Occupational stress and strain in the naval service: 1999 and 2004

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Introduction

In the late 1990s, the Naval Service (NS), consisting of the Royal Navy (RN) and the Royal Marines (RM), embarked upon a programme of research into occupational stress, led by G. Slaven. The programme was designed to support the development of health and safety policy.

Between 1995 and 1999, 1516 NS personnel were medically downgraded prior to medical discharge but there was no evidence of high levels of anxiety and depression (hereafter ‘strain’). Depression accounted for 2.2% and anxiety 0.7%. The NS has a low incidence of suicide—lower than the British Army and Royal Air Force (RAF) and under half the rate of the equivalent UK male population (A. Shariff, G. Slaven, N. Pullinger, G. H. G. McMillan, unpublished MoD report). In contrast, chronic musculoskeletal disorders accounted for >45% of medical downgrades. Chronic knee and back pain accounted for 25% and 17%, respectively. Although service at sea does expose personnel to physical risk factors for the latter disorders, the transition from pain to disability is known to be related to the presence of anxiety, depression and exposure to stress [1]. Adverse psychological reactions to occupational stress exposure may be reflected in a high incidence of other conditions.

A workplace ‘stressor’ is an aspect of the external work environment that makes demands of the individual that they feel cannot be met, causing strain [2]. Workload has been shown to be negatively related to job and workload satisfaction and positively related to depression, anxiety and irritation [3]. The NS has seen increasing work demands, reductions in manpower and societal and organizational changes have affected the service. The years 1999–2004 were marked by several major conflicts (e.g. in Afghanistan and Iraq) as well as extra work, such as the provision of cover during the firemen’s strike.

According to Karasek’s [4] job demand–control model, strain occurs when high job demands combine with low opportunity to influence tasks and procedures, resulting in poor employee health and low job satisfaction. There is considerable evidence to support the main effects predicted by the model for high work demands, skill discretion and decision latitude [5].

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Karasek and Theorell [6] included social support as a stress buffer, predicting that employee strain would be highest when work demands are high with low levels of work control and social support [7]. Numerous studies have provided evidence for the protective effect of social support [8]. For example, higher psychosomatic health scores have been shown to be associated with high-strain jobs (high demands, low control) when social support was low [9]. Empirical studies have shown a consistent association between high levels of social support and reduced psychological strain [10–12].

The demands of life in the NS are many and there are a priori reasons to expect that personnel are exposed to many of the stressors identified in the literature. For example, personnel spend much of their time at sea, separated from their families, and working long hours. Life at sea places constraints on individuals that are different to, and in many ways greater than, those experienced in everyday life. This paper reports on the findings of surveys carried out in the NS in 1999 and 2004 to examine stressor exposures and their effects on personnel. Figure 1 depicts the assumed relationships between work stressors, strain and the role of buffers, such as social support.

Methods

Following Ministry of Defence ethics committee approval, cross-sectional surveys were carried out in 1999 and 2004 using the Work and Well-Being Questionnaire (WWBQ). The questionnaire contained a section dealing with demographic factors, such as rank, marital status, sex, branch/specialization, hours of work and whether the individual was serving at sea or ashore when the questionnaire was completed. A second section dealt with stressor exposures and their effects on personnel. Figure 1 depicts the assumed relationships between work stressors, strain and the role of buffers, such as social support.

![Diagram of stressors, buffers and strain](image-url)

**Figure 1.** Potential relationships between work stressors, buffers and strain.

A third section of the questionnaire contained the GHQ-12 to measure strain [14]. The final section provided space for open-ended comments.

The sampling rate was 4.2% for males and 20% for females (the latter to ensure adequate sub-sample size for analysis). The sample was stratified by branch. The total numbers of males and females in December 1998 were ~40 400 and 3300, respectively. The sample sizes for the main survey were chosen such that the maximum errors on unknown percentages indicating ‘X’ (e.g. ‘strain case’) were 1.5% for males and 2.5% for females. Assuming a response rate of 65–70%, the sample sizes were calculated at 1600 males and 600 females. Questionnaires were posted to 2194 randomly selected personnel in 1999 and to 2672 randomly selected personnel in 2004.

All data were initially entered into MS Excel. Data were validated by double data entry cross-validation in addition to outlier and range checks. Subsequently, all data were analysed by Statistica v6 (Tulsa, OK, USA). For the main independent variables from the WWBQ, we computed 1 week test–retest reliability (n = 15) on the sub-scales and summary scores with Pearson product–moment correlations. In addition, we carried out oblique and orthogonal varimax factor analyses, confirming the factor structure previously given by the main author of the WWBQ.

The various factors from the WWBQ were compared as outcome measures between year (1999 versus 2004), gender, rank and by RN or RM and listed as descriptive statistics and in some cases as t-tests. Stress cases were presented as percentages and 95% confidence intervals (CIs) and broken down into relevant sub-samples, e.g. RN versus RM. Forward stepwise regression procedures were carried out by regressing GHQ as either a continuous variable on the WWBQ predictors or as a ‘stress case’ by dichotomous discriminant function analyses and confirmatory logistic regression. Residual plots were examined. Only models with significant predictors are reported.

