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Combined effects of work-related stress in Her Majesty's Coastguard (HMCG)

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ABSTRACT

Background. Having initially reported on the overall level of stress in Her Majesty's Coastguard (HMCG), in a second study we found that a combined (negative) effects approach to stress was better able to identify the associated psychosocial risk factors than by using the well-documented Effort-Reward Imbalance (ERI) or Job Demand-Control Support (JDCS) models alone. Using the same combined effects method, this study now examines the negative health and wellbeing outcomes associated with the level of high stress found in this occupational group.

Material and methods. Participants included 282 coastguards. A range of known stress outcomes were measured including: mental and physical health, accidents, risk taking, effects of memory, lifestyle, and job satisfaction.

Results. Significant associations were found with: anxiety, depression, number of sick days, perception that illness was caused or made worse by work, number of symptoms, medicines taken, insomnia, ability to maintain a desired body weight or take planned exercise and find time to "relax and wind down", time spent on hobbies or interests, the impact of job on family life/ /family life on job, and job satisfaction.

Conclusions. Sixteen negative outcomes were significantly associated with the combined effects approach, compared with 15 using ERI or 10 using JDCS alone. Results clearly demonstrated the harmful effects of stress in maritime related roles, other than those of seafarers and suggest that further research in this area would be useful. Further studies on the more flexible stress model, which allows for the examination of both established and new combinations of risk factors and associated outcomes, would also be beneficial.

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Key words: stress, coastguards, combined effects, Job Demand-Control-Support (JDCS), Effort-Reward Imbalance (ERI), outcomes

INTRODUCTION

This is our third paper reporting on stress in Her Majesty's Coastguard (HMCG). In the first [1] we highlighted the lack of research on stress and wellbeing in the maritime sector. Where it does exist, the increased automation and the decreased number of seamen per ship have been reported as major causes [2]. Others include role conflict between working to professional standards and operating the ship with reduced crew numbers to satisfy requirements for profitability [3], and differences in levels of stress have been found within multi-occupational samples [4, 5]. We also highlighted the fact that the maritime sector involves occupations other than seafarers, with very little research on coastguards in general [6].

To this end, our present studies investigated stress in this occupational group and are the first to report data on this topic.

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PREVALENCE OF STRESS IN HMCG AND ASSOCIATED RISK FACTORS

Aside from the general lack of research, one of the key reasons for examining this group was the nature of their work as an emergency service. HMCG form part of the Maritime and Coastguard Agency, a UK Government Agency. Their general remit is to provide a civil (non-military) maritime search and rescue response by co-ordinating activities to help persons either in distress at sea or at risk of injury or death on the cliffs and shoreline of Britain, mainly from a number of control rooms located around the UK coast [7]. Given the potential for stress from dealing with fatalities, our first study [1] set out to examine the prevalence of high stress. However, analysis found this to be lower in HMCG than in general UK working population samples: 11% compared with 17%, [8, 9]. This was due, in part, to high levels of moderating social support from working in watches. Despite this, HMCG were also found to have significantly higher levels of depression.

Our second study [10] subsequently examined the psychosocial risk factors associated with the level of high stress in this group. This was done using two of the most influential models in the literature to date; Effort-Reward Imbalance (ERI) [11] and Job Demands-Control-Support (JDCS) [12–14]. However, analyses of this data found that stress, anxiety, and depression were better explained by the combined effects of a range of risk factors than by either model alone. Using the combined method [15], significant predictors of stress were identified as ERI, organisation change, and exposure to physical agents (noise). Anxiety was predicted by ERI, noise, and bullying. Depression was predicted by ERI, bullying, noise, training, and role conflict/ambiguity [10]. Continuing with a focus on combined negative effects from risk factors, analyses in this third study now progresses to examine any negative *outcomes* associated with high stress in this occupational group.

COMBINED NEGATIVE OCCUPATIONAL FACTORS (NOF)

This approach [15] theorises that individuals are more likely to be exposed to multiple hazards in the workplace, and that the relationship between combinations of stressors is likely to be additive and will explain more variance in the outcome measures than any of the independent variables in isolation. Scores for risk factors are summed to create a composite or "combined effects" measure called the Negative Occupational Factors (NOF) score, which is then split into quartiles for analysis purposes. The negative influence of job characteristics will be strongest when the greatest number of multiple stressors is present in combination (i.e. the top quartile). Whilst both the ERI and JDCS models combine more than one risk factor, this approach allows for the possibility to assess *multiple* stressors at one time, sufficient to actually subsume ERI and JDCS components, in addition to other, individual, known risk factors (e.g. bullying), as was the approach taken here.

