anxiety and insomnia and exhaustion (see Figure 1).

Furthermore, a large number of studies have reported associations between negative WHI and ill health. In a review by Allen, Herst, Bruck and Sutton (2000), it is shown that negative WHI is related to stress-related variables such as burnout, general strain and somatic complaints, as well as physical consequences such as headache, backache, upset stomach, fatigue and sleep deprivation (insomnia). In a study among medical residents, Geurts, Rutte and Peeters (1999) found that negative WHI was associated with psychosomatic health complaints and sleep deprivation. O'Driscoll, Ilgen and Hildreth (1992) found a positive relationship between work/non-work conflict and general strain, while Beatty (1996) reported positive relationships with anxiety. Similarly, Burke (1988) found positive associations between work-family conflict and negative affective states, including depression, the impulse and overt to aggression, anger, irritation, and insomnia. A consistent relationship is also found between burnout and WHI (e.g. Allen et al., 2000; Burke, 1988; Kinnunen & Mauno, 1998; Netemeyer, Boles & McMurrian, 1996), and more specifically between negative WHI and exhaustion (Bakker & Geurts, 2004; Janssen, Peeters, De Jonge, Houkes & Tummers, 2004; Montgomery, Peeters, Schaufeli & Den Ouden, 2003).

In the framework of the Effort-Recovery (E-R) model it seems that high job demands and a lack of sufficient resources in the work environment is associated with poor health such as exhaustion, psychosomatic complaints, anxiety and insomnia. As a result, people will return home in a sub-optimal state, needing more time to recover from the day's work. It therefore seems that negative WHI will occur when the work situation is characterised by stressful job characteristics (i.e. increased job demands and lack of available resources), and that the possibility of ill health influencing negative WHI is highly probable. This study therefore proposes that ill health is associated with an increased risk of work negatively influencing the home environment (*Hypothesis 2*) (see Figure 1).

Although job characteristics are indirectly associated with negative WHI through ill health, several empirical studies support the assumption that job characteristics are also directly associated with negative WHI and that job demands and a lack of workplace social support and resources could endanger the work-home balance and foster negative WHI (e.g. Grzywacz & Marks, 2000; Leiter & Durup, 1996). Regarding job demands, it is consistently found that work overload has the most robust relationship with negative WHI (Frone, Russell & Cooper, 1997; Geurts et al., 1999; Wallace, 1997). Relationships are also reported between negative WHI and pressure at work (Frone, Russell & Cooper, 1992; Grzywacz & Marks, 2000; Mostert & Oosthuizen, 2006), role conflict and role ambiguity (Carlson & Perrewé, 1999; Grandey & Cropanzano, 1999; Mostert & Oosthuizen, 2006) and job insecurity (Kinnunen & Mauno, 1998). It therefore seems that job demands will have a direct relationship with negative WHI, in addition to the indirect effect through ill health (*Hypothesis 3a*) (see Figure 1).

Several job resources have been found to have a negative relationship with work-home conflict. The most frequently studied relationships are with autonomy and social support, where it has been found that lower levels of work-family conflict are associated with higher levels of autonomy (Frone et al., 1992; Grzywacz & Marks, 2000; Kinnunen & Mauno,

1998; Parasuraman, Purohit, Godshalk & Beutell, 1996) and more social support (Carlson & Perrewé, 1999; Grzywacz & Marks, 2000; Kinnunen & Mauno, 1998; Kirchmeyer & Cohen, 1999; Mostert & Oosthuizen, 2006). Based on these findings, it is hypothesised that job resources will also be directly related to negative WHI, in addition to the indirect effect through ill health (*Hypothesis 3b*) (see Figure 1).
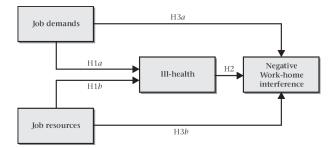

Figure 1: Hypothesised model (*Note:* Numbers correspond with the hypotheses)

RESEARCH DESIGN

Research approach
In order to answer the research questions, a quantitative research approach, and more specifically a cross-sectional design, was used.

Research method
Participants and sampling procedure
Random samples (*N* = 320) were taken from mining houses in the Gauteng, North West and Northern provinces, including gold, platinum and phosphate mines. The sample included employees of different Patterson grade levels (B2-E2), ranging from employees working underground to managers. Table 1 gives an indication of the characteristics of the participants in the study.

