This chapter reports relationships between various dimensions of JobLoad and subjects’ Wornout level represented by scores of the ‘Wornout’ dimension of the General Wellbeing Questionnaire (GWBQ). Data from two groups of subjects in two different work organisations are reported separately.

The JLM posits that being wornout is one of several possible outcomes which may arise from a poor ‘fit’ between the job demands and the individual’s current coping capacity. While motivated individuals may temporarily overcome the impact of being wornout by exerting more effort and/or by adopting strategies to maintain their performance, it is hypothesised that being wornout is likely to ultimately lead to higher levels of stress, bodily discomfort, dissatisfaction, lower arousal levels and poorer performance.

In addition to the GWBQ Wornout dimension, a single item ‘how high was your general level of fatigue this week’ was asked at both sites. Not surprisingly this question had a high bivariate correlation with the Wornout score (site one \( r = .346, p<.01 \); and site two \( r = .642, p<.01 \)). However, in the preliminary investigation when this item was added to the Wornout scale to create a ‘total fatigue score’, the relationship to the work factors was only marginally strengthened. As inclusion of this additional item would have prohibited legitimate comparison of results to existing norms, it was decided not to retain this item. Instead, the item’s relationship to other measures is discussed in Chapter 15.

**RESULTS: SITE ONE**

The overall mean was 16.9 (SD 8.1), which matches the normative value of 16.7 (SD 8.3) for a general population reported by Cox and Griffith (1995). The distribution of Wornout scores were slightly positively skewed, with a mild kurtosis but within acceptable limits.
A one-way ANOVA showed no statistical difference between Wornout scores over the three rounds.

**Identification of factors influencing Wornout**

**Preliminary Analyses**

Bivariate correlations between Wornout and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 10.1 of Appendix 10. The results of the preliminary multivariate analyses using MR and LMM (as previously described) are also reported in Appendix 10.

The variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses were:

- two of the six General and Temporal Demands: *increasing workload pressure*, and *unpleasant working hours*
- two of the seven Specific Work Demands: *static physical demands, demand for care and vigilance, emotional demands and errors important consequences*
five of the seven Contextual Demands and Impediments factors: interruptions and disruptions, environmental and informational impediments, uncertain work requirements, career uncertainty, conflict

two of the four Job Control and Variety factors: skill utilization, influence
	hree of the five Support factors: coworkers support this week, supervisor support this week, general level of supervisor support

SPPCA

two of the six Personal And Non-Work factors: Stress at home, conflict between home work demands.

MULTIVARIATE ANALYSES

Stepwise Sequential Multiple Regression Analysis (Round One Data)
The strategy adopted for multivariate analyses has been previously described (see chapter 8). Results of the initial stages of the preliminary analyses are reported in Appendix 10. Based on these results above, along with evidence from published research, the factors within each domain that were most strongly related to the Wornout score were identified, and used in the further analyses which are reported below.

Results of the sequential MR are summarised below and in Tables 10.1 and 10.2:

- Block one - Personal & Non-Work Factors: \( R^2 = .293, (F_{[2, 116]} = 5.435, p < .01) \). Two factors were entered: conflict between home and work demands and age. These explained 8.6% of the variance in scores.

- Block two - General and Temporal Work Demands: \( R^2 = .369, (F_{[6, 110]} = 2.939, p < .05) \). Four factors were entered: time pressure and deadlines (Z score), too much work to do in the available time (Z score), increasing workload pressure (Z score), and responsibility (Z score). These accounted for approximately 5% of the variance.

- Block three - Specific Work Demands: \( R^2 = .508, (F_{[10, 108]} = 3.754, p < .01) \). Four factors were entered: static physical demands (Z score), demand for care/vigilance (Z score), cognitive demands (Z score), and emotional demands (Z score). These explained an additional 16.1% of variance.

- Block four - Contextual Demands & Impediments: \( R^2 = .647, (F_{[15, 103]} = 4.954, p < .01) \). Six factors were entered: interruptions and disruptions (z score), environmental and
informational impediments (Z score), career uncertainty (Z score), performance uncertainty (Z score), and workload variance (Z score). These explained 18.7% of the variance ‘pro rata’.

- Block five - Job Control and Variety: $R^2 = .647$, ($F_{[16, 102]} = 4.600$, $p < .01$). One factor was entered: influence (Z score) but this explained little of the variance in scores.

- Block six - Support: $R^2 = .666$, ($F_{[18, 100]} = 4.418$, $p < .01$). Two factors were entered, these were coworker cohesion relationship (Z score), and supervisor support this week (Z score) and explained a further 2% of variance in scores.