OUTCOMES OF STRESS

In general terms, anxiety and depression have been reported as the most common stress-related complaints [16]. Whilst a range of other outcomes have been found (e.g. musculoskeletal problems [17, 18], increased smoking, and drinking [19, 20]), there are fewer studies in these areas, as the popular ERI and JDCS models were originally developed to study the relationship between work stress and cardiovascular disease. Thus, most research conducted to date has been on this latter association [21, 22]. Studies using the combined effects of both models are limited, but authors of the NOF approach have been able to use them to examine stress in a number of different ways [15]. Within their UK community survey sample studies, they found that stress could be predicted by each of the JDCS and ERI models, but it was most likely to be reported by workers who were exposed to a combination of the underlying factors, specifically where jobs were highly demanding, required high levels of effort, and exposed them to high levels of physical hazards and/or deleterious working hours. They also found that overall, high effort jobs by themselves exerted the most negative influence on work stress. Through a number of different analyses, they reported on several combinations of risk factors having an impact on a wide range of outcomes, for example: anxiety, depression, the number of hospital outpatient visits, musculoskeletal problems, 6 or more sick days leave in the previous 12 months, gastrointestinal problems, respiratory tract infections and sleeping difficulties, accidents, and injuries, to name but a few. The usefulness of this approach in our second study [10] to identify risk factors, plus its inherent flexibility, led us to use the method again here to examine the relationship between our high stress and outcome data.

HYPOTHESES

The following hypotheses were tested in the current research:

— H1: the NOF score would be significantly associated with stress and mental health (anxiety and depression);
— H2: the NOF score would be significantly associated with symptoms of physical health and medication;
— H3: the NOF score would be significantly associated with other outcomes such as job satisfaction and aspects of lifestyle.
— H4: the NOF (combined) score would have more significant negative outcome associations than the ERI and JDCS models alone.

MATERIALS AND METHODS

Materials and methods are described in detail in the first, previous, related paper [1]. However, to summarise, data were collected as part of a PhD thesis [6], via a 24 × A4 page paper questionnaire. In addition to standard sample and demographic characteristics (e.g. age, gender), the scales and single items here were those presented in Table 1. The total number of coastguard participants was 282 (response rate = 47%). Of which 95% were full-time, 77% worked shifts, 76% were male, 64% were aged between 41–60 years, 63% had previously worked in a maritime environment (e.g. merchant or Royal Navy), and 28% were undergoing training at the time of the study. Support and encouragement to participate was provided by senior management and the local trade union, which had raised concerns about reports of stress from some of their members. Data were analysed using univariate ANOVA and logistic regression (Table 1).

RESULTS

H1: THE NOF SCORE WOULD BE SIGNIFICANTLY ASSOCIATED WITH STRESS AND MENTAL HEALTH

Using ANOVA, significant differences were found so that those with a higher NOF score also reported higher stress, anxiety, and depression. Results are presented in Table 2. Further analysis, using logistic regression, found that those with high NOF scores were four times more likely to report higher levels of work stress (OR = 4.42, CI = 1.74, 11.19, p = 0.002), anxiety (OR = 3.66, CI = 2.22, 6.05, p = <0.001), and/or depression (OR = 4.22, CI = 2.53, 7.02, p < 0.001) (Table 2).

H2: THE NOF SCORE WOULD BE SIGNIFICANTLY ASSOCIATED WITH SYMPTOMS OF PHYSICAL HEALTH AND MEDICATION

Table 3 presents the results of these analyses. Again, using ANOVA, significant differences were

Table 1. Measures included in the study

Risk Factors
Exposure to physical agents and noise [8, 15]
Job Demands-Control-Support (JDCS) [23]
Effort-Reward Imbalance (ERI) [24]
Organisational Culture Profile (OCP) [25]
Management of change [6]
Leader-member exchange (LMX) [26], Team-member exchange (TMX) [27]
Bullying [28]
Role conflict and ambiguity [29]
Training [6]
Appraisals (Perceptions)
Work stress *(In general how do you find your job? not at all/mildly/moderately/very/extremely stressful)* [8, 15]
Outcomes
Number of sick days in last 12 months [8, 15]
Have you suffered from any illness you think was caused/made worse by work? [8, 15]
HADS (anxiety and depression) [30]
Symptoms and Medication [8, 15]
Epworth [31] (sleepiness)
How frequently do you suffer from insomnia? [8, 15]
Accidents and injuries [8, 15], memory problems [8, 15], risk taking [8, 15]
Smoking [8, 15], drinking [8, 15]
Do you maintain a desired bodyweight/ take planned exercise/ find time to relax? [32]
Number of hours per week spent on hobbies/interests [6]
Impact of family life on job [8, 15], impact of job on family life [8, 15]
Individual Characteristics
Negative affectivity [8, 15], coping [33]

found, so those with a higher NOF score also reported higher levels in: the number of sick days taken, the perception that illness was caused or made worse by work, the number of symptoms in the previous 12 months, medicines taken in previous 12 months, and the prevalence of insomnia.