According to Table 1, the majority of the participants (79,90%) were male and between the age of 30 and 49 years. In total, 56,90% were Caucasian and 40,30% African. In total, 148 (46,30%) of the participants were Afrikaans speaking, with African languages constituting 128 (40,00%) of the sample. In terms of educatonal distribution, 192 (59,90%) of the participants possessed a secondary educational qualification (grade 12 or lower), while 122 (38,10%) possessed a tertiary education qualification. With regard to marital status, 76,30% of the participants were not married (either single or divorced) and 22,70% were married.

Measuring instruments
The following questionnaires were utilised in the empirical study:

Job characteristics. Focus groups were held in several mining houses to determine the specific job demands and job resources that employees experience in their work. Employees were asked to identify possible characteristics in their job and work environment that help or hinder them in doing their jobs. The responses were analysed and used to develop items for the questionnaire. Two major job demands were identified, namely Pressure (10 items, e.g. "Do you have too much work to do?") and Poor Working Conditions (11 items, e.g. "Are you exposed to health risks in your work environment (i.e. HIV/ Aids, tuberculosis, gasses, etc.)?"). Major job resources included Autonomy (seven items, e.g. "Do you have freedom in carrying out your work activities?"), Task Characteristics (six items, e.g. "Do you have enough variety in your work?"), Social Support (nine items, e.g. "Can you count on your supervisor when you come across difficulties in your work?"), Instrumental Support (six items, e.g. "Do you receive sufficient technical support to complete your tasks?") and Pay and Benefits (five

items, e.g. "Does your job offer you the possibility to progress financially?"). All items were rated on a four-point scale ranging from 1 (*never*) to 4 (*always*).

TABLE 1
CHARACTERISTICS OF THE PARTICIPANTS

Item	Category	Frequency	Percentage
Gender	Male	254	79,90
	Female	64	20,10
	Missing values	2	0,60
Ethnicity	Caucasian	182	56,90
	African	129	40,30
	Missing values	3	0,90
Age	22-29 years	42	13,10
	30-39 years	126	39,40
	40-49 years	104	32,50
	50-69 years	43	13,40
	Missing values	4	1,30
Language	Afrikaans	148	46,30
	English	41	12,80
	Sepedi	19	5,90
	Sesotho	34	10,60
	Setswana	22	6,90
	siSwati	15	4,70
	Tsivenda	3	0,90
	IsiNdebele	0	0
	isiXhosa	13	4,10
	isiZulu	8	2,50
	Xitsonga	13	4,10
	Other	1	0,30
	Missing values	3	0,90
Level of Qualification	Lower than grade 10	26	8,10
	Grade 10	27	8,40
	Grade 12	139	43,40
	Matric + Diploma	57	17,80
	Matric + Higher Diploma/ Degree	41	12,80
	Matric + Honours Degree	17	5,30
	Matric + Master's Degree	7	2,20
	Missing values	6	1,90

Ill health. Three indicators of ill health were used, namely somatic complaints, anxiety and insomnia, and exhaustion. Items were adapted from the General Health Questionnaire (GHQ, Goldberg & Williams, 1988) to measure Somatic Complaints (four items, e.g. "Have you recently been feeling ill?") and Anxiety and Insomnia (seven items, e.g. "Have you recently been losing sleep over constant worries?"; "Have you recently been feeling constantly under strain?"). Items were rated on a four-point scale ranging from 1 (*better than usual*) to 4 (*much worse than usual*). Exhaustion was measured using five adapted items (e.g. "I feel exhausted from my work") from the MBI-HSS (Maslach & Jackson, 1986). Items were scored on a seven-point scale, ranging from 0 (*never*) to 6 (*every day*).

Negative WHI. Negative WHI was measured using the Negative WHI scale of the "*Survey Work-Home Interaction – NijmeGen*" (SWING) (Geurts et al., 2005). Negative WHI refers to a negative impact of the work situation on one's functioning at home (eight items, e.g. "How often do you feel that your work schedule makes it difficult to fulfil domestic obligations?"). All items were scored on a four-point frequency rating scale, ranging from 0 (never) to 3 (always). Geurts et al. (2005) obtained a Cronbach alpha coefficient of 0,84, while Pieterse

and Mostert (2005) noted a coefficient α of 0,87 in their psychometric analysis of the SWING in the earthmoving equipment industry in South Africa.