- Block seven - SPPCA: $R^2 = .790$, ($F_{[19, 99]} = 8.647$, $p < .01$). SPPCA was a single factor in this block, accounting for 18.1% of variance in scores.

Table 10.1 shows that the F-changes between blocks in the above sequence were significant (in red) at the first, third, fourth and seventh blocks.

<table>
<thead>
<tr>
<th>Table 10.1. Models of IVs and Wornout in (site one, round one)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block one- Personal &amp; Non-Work Factors</td>
</tr>
<tr>
<td>Block two- General Job Demands</td>
</tr>
<tr>
<td>Block three- Specific Work Demands</td>
</tr>
<tr>
<td>Block four – Contextual Demands &amp; Impediments</td>
</tr>
<tr>
<td>Block five- Job Control &amp; Variety</td>
</tr>
<tr>
<td>Block six – Support</td>
</tr>
<tr>
<td>Block seven- SPPCA</td>
</tr>
</tbody>
</table>

Table 10.2 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients ($sr_i^2$), and for the factors in the final model, the $R^2$ and adjusted $R^2$ values.

With this combination of variables, demand for care and vigilance, environmental and informational impediments, workload variance and poor self-perceived performance capacity and adequacy (in red) differed significantly from zero, and their unique contribution to the $R^2$ was .259. One factor (in blue) reached significance levels between .5 and 1, interruptions and disruptions. The other IVs in combination contributed another .365 in shared variability. Thus a total of 62.4% (55.2% adjusted) of the variability in Wornout scores were predicted by these IVs.
Table 10.2. Results of Sequential Multiple Regression of Wornout with Significant IVs (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>β</th>
<th>Sig.</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict with home and work demands</td>
<td>-1.03</td>
<td>1.25</td>
<td>-0.061</td>
<td>.409</td>
<td>-0.051</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td>-0.24</td>
<td>1.055</td>
<td>-0.023</td>
<td>.816</td>
<td>-0.014</td>
</tr>
<tr>
<td>Too Much Work to do in Available Time</td>
<td>0.61</td>
<td>1.283</td>
<td>0.055</td>
<td>.631</td>
<td>.030</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-0.78</td>
<td>0.785</td>
<td>-0.082</td>
<td>.317</td>
<td>-0.062</td>
</tr>
<tr>
<td>Responsibility</td>
<td>0.42</td>
<td>0.805</td>
<td>0.042</td>
<td>.601</td>
<td>.032</td>
</tr>
<tr>
<td>Static Physical Demands</td>
<td>0.42</td>
<td>0.811</td>
<td>0.045</td>
<td>.605</td>
<td>.032</td>
</tr>
<tr>
<td><strong>Demand for Care &amp; Vigilance</strong></td>
<td><strong>4.05</strong></td>
<td><strong>1.265</strong></td>
<td><strong>.293</strong></td>
<td><strong>.002</strong></td>
<td><strong>.198</strong></td>
</tr>
<tr>
<td>Cognitive Demand</td>
<td>-0.52</td>
<td>0.781</td>
<td>-0.055</td>
<td>.506</td>
<td>-0.041</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>0.31</td>
<td>0.791</td>
<td>.031</td>
<td>.696</td>
<td>.024</td>
</tr>
<tr>
<td><strong>Interruptions and Disruptions</strong></td>
<td><strong>1.68</strong></td>
<td><strong>1.013</strong></td>
<td><strong>.148</strong></td>
<td><strong>.099</strong></td>
<td><strong>.103</strong></td>
</tr>
<tr>
<td>Environ. &amp; Informational Impediments</td>
<td>2.58</td>
<td>1.114</td>
<td>.195</td>
<td>.022</td>
<td>.143</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>-0.77</td>
<td>1.059</td>
<td>-0.063</td>
<td>.463</td>
<td>-0.045</td>
</tr>
<tr>
<td><strong>Workload Variance</strong></td>
<td><strong>-1.56</strong></td>
<td><strong>.689</strong></td>
<td><strong>-1.68</strong></td>
<td><strong>.025</strong></td>
<td><strong>-1.140</strong></td>
</tr>
<tr>
<td>Performance Uncertainty</td>
<td>0.97</td>
<td>.948</td>
<td>.074</td>
<td>.305</td>
<td>.063</td>
</tr>
<tr>
<td>Influence</td>
<td>-1.60</td>
<td>-0.985</td>
<td>.145</td>
<td>.107</td>
<td>-.100</td>
</tr>
<tr>
<td>Coworker Cohesion &amp; Relationship</td>
<td>-0.20</td>
<td>-0.719</td>
<td>.021</td>
<td>.774</td>
<td>-.018</td>
</tr>
<tr>
<td>General supervisor support last six months</td>
<td>-1.20</td>
<td>-0.747</td>
<td>.123</td>
<td>.109</td>
<td>-.100</td>
</tr>
<tr>
<td><strong>SPPCA</strong></td>
<td><strong>-4.96</strong></td>
<td><strong>-7.19</strong></td>
<td><strong>.541</strong></td>
<td><strong>.000</strong></td>
<td><strong>.425</strong></td>
</tr>
</tbody>
</table>