H3: THE NOF SCORE WOULD BE SIGNIFICANTLY ASSOCIATED WITH A RANGE OF OTHER OUTCOMES SUCH AS LIFESTYLE AND JOB SATISFACTION

Table 4 presents the results of these analyses. Significant differences were found such that those

Table 2. Significant differences between Levels of NOF and Mental Health (Anxiety and Depression)

Outcome	Quartile	M	SD	n	df	F	P
Work stress*·	Q1	0.95	0.74	57			
	Q2	1.38	0.82	74			
	Q3	1.59	0.84	70	3, 263	12.02	< 0.001
	Q4	1.93	0.86	67			
Anxiety*·	Q1	3.70	3.33	57			
	Q2	5.17	3.81	76			
	Q3	6.71	4.07	70	3, 267	22.62	< 0.001
	Q4	9.19	4.44	68			
Depression*·	Q1	1.93	2.56	57			
	Q2	2.99	2.79	73	3, 258	25.72	< 0.001
	Q3	4.65	4.08	69			
	Q4	7.42	3.96	64			

*Significant association with ERI, · — significant association with JDCS

Table 3. Significant Differences between levels of NOF and Physical Health Outcomes

Outcome	Quartile	M	SD	N	df	F	P
Number sick days in last 12 months*·	Q1	0.72	0.83	58			
	Q2	0.70	0.69	76			
	Q3	1.03	0.99	70	3, 265	6.49	< 0.001
	Q4	1.39	1.24	66			
Illness caused/ made worse by work*·	Q1	0.09	0.29	56			
	Q2	0.09	0.29	75			
	Q3	0.27	0.45	67	3, 258	7.60	< 0.001
	Q4	0.42	0.50	65			
Symptoms in last year*	Q1	0.95	1.21	58			
	Q2	1.17	1.24	71			
	Q3	1.75	1.66	67	3, 252	7.02	< 0.001
	Q4	2.25	1.61	61			
Symptoms in last 14 days*·	Q1	2.38	2.23	53			
	Q2	3.96	3.16	71			
	Q3	4.86	3.53	66	3, 246	9.84	< 0.001
	Q4	5.87	3.30	61			
Medicines in year·	Q1	0.79	0.89	58			
	Q2	1.23	1.26	74			
	Q3	1.18	1.20	62	3, 252	3.04	0.03
	Q4	1.54	1.42	63			
Insomnia*	Q1	1.10	0.95	58			
	Q2	1.54	0.97	76	3, 266	8.52	< 0.001
	Q3	1.70	1.08	70			
	Q4	2.18	1.06	67			

*Significant association with ERI; · — significant association with JDCS

Table 4. Significant Differences between levels of NOF and Other Outcomes

Outcome	Quartile	M	SD	n	df	F	P
Inability to maintain desired body weight*	Q1	0.72	0.77	58			
	Q2	1.00	0.88	76			
	Q3	0.86	0.79	70	3, 265	4.77	0.003
	Q4	1.30	0.82	66			
Inability to take planned exercise	Q1	1.66	1.43	58			
	Q2	2.21	1.54	76			
	Q3	2.19	1.43	70	3, 266	2.84	0.38
	Q4	2.54	1.41	67			
Inability to "relax and wind down"*·	Q1	0.91	0.88	58			
	Q2	1.25	0.82	76	3, 266	9.23	< 0.001
	Q3	1.60	0.86	70			
	Q4	1.76	0.90	67			
Time spent on hobbies and interests*	Q1	2.12	0.88	58			
	Q2	1.89	0.90	76	3, 266	3.16	0.03
	Q3	1.67	0.86	70			
	Q4	1.58	0.89	67			
Impact of job on family life*·	Q1	1.86	1.47	51			
	Q2	2.64	2.02	69	3, 248	12.46	< 0.001
	Q3	3.54	2.25	68			
	Q4	4.18	1.97	65			
Impact of family life on job	Q1	1.00	1.60	51			
	Q2	1.21	1.43	72	3, 248	3.90	0.01
	Q3	1.76	2.00	66			
	Q4	2.20	2.06	64			
Job satisfaction*·	Q1	2.13	0.76	67			
	Q2	2.65	0.80	69	3, 265	23.13	< 0.001
	Q3	2.91	0.72	76			
	Q4	3.28	0.67	58			

*Significant association with ERI; · — significant association with JDCS

with a higher NOF score also reported higher levels in: (in)ability to maintain a desired body weight or take planned exercise and find time to "relax and wind down", time spent on hobbies/interests, impact of job on family life/ family life on job, and job satisfaction.