Results

The GHQ-12 had a test–retest Pearson correlation of 0.60 for the raw score with no difference in the number of cases on Monday and on Friday when a cut off score of ≥4 was used. Thus, strain rates were calculated using a cut off score of ≥4. All demographic factors had correlation coefficients of 0.99–1.00 and all stressors scales had coefficients >0.60 (P < 0.05).
The response rates were 78% in 1999 and 67% in 2004—all were >50% for both officers and ratings and for males and females. The mean age was 31.05 years (SD 7.63) in 1999 and 31.90 years (SD 8.06) years in 2004. Mean length of service was 12.27 years in 1999 (SD 8.06) and 12.69 years in 2004 (SD 8.54). No differences in age and length of service were statistically significant ($P > 0.05$).

The mean GHQ-12 scores in 1999 and 2004 were 2.84 (SD 3.11) and 2.86 (SD 3.18). The difference in scores was not statistically significant ($P > 0.05$). The median score was 2, on both occasions.

The GHQ-12 scores for the 1999 and 2004 surveys were converted to strain rates on a case/non-case basis using a cut off score of $\geq 4$. The rates were 32% in 1999 and 33.5% in 2004 with no statistically significant difference between them ($P > 0.05$). Strain was more prevalent among females ($P < 0.05$) than among males, with no statistically significant differences between 1999 and 2004 ($P > 0.05$, see Table 1).

Male ratings had higher strain rates than male officers in both surveys ($P < 0.05$, Table 2) but rank did not appear to differentiate strain in females ($P > 0.05$). Female ratings had higher strain rates than male officers of any rank ($P < 0.05$). The overlapping 95% CIs of the 1999 and 2004 strain rates indicate no statistically significant difference between the groups ($P > 0.05$).

The chi-squared test was used to investigate the proportions of strain cases among personnel serving at sea or serving ashore when the questionnaire was completed. Separate analyses were carried out for males and for females at both time points. In all cases, a larger proportion of personnel were experiencing strain when serving at sea than ashore (chi-squared $= 9.54, P = 0.002$, and 10.79, $P = 0.001$, for males in 1999 and 2004, respectively, and 12.39, $P = 0.0004$, and 6.76, $P = 0.009$, for females in 1999 and 2004). Service at sea was therefore deemed to be associated with strain (Table 3).

The stressor item scores were summed and the means and standard deviations were calculated (Table 4). The mean stressor rankings for 1999 and 2004 were compared using the $t$-test.

Statistically significant differences in mean scores were found for autonomy and control, organizational commitment, and organizational support. However, these differences were small (0.1–0.2 of a point on the five-point scale and unlikely to be of any psychological significance). Support from leaders, peers and family was rated positively, as was organizational commitment. Autonomy and control and role conflict were rated neutral. Lack of resources, work–family conflict and organizational support were rated negatively, on average.

The lack of significant differences in strain rates and stressor scores in the two surveys enabled the 1999 and 2004 data sets to be combined and subjected to multiple regression analysis. Separate regression analyses were carried out for RN males, RN females and RMs. Table 5 presents the main findings.

The stressor most strongly associated with strain in RN males was role conflict. Lack of leader support and low organizational commitment were also associated, indicative of a buffering effect. The multiple correlation coefficient had a value of 0.49. The square of the multiple correlation coefficient gives the proportion of variance in strain accounted for by these stressors. A coefficient

### Table 1. Prevalence rates of strain in NS males and females in 1999 and 2004

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Males</td>
<td>1217</td>
<td>1319</td>
<td>31</td>
<td>31</td>
<td>28–34</td>
<td>28–33</td>
</tr>
<tr>
<td>Females</td>
<td>490</td>
<td>430</td>
<td>43</td>
<td>41</td>
<td>38–47</td>
<td>36–45</td>
</tr>
<tr>
<td>All</td>
<td>1707</td>
<td>1749</td>
<td>32</td>
<td>32</td>
<td>29–34</td>
<td>31–36</td>
</tr>
</tbody>
</table>

*Strain rate* refers to the percentage of respondents scoring $\geq 4$ on the GHQ-12.

### Table 2. Strain rates by rank and sex in 1999 and 2004

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<tbody>
<tr>
<td>RN male officer</td>
<td>251</td>
<td>291</td>
<td>24</td>
<td>25</td>
<td>19–30</td>
<td>20–30</td>
</tr>
<tr>
<td>RN male rate</td>
<td>801</td>
<td>825</td>
<td>34</td>
<td>34</td>
<td>31–37</td>
<td>31–37</td>
</tr>
<tr>
<td>RM officer</td>
<td>26</td>
<td>48</td>
<td>19</td>
<td>15</td>
<td>7–39</td>
<td>5–25</td>
</tr>
<tr>
<td>RM other ranks</td>
<td>134</td>
<td>155</td>
<td>29</td>
<td>30</td>
<td>21–36</td>
<td>23–37</td>
</tr>
<tr>
<td>RN female officer</td>
<td>75</td>
<td>98</td>
<td>33</td>
<td>39</td>
<td>23–45</td>
<td>29–48</td>
</tr>
<tr>
<td>RN female rate</td>
<td>412</td>
<td>332</td>
<td>44</td>
<td>42</td>
<td>39–49</td>
<td>37–48</td>
</tr>
</tbody>
</table>

*Strain rate* refers to the percentage of respondents scoring $\geq 4$ on the GHQ-12.