Research procedure
Scheduled visits with the mining houses were made. Having obtained permission, focus group sessions were arranged with the purpose of gathering information on their work environment and factors that might help or hinder them in doing their job. A selected number of employees from various sections and grade levels within the mine participated in the focus groups. After obtaining an idea of what the recurring topics and main concerns of the employees were, the measuring battery was compiled and questionnaires were distributed. A letter was included, explaining the goal and importance of the study, as well as a list of contact persons should participants have any enquiries. Participants were assured of the anonymity and confidentiality with which the information would be handled. Participants were given three weeks to complete the questionnaires, after which they were personally collected or sent to the university by the HR consultant.

Statistical analysis
The statistical analysis was carried out with the SPSS program (SPSS Inc., 2005) and the Amos program (Arbuckle, 2003). Cronbach's alpha coefficients were used to assess the reliability of the constructs that were measured in this study. Descriptive statistics (e.g. means, standard deviations, skewness and kurtosis) and inferential statistics were used to analyse the data.

Pearson product-moment correlation coefficients were used to specify the relationship between the variables. In terms of statistical significance, it was decided to set the value at a 95% confidence interval level ($p \leq 0,05$). Effect sizes were used to decide on the practical significance of the findings (Steyn, 1999). Cut-off points of 0,30 (medium effect, Cohen, 1988) and 0,50 (large effect) were set for the practical significance of correlation coefficients.

The factor structures and structural model was tested with structural equation modelling (SEM) analyses using the Amos software package (Arbuckle, 2003). Maximum likelihood estimation were used with the covariance matrix of the scales as input for the analysis. The goodness-of-fit of the model was evaluated using absolute and relative indices. The χ^2 goodness-of-fit statistic and the Root Mean Square Error of Approximation (RMSEA) were used as absolute goodness-of-fit indices. Acceptable fit of the model is indicated by non-significant χ^2 values and RMSEA values smaller than or equal to 0,08 (Cudeck & Browne, 1993). However, because the χ^2 statistics is sensitive to sample size, Marsh, Balla and Hau (1996)

recommended using relative goodness-of-fit indices. Therefore, the following goodness-of-fit-indices were used as adjuncts to the χ^2 statistics: a) χ^2/df ratio; b) the Goodness-of-Fit Index (GFI); c) the Incremental Fit Index IFI; d) the Tucker-Lewis Index (TLI); and e) the Comparative Fit Index (CFI). For these relative fit-indices, as a rule of thumb, values of 0,90 or higher are considered as indicating a good fit (Hoyle, 1995). For the χ^2/df ratio, it is generally agreed that values smaller or equal to 5,00 are indicative of good fit (Byrne, 2001).

RESULTS

Construct validity of the measuring instruments
Before analysing the data, the factor structure of the job characteristics inventory and the ill health questionnaire was determined using confirmatory factor analysis. A two-factor model was tested for job characteristics, consisting of job demands (Pressure and Poor Working Conditions) and job resources (Autonomy, Task Characteristics, Social Support, Instrumental Support and Pay and Benefits). A three-factor model was tested for ill health, consisting of Somatic Complaints, Insomnia and Anxiety, and Exhaustion. Because it is not desirable to use individual items or the full scale in a structural model (Bagozzi & Edwards, 1998; Landis, Beal & Tesluk, 2000; Reckase, 1996), a two-factor model was tested for Negative WHI, consisting of strain-based and time-based interference. The results are reported in Table 2.

TABLE 2
GOODNESS-OF-FIT STATISTICS FOR THE FACTOR MODELS

Model	χ^2	χ^2/df	GFI	IFI	TLI	CFI	RMSEA
Job Characteristics	39,40	3,03	0,97	0,92	0,89	0,92	0,08
Ill Health	265,79	2,63	0,90	0,93	0,92	0,93	0,07
Negative WHI	58,27	3,07	0,96	0,97	0,95	0,97	0,08

Table 2 indicates that the models fit suitably to the data. Since the fit of these models were satisfactory and the results agreed with the theoretical assumptions underlying the instruments, these constructs were used to test the hypothesised structural model.