H4: THE NOF (COMBINED) SCORE WOULD HAVE MORE SIGNIFICANT NEGATIVE OUTCOME ASSOCIATIONS THAN ERI AND JDCS MODELS ALONE

In addition to significant NOF associations with negative outcomes (× 16), Tables 1–4 also indicate significant ERI (× 15) and JDCS (× 10) associations when tested as single models. The latter has been published in detail elsewhere [1]. For NOF and ERI, an overlap existed between the models and outcomes, except in two cases where ERI was significantly associated with chronic symptoms (F = 2.99, df = 3, 226, p = 0.03) and sleepiness (F = 3.24, df = 3, 226, p = 0.02) but were not associated with NOF. NOF was also significantly associated with the ability to take planned exercise and the impact of family life on work, but these outcomes were not apparent with ERI. Table 5 provides a comparison of the effect siz-

Table 5. Comparison of Effect Sizes for Significant Outcomes Across the Stress Models

Dependent Variable	Partial Eta Squared		
	NOF	ERI	JDCS (SS)
Work stress	.12	.21*	.06
Anxiety	.20	.46*	.12
Depression	.23	.33*	.13
Sick days in last 12 months	.07*	.03	.06
Illness caused/made worse by work	.08	.10*	.08
Chronic symptoms	NS	.04*	NS
Symptoms in last year	.08*	.06	NS
Symptoms in last 14 days	.11	.14*	.05
Medicines taken in last year	.04*	NS	.04*
Sleepiness	NS	.04*	NS
Insomnia	.09*	.08	NS
Inability to maintain desired body weight	.05*	.04	NS
Inability to take planned exercise	.03*	NS	NS
Inability to "relax and wind down"	.09	.13*	.07
Time spent on hobbies/interests	.03	.07*	NS
Job impact on family life	.13	.34*	.10
Family life impact on job	.05*	NS	NS
Job satisfaction	.21*	.14	.19

*Largest impact across the models; JDCS (SS) — social support element of the JDCS Model

es of the significant outcome associations across the three models. Larger effects were found with ERI for mental health and chronic symptoms, with larger effects associated with NOF across a range of other outcomes, such as job satisfaction, insomnia, and the number of symptoms in the previous year.

There were no significant associations found with any model for the following outcomes: medicines taken in the last month or 14 days, pathological sleepiness, smoking, drinking, accidents and injuries, memory problems, and risk taking.

DISCUSSION

OUTCOMES

The results reflect the literature in that there is a considerable body of evidence linking the main ERI and JDCS components of the NOF score to stress, anxiety, and depression (because of conceptual overlap), with a more varied association with other outcomes. Fewer outcomes may have been expected as a consequence of the level of stress found in HMCG (11%), but results show that even lower levels of stress

can be harmful, varied, and far reaching. It was surprising that none of the models predicted an increase in smoking or drinking. This may be due to a number of reasons, e.g. the level of professionalism and dedication associated with the role or greater care taken over health due to the age range (64% aged between 41–60 years), but it should also be borne in mind that the survey was based on self-report.

STRESS MODELS

As in our second study [10], when we were examining risk factors in this occupational group, here again, NOF proved a more useful model of stress for HMCG than ERI or JDCS alone, as it was sensitive enough to predict the most negative outcomes of stress (16 compared to 15 from ERI and 10 from JDCS) and provided a useful insight into the size of the effects that less commonly measured outcomes can have.

ERI was efficient in terms of its ease of use, explanation of the main risk factor, and number of negative outcome associations. However, it is limited in what it measures, and there were other risk factors

and outcomes identified using the combined approach, which would have been missed if measuring for ERI alone. The JDCS model did not add anything different to NOF and was found to be associated with five less outcomes using data on this model only. In comparison to ERI, the only difference that low support was able to add to predicting outcomes was the number of medicines taken in the last year. As with ERI, using JDCS alone would have been limiting in this study (both for identifying risk factors and outcomes). The only potential consideration when using the NOF approach is the amount of data collected. Whilst a large amount of information is useful to maximise the benefits of its inherent flexibility, there may be occasions where such a method is not practical. That said, with further research or the use of appropriate skips and filters, such issues may be easily overcome.

CONCLUSIONS

In total, 16 negative outcomes were significantly associated with the combined effects approach, compared with 15 using ERI or 10 using JDCS alone. The results, therefore, showed that even lower levels of stress can be harmful, varied, and far reaching. At this point, our research suggests that further studies into stress in maritime sector occupations other than seafarers would be useful. In addition, it raises questions about the appropriate selection of stress model for any given study. The results reported here and in our previous papers [1, 10] clearly indicate that findings and interpretation of data could vary significantly. We conclude that further research using a more flexible approach, such as NOF, which can examine both established and new combinations of risk factors, would be beneficial to the future study of work-related stress.

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