F [19, 99) = 8.647, p < .01
Intercept = 21.282 (2.44)
Unique variability = .259
Regression coefficient R = .790, R² = .624, Adjusted R² = .552

Linear Mixed Model Analyses (two and three repetitions)

LMM analysis was used to extend the investigation to encompass results from second and third repetitions of data within some subjects. To maintain an acceptable ratio of cases to variables, only significant variables from the most centrally important domains were included in LMM analyses; results are shown in Table 10.3. The statistically significant variables are indicated in red. However, with three repetitions some variables with low effects were omitted to achieve the necessary subject to variables ratios.

Wornout scores were higher (% per unit change in Wornout) when:

- **demand for care and vigilance** was higher (with both repetitions by approximately 5.8% and 4.6%),
- **conflict between home and work demands** was higher (with both repetitions by approximately 5.2%),
- **interruptions and disruptions** were higher (with both repetitions by approximately 3.7% and 2.4%),
- emotional demand were higher (by approximately 2.4%).

Wornout scores were lower (per unit change) when:
- SPPCA was better (in both repetitions by 8%),
- supervisor support was higher (with both repetitions by approximately 3.1% and 2.6%)
- influence was higher (by approximately 3.1%),
- increasing workload pressure was higher (with both repetitions by approximately 2.6% and 1.8%), and
- subjects were older (age) (with both repetitions by less than 1%).

Table 10.3. Estimates of Fixed Effects Wornout and significant IVs (site one two and three repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n = 103)</th>
<th></th>
<th></th>
<th>Three Repetitions (n = 71)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Effects (%)</td>
<td>Std. Error</td>
<td>df</td>
<td>Sig.</td>
<td>Estimated Effects (%)</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Intercept</td>
<td>20.43</td>
<td>1.93</td>
<td>185.027</td>
<td>.000</td>
<td>20.40</td>
<td>1.82</td>
</tr>
<tr>
<td>Conflict between home and work demands</td>
<td>1.69 (2.8)</td>
<td>.91</td>
<td>185.854</td>
<td>.065</td>
<td>3.16 (5.2)</td>
<td>.89</td>
</tr>
<tr>
<td>No conflict between home &amp; work demands</td>
<td>0(a)</td>
<td>0</td>
<td>.</td>
<td>0(a)</td>
<td>0</td>
<td>.</td>
</tr>
<tr>
<td>Age</td>
<td>-0.09 (0.15)</td>
<td>.04</td>
<td>185.173</td>
<td>.042</td>
<td>-0.10 (0.1)</td>
<td>.04</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td>0.67 (1.1)</td>
<td>.88</td>
<td>179.782</td>
<td>.450</td>
<td>0.29 (0.5)</td>
<td>.67</td>
</tr>
<tr>
<td>Too Much Work To Do</td>
<td>0.11 (0.2)</td>
<td>.98</td>
<td>184.837</td>
<td>.907</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-1.61 (2.6)</td>
<td>.63</td>
<td>182.548</td>
<td>.012</td>
<td>-1.10 (1.8)</td>
<td>.50</td>
</tr>
<tr>
<td>Responsibility</td>
<td>0.29 (0.4)</td>
<td>.63</td>
<td>185.222</td>
<td>.644</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static Physical Demands</td>
<td>0.62 (1.0)</td>
<td>.67</td>
<td>181.637</td>
<td>.357</td>
<td>0.66 (1.1)</td>
<td>.63</td>
</tr>
<tr>
<td>Demand for Care &amp; Vigilance</td>
<td>3.48 (5.8)</td>
<td>.96</td>
<td>184.335</td>
<td>.000</td>
<td>2.81 (4.6)</td>
<td>.92</td>
</tr>
<tr>
<td>Cognitive Demand</td>
<td>-0.52 (0.8)</td>
<td>.60</td>
<td>185.998</td>
<td>.388</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>0.77 (1.2)</td>
<td>.63</td>
<td>184.744</td>
<td>.225</td>
<td>1.45 (2.4)</td>
<td>.57</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>2.25 (3.7)</td>
<td>.73</td>
<td>185.149</td>
<td>.003</td>
<td>1.41 (2.3)</td>
<td>.68</td>
</tr>
<tr>
<td>Environ &amp; Informational Impediments</td>
<td>0.99 (1.6)</td>
<td>.85</td>
<td>185.978</td>
<td>.245</td>
<td>1.31 (2.1)</td>
<td>.81</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>0.08 (0.1)</td>
<td>.80</td>
<td>185.962</td>
<td>.920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Uncertainty</td>
<td>0.83 (1.3)</td>
<td>.71</td>
<td>184.106</td>
<td>.245</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influence</td>
<td>-1.87 (3.1)</td>
<td>.75</td>
<td>184.394</td>
<td>.014</td>
<td>-1.16 (1.9)</td>
<td>.61</td>
</tr>
<tr>
<td>Coworker Cohesion Relationship</td>
<td>-0.10 (0.1)</td>
<td>.56</td>
<td>184.712</td>
<td>.860</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervisor Support</td>
<td>-1.86 (3.1)</td>
<td>.57</td>
<td>183.820</td>
<td>.002</td>
<td>-1.57 (2.6)</td>
<td>.48</td>
</tr>
<tr>
<td>SPPCA</td>
<td>-4.84 (8.0)</td>
<td>.53</td>
<td>185.895</td>
<td>.000</td>
<td>-4.84 (8.0)</td>
<td>.50</td>
</tr>
</tbody>
</table>