Descriptive statistics, internal consistencies and product-moment correlations of the measuring instruments

The results of the descriptive statistics, internal consistencies and product-moment correlation coefficients are given below in Table 3.

TABLE 3
PRODUCT-MOMENT CORRELATIONS

	M	SD	α	1	2	3	4	5	6	7	8	9	10
1. Pressure	25,16	5,11	0,80	1,00	-	-	-	-	-	-	-	-	-
2. Poor Work Conditions	24,86	6,77	0,84	0,42	1,00	-	-	-	-	-	-	-	-
3. Autonomy	20,57	4,24	0,82	-0,04	-0,06	1,00	-	-	-	-	-	-	-
4. Task Characteristics	15,50	3,93	0,77	0,03	0,11	0,41	1,00	-	-	-	-	-	-
5. Social Support	26,02	6,32	0,89	-0,25	-0,06	0,32	0,41	1,00	-	-	-	-	-
6. Instrumental Support	17,31	3,62	0,78	-0,11	-0,01	0,21	0,35	0,35	1,00	-	-	-	-
7. Pay and Benefits	10,83	4,06	0,87	-0,12	-0,06	0,23	0,35	0,35	0,22	1,00	-	-	-
8. Somatic Complaints	7,05	2,79	0,81	0,16	0,13	-0,09	-0,10	-0,16	-0,03	-0,13	1,00	-	-
9. Anxiety & Insomnia	12,96	4,68	0,89	0,17	0,23	-0,15	-0,15	-0,22	-0,15	-0,05	0,67	1,00	-
10. Exhaustion	14,42	7,41	0,83	0,45	0,37	-0,19	-0,17	-0,23	-0,17	-0,17	0,25	0,38	1,00
11. Negative WHI	9,09	5,35	0,90	0,47	0,46	-0,13	-0,07	-0,14	-0,17	-0,15	0,35	0,38	0,51

All correlations ≥ 0,11 are statistically significant; $p < 0,05$
All correlations $0,30 \leq r \leq 0,49$ are practically significant (medium effect)
All correlations ≥ 0,50 are practically significant (large effect)

From the results in Table 3, it can be seen that the Cronbach's alpha coefficients of all the sub-scales were considered acceptable compared to the guideline of α > 0,70 (Nunnally & Bernstein, 1994). It is evident from Table 3 that Job Demands (Pressure and Poor Working Conditions) have positive and statistically significantly relationships with Somatic Complaints and Anxiety and Insomnia and positive and practically significantly relationships (medium effect) with Exhaustion and Negative WHI. Furthermore, it seems that negative and statistically significantly relationships exist between Somatic Complaints, Social Support and Pay and Benefits; Anxiety and Insomnia, Autonomy, Task Characteristics, Social Support and Instrumental Support; Exhaustion and all five job resources; and Negative WHI, Autonomy, Social Support, Instrumental Support and Pay and Benefits. Finally, Somatic Complaints and Anxiety and Insomnia have positive and practically significantly relationships (with a medium effect) with Negative WHI, while Exhaustion has a positive and practically significantly relationship (large effect) with Negative WHI.

The structural model of job characteristics, ill health and negative WHI

The structural model was tested for its goodness-of-fit to the co-variance matrix of the measured variables. The latent exogenous factors, namely job demands and job resources, were both operationalised by exogenous observed variables (see Figure 2). Job demands were indicated by pressure and poor working conditions. The manifest indicators of job resources were autonomy, task characteristics, social support, instrumental support, and pay and benefits. In addition, the structural model includes two endogenous latent variables, namely ill health and negative WHI. The latent "ill health" factor was assessed by three observed variables, namely somatic complaints, anxiety and insomnia, and exhaustion. The manifest indicators of negative WHI was strain-based WHI and time-based WHI. The fit of the hypothetical model was assessed by (1) a quick overview of the overall χ^2 value, together with its degrees of freedom and probability value; and (2) global assessments of model fit based on several goodness-of-fit statistics. The results are shown in Table 4.