### Table 3. Association between serving at sea and serving ashore and strain prevalence in males and females

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sea</td>
<td>Shore</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strain</td>
<td>37</td>
<td>28</td>
</tr>
<tr>
<td>No strain</td>
<td>63</td>
<td>72</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strain</td>
<td>38</td>
<td>28</td>
</tr>
<tr>
<td>No strain</td>
<td>62</td>
<td>72</td>
</tr>
</tbody>
</table>

Table shows the percentages (and frequencies) of RN personnel serving at sea and serving ashore, with and without strain in 1999 and 2004.
of 0.49 indicates that the variation in exposure to these stressors accounts for almost 25% of the variance in strain as measured by the GHQ-12.

Role conflict was the most important predictor of strain in the RM, followed by poor physical work environment. Low peer support was associated with strain, indicative of a buffering effect when support is good. The predictor variables accounted for 26% of the GHQ-12 variance.

Dissatisfaction with the physical environment and role conflict were the main work stressors associated with strain in RN females. Organizational commitment appeared to have a buffering effect. The model accounted for 18% of the GHQ-12 variance.

Discussion

The main findings of the 1999 survey were replicated in 2004. Despite increased workload and, for some, exposure to several major global conflicts, strain rate did not change between 1999 and 2004 and was higher than the general population rates of 15% of males and 19% of females [15].

Strain was more prevalent among females than males, irrespective of rank or age. This accords with the findings of studies of similar occupational groups [16] such as the UK police force, where the strain rate was strikingly similar to that in the NS, as was the difference in strain rate between males and females [17].

Ratings of stressor severity changed little over the time period. Leader support, peer support, domestic support and organizational commitment were rated positively but were associated with strain, indicating that below-average leadership or a lack of commitment leads to strain. The assertion that a naval career demands high organizational commitment comes from a survey of naval personnel on a Greek warship [18]. The male-only ship's company had a strain rate of 48.8%. The strain prevalence rate of officers was 25.5% (comparable to 25% in RN male officers). Among ratings (non-officers), who were conscripts, the rate was 88%. Although organizational commitment was not measured in this study, it is likely that it was lacking in conscripts.
Role conflict and autonomy and control were rated as neutral. Role conflict is likely to be related to excessive workload (e.g. when occupying different work roles simultaneously) and was associated with strain across the NS. Hours worked per week were not associated with strain but long hours may reflect the need to occupy several work roles.

Availability of resources, physical work environment and organizational support for work and family problems were rated negatively. Only physical work environment was associated with strain, however, and only for RN females and the RM.

Additive models, in which the risk of strain increased with the number of stressors to which an individual is exposed (Table 5), provide some support for the stress–strain model in Figure 1. For RN males, work–family conflict and role conflict were the main work stressors associated with strain. More than 50% of RN males were married. Supporting evidence for the assertion that separation from family is associated with strain comes from Limbert [19] who found a strain rate of 32% (GHQ-12) in a group of RN, RAF and Army personnel serving in the Falkland Islands and not accompanied by their spouses. Commitment to the organization, support of leaders and peer support appeared to have a buffering effect.

For RN females, role conflict, the physical work environment and a lack of autonomy and control were the main work stressors associated with strain. Organizational commitment had a buffering effect. Only 16% of RN females were married and it is plausible that females are more likely to leave the NS after marriage to avoid work–family conflict. For the RM, role conflict, work–family conflict and the poor physical work environment were associated with strain, with peer support having a buffering effect.

Service at sea is one of the features that most distinguishes a naval career from that in other uniformed services and it is somewhat surprising that strain rates were higher among those at sea. However, naval life exposes personnel to role conflict, a poor physical work environment and work–family conflict and demands commitment to the NS. These exposures are usually greater when personnel are serving at sea. Commitment to the organization and support from leaders and peers has a buffering effect that protects individuals from strain.

Initiatives currently being implemented to reduce strain are consistent with the model in Figure 1. The physical work environment on ships is poor due to exposure to ship motion and extreme weather. Accommodation is spartan—cramped and with only basic facilities. Accommodation is being improved gradually and improved habitability on new ships is a requirement of the procurement process. However, it will take many years to improve the average level of accommodation. Other initiatives include a comprehensive stress management training programme, training in coping strategies for dealing with role conflict and the introduction of ‘Harmony Time,’ a work-scheduling system to ensure that personnel spend no more than 660 days away from their home port in any rolling 3-year period (guaranteeing a minimum of 465 days ashore or alongside).

Further research will assess the effect of these initiatives and also track strain levels as individuals move from shore-based to sea-going deployments and vice versa. Associations between strain and key organizational performance indicators such as retention of personnel, fitness for duty [20] and acts such as deliberate self-harm will be investigated.

Conflicts of interest
None declared.

References