a this parameter is redundant  DV: Wornout Score  % approximate only
RESULTS: SITE TWO

The overall mean was 17.8 (SD 7.1) (compared to site one 16.9 [SD 8.1]) which is very close to the normative value of 16.7 (SD 8.3) for a general population reported by Cox and Griffith (1995). Wornout score Distribution for both of the rounds were slightly positively skewed with mild kurtosis, within acceptable limits.

![Wornout Score Distribution](image)

**Figure 10.2. Distribution of Wornout Scores Site Two**

A one-way ANOVA showed no statistical difference between Wornout scores over the two rounds.

IDENTIFICATION OF FACTORS INFLUENCING WORNOUT

Preliminary Analyses

Bivariate correlations between Wornout and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 10.1 of Appendix 10. The results of the preliminary multivariate analyses using MR and LMM as previously described are reported in Appendix 10.
Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses were:

- none of the six General and Temporal Demands cf. to at site one: *increasing workload pressure*, and *unpleasant working hour*
- three of the seven Specific Work Demands: *cognitive demands*, *emotional demands* and *errors important consequences* cf. site one: *static physical demands, demand for care and vigilance, emotional demands and errors important consequences*
- none of the seven Contextual Demands and Impediments factors cf. site one: *interruptions and disruptions, environmental and informational impediments, uncertain work requirements, career uncertainty, conflict*
- all of the Job Control and Variety factors: *decision latitude, work variety, skill utilization, influence* cf. site one: *skill utilization, influence*
- three of the five Support factors: *coworkers support this week, supervisor support this week, general level of supervisor support*; same as site one
- *SPPCA* same as site one
- two of the six Personal and Non-Work variables: *Stress at home, conflict between home work demands*

**MULTIVARIATE ANALYSES**

**Stepwise Sequential Multiple Regression Analysis (Round One Data)**

Results of the sequential MR are summarised below and in Tables 10.4 and 10.5:

- Block one - Personal & Non-Work Factors: $R^2 = .047$, ($F[1, 49] = 2.447, p = .124$). One factor was entered: *conflict between home and work demands*, this explained 4.7% of the variance in scores.

- Block two - General and Temporal Demands: $R^2 = .116$, ($F[3, 47] = 2.159, p = .105$). Two factors were entered: *too much to do in the available time* (Z score), and *increasing workload pressure* (Z score). These accounted for 6.8% of variance in scores.

- Block three - Specific Work Demands: $R^2 = .217$, ($F[5, 45] = 2.772, p < .05$). Two factors were entered: *demand for care and vigilance* (Z score) and *emotional demands* (Z score). These accounted for 10.1% of variance in scores.
• Block four - Contextual Demands and Impediments: \( R^2 = .292, (F[8.42] = 2.666, p < .01). \) Three factors were entered: interruptions and disruptions (Z score), environmental & informational impediments (Z score), and career uncertainty (Z score) explaining 7.5% of variance in scores.

• Block five - Job Control and Variety: \( R^2 = .318, (F[9, 41] = 2.467, p < .05). \) One factor was entered work variety (Z score) and explained approximately 2.6% of variance in scores.

• Block six - Support: \( R^2 = .345, (F[10, 40] = 2.425, p < .05). \) One factor was entered supervisor support (Z score) explaining 2.7% of variance in scores.