Table 4
GOODNESS-OF-FIT STATISTICS FOR THE HYPOTHESISED MODELS

Model		χ^2	χ^2/df	GFI	IFI	TLI	CFI	RMSEA
M_1	Hypothesised model	198,34	4,05	0,91	0,88	0,83	0,88	0,10
M_2	Re-specified model	113,23	2,31	0,95	0,95	0,93	0,95	0,06

From the results in Table 4, it is clear that the hypothesised model did not fit well to the data, with χ^2 = 198,34; IFI, TLI and CFI < 0,90 and RMSEA > 0,08. A review of the modification indices revealed that this lack of fit was mainly due to a covariation between the measurement errors of "somatic complaints" and "anxiety and insomnia". A possible explanation for the covariation between these errors could be that items with comparable rating scales often have measurement errors that are correlated (Byrne, 2001). According to De Jonge et al. (2001), such an error correlation may be due to the existence of an additional variable that is not included in the model. Therefore, correlated measurement error terms would imply a common source of non-relevant variance (e.g. another latent variable not formally assessed). As a result, this correlation could be necessary to explain the outcome variables more fully (MacCallum, Wegener, Uchino & Fabrigar, 1993). Furthermore, the path between job resources and negative WHI was highly insignificant (p = 0,10) and is was decided to omit this path from the model.

After the hypothesised model was revised with the covariation included and the path between job resources and negative WHI omitted, the fit statistics indicate excellent fit of the

measurement model to the data (χ^2 = 113,23; GFI, IFI, TLI and CFI > 0,90; and RMSEA < 0,08) and resulted in a significant improvement in the fit of the first model (M2 vs. M1: $\Delta\chi^2$ = 85,11$_{(N = 320)}$, df = 1,00, p < 0,01). Therefore, these results provide support for Hypothesis 1a (the coefficient of the path from job demands to ill health was positive and highly significant: β = 0,78, t = 4,77, p < 0,01), Hypothesis 1b (the coefficient of the path from job resources to ill health was negative and significant: β = -0,39, t = -3,95, p < 0,01), Hypothesis 2 (the coefficient of the path from ill health to negative WHI was positive and highly significant: β = 0,45, t = 3,28, p < 0,01) and Hypothesis 3a (the coefficient of the path from job demands to negative WHI was positive and highly significant: β = 0,41, t = 3,22, p < 0,01). However, no support was found for Hypothesis 3b. In total, job demands and job resources explained 76% of the variance in ill health, while job demands and ill health explained 65% of the variance in negative WHI. The standardised parameter estimates are shown in the model in Figure 2.
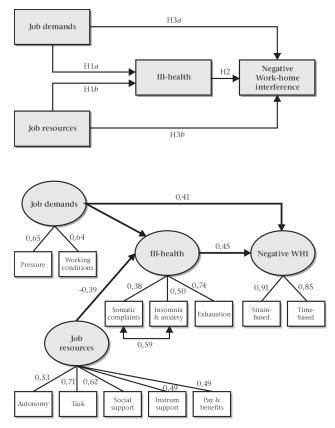

Figure 2: Standardised parameter estimates for the Final Model. All factor loadings and path coefficients are statistically significant, p < 0,00.

DISCUSSION

The objective of this study was to test a structural model consisting of job characteristics, ill health and negative WHI. The model showed that high job demands and a lack of job resources are associated with exhaustion, somatic complaints and anxiety and insomnia, which in turn are associated with negative interference from work to the private domain. These results are consistent with previous research studies which found that demands and resources in the job setting are important predictors of adverse health outcomes such as burnout and psychosomatic health complaints (e.g. Bakker & Geurts, 2004; Demerouti et al., 2001; Houkes et al., 2003; Peeters et al., 2005) and that self-reported poor general health is positively related to work-home conflict (Frone, 2002; Grandey & Cropanzano, 1999; Kinnunen & Mauno, 1998).

It was also found that a significant relationship exist between job demands and negative WHI, in addition to the direct relationship with ill health (e.g. Frone et al., 1997; Geurts et al., 1999; Grandey & Cropanzano, 1999; Grzywacz & Marks, 2000; Kinnunen & Mauno, 1998; Leiter & Durup, 1996). It therefore seems that demanding aspects of work contribute to poor health, which will eventually lead to a negative interference with the home domain. More specifically, high pressure at work (e.g. working very hard and under time pressure, having an excessive amount of work to do, having to concentrate for very long periods, reaching impossible or unrealistic targets) and poor working conditions (e.g. working in dangerous and unsafe conditions, being exposed to high security risks, being exposed to health risks in the work environment such as HIV/ Aids, tuberculosis and gasses, working overtime and socially undesirable hours) are positively and highly significantly related to employees feeling exhausted, physically ill and suffering from anxiety and insomnia. In addition, a lack of job resources such as low autonomy (e.g. no freedom in carrying out work activities), poor task characteristics (e.g. not enough variety in the job, no opportunities for personal growth, development or promotion) a lack of social and instrumental support (e.g. support from supervisor and colleagues, technical support to complete tasks) and poor salaries and benefits could further contribute to health-related problems.

In the framework of the effort-recovery model, it seems that high and continuous job demands endanger people's health in particular if they are not able to recover during non-working hours. This leads to the depletion of an individual's time and energy resources due to increasing demands, which could result in serious conflicts evolving between work and family roles. Employees also particularly experience negative interference between their work and family life when they have to deal with very high pressures under poor working conditions that require sustained physical or psychological effort. This may lead to the building up of negative load reactions and, in addition, evoke somatic symptoms, high anxiety levels, difficulties with sleeping and feelings of exhaustion that spill over to the private domain, where opportunities to recover sufficiently from the effort put into the job are obstructed (Bakker & Geurts, 2004). The end result is that individuals have to make additional compensatory efforts to recover or adapt at home, influencing his/her functioning at home and making it difficult to fulfil domestic obligations. According to Demerouti, Bakker and Bulters (2004), employees who encounter high job demands, feelings of fatigue and negative WHI may end up in a "loss spiral" where negative experiences reinforce each other.

On the other hand, sufficient job resources may enable workers to deal with high job demands and at the same time increase their enthusiasm to exert energy into their work. This may be associated with the mobilisation of energy which may prevent symptoms of somatic complaints, anxiety/insomnia and exhaustion. As a result, there may exist a reduced need for recovery at home that will leave the individual with more energy to engage in pleasant activities at home and to fulfil family responsibilities.

Limitations and recommendations

Firstly, a major limitation is the fact that a cross-sectional research design was utilised. As a result, no concrete decisions could be made regarding cause-and-effect relationships among variables. Therefore, it is impossible to verify causal assumptions about "antecedents" and "consequences". In this study, negative WHI was seen as an outcome of ill health (see Bakker & Geurts, 2004). However, several researchers regard WHI as a stressor or a mediator (Geurts et al., 1999; Geurts et al., 2005; Grzywacz & Marks, 2000; Janssen et al., 2004; Montgomery et al., 2003; Mostert, Cronje & Pienaar, 2006). It is therefore possible that negative WHI could act as a mediator between job characteristics and ill health, where ill health is treated as a criterion variable. It is also possible that a feedback loop exists where negative interference from work to home, and the lack of recovery time could become an additional stressor, contributing to even higher levels of ill health. It is therefore important for future studies to use longitudinal designs and multiwave studies. The advantage of these designs is that the hypothesised causalities of the relationships can be further validated and can therefore indicate whether the relationships hold true over time. A second limitation was the use of "self-report questionnaires". This may lead to a problem commonly referred to as "method-variance" or "nuisance". Another limitation was that of the exclusive focus on ill health and negative WHI. Although a number of research findings have found negative WHI to be the most pervasive, future research could focus on strategies to implement in organisations in order to ensure a positive transfer of skill, attitude, and general life satisfaction.

Despite the limitations surrounding this research, there are a number of findings that could prove helpful to the mining industry. Mining is an industry driven by performance, and resultantly has increased job demands and lack of available resources, which has adverse implications on the health and well-being of individuals and organisations. With negative WHI having extensive implications for individuals and organisations, the mining industry should focus on providing support in terms of available resources and effectively managed job demands that are conducive to helping employees align their work and home domains. According to Geurts and Demerouti (2003), the focus should not only be on *formal* policies (e.g. by offering flexible working hours, compressed work schedules, child care facilities, parental leave), but also on the *informal* work environment. Although the organisation may have policies in place that provide for family responsibility leave, an environment needs to be created where employees feel at ease in utilising such policies without feeling being branded against.

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