• Block seven - SPPCA: \( R^2 = .557, (F[11, 39] = 5.199, p < .01). \) SPPCA (Z score) was included as a single factor and explaining 21.3% of variance in scores.

Table 10.4 shows that the F-changes between blocks in the above sequence were significant at the seventh block, and approached significance at the third.

Table 10.4. Models of IVs and Wornout in Round 1 (site two, round one)

<table>
<thead>
<tr>
<th>Block</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block one – Personal &amp; Non-Work Factors</td>
<td>.047</td>
<td>.047</td>
<td>2.479</td>
<td>.122</td>
</tr>
<tr>
<td>Block two – General &amp; Temporal Demands</td>
<td>.116</td>
<td>.068</td>
<td>1.856</td>
<td>.167</td>
</tr>
<tr>
<td>Block three – Specific Work Demands &amp; Impediments</td>
<td>.217</td>
<td>.101</td>
<td>2.966</td>
<td>.061</td>
</tr>
<tr>
<td>Block four – Contextual Demands &amp; Impediments</td>
<td>.292</td>
<td>.075</td>
<td>1.523</td>
<td>.222</td>
</tr>
<tr>
<td>Block five – Job Control &amp; Variety</td>
<td>.318</td>
<td>.026</td>
<td>1.619</td>
<td>.210</td>
</tr>
<tr>
<td>Block six – Supports</td>
<td>.345</td>
<td>.027</td>
<td>1.669</td>
<td>.204</td>
</tr>
<tr>
<td>Block seven – SPPCA</td>
<td>.557</td>
<td>.213</td>
<td>19.208</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 10.5 below, shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient (\( ß \)), the semipartial correlation coefficients (sr\(^2\)) and \( R^2 \), and adjusted \( R^2 \) values for the final model.

With this combination of variables, three of the regression coefficients differed significantly (in red) from zero: increasing workload pressure, emotional demands, and self-perceived performance capacity and adequacy whose unique contribution to the \( R^2 \) was .399. Two factors (in blue) were significant between the .05 and .10 levels, too much to do and environmental & informational impediments. The IVs in combinations contributed another .196 in shared variability. Thus a total of 55.7% (43.6 adjusted) of the variability in Wornout was predicted by variables.
Table 10.5. Sequential Multiple Regression of Wornout & Significant IVs (site two, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>ß</th>
<th>Sig.</th>
<th>sri2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict with home and work demands</td>
<td>-0.99 (1.9)</td>
<td>1.726</td>
<td>-0.66</td>
<td>.567</td>
<td>-.059</td>
</tr>
<tr>
<td><strong>Too Much To Do</strong></td>
<td><strong>2.35 (5.6)</strong></td>
<td><strong>1.308</strong></td>
<td><strong>.327</strong></td>
<td><strong>.080</strong></td>
<td><strong>.184</strong></td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-2.48 (4.6)</td>
<td>.931</td>
<td>-.363</td>
<td>.011</td>
<td>-.272</td>
</tr>
<tr>
<td>Demands for Care &amp; Vigilance</td>
<td>-0.76 (0.5)</td>
<td>.815</td>
<td>-.116</td>
<td>.353</td>
<td>-.096</td>
</tr>
<tr>
<td><strong>Emotional Demands</strong></td>
<td><strong>1.84 (3.3)</strong></td>
<td><strong>.849</strong></td>
<td><strong>.256</strong></td>
<td><strong>.036</strong></td>
<td><strong>.222</strong></td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>-0.97 (1.9)</td>
<td>1.460</td>
<td>-.131</td>
<td>.508</td>
<td>-.068</td>
</tr>
<tr>
<td><strong>Environmental &amp; Informational Impediments</strong></td>
<td><strong>1.62 (3.2)</strong></td>
<td><strong>.843</strong></td>
<td><strong>.251</strong></td>
<td><strong>.061</strong></td>
<td><strong>.196</strong></td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>0.18 (0.4)</td>
<td>.853</td>
<td>.026</td>
<td>.832</td>
<td>.022</td>
</tr>
<tr>
<td>Work Variety</td>
<td>-1.03 (2.8)</td>
<td>.831</td>
<td>-.149</td>
<td>.220</td>
<td>-.127</td>
</tr>
<tr>
<td>Supervisor Support</td>
<td>-0.96 (2.0)</td>
<td>.917</td>
<td>-.130</td>
<td>.300</td>
<td>-.107</td>
</tr>
<tr>
<td><strong>SPPCA</strong></td>
<td><strong>-3.85 (7.9)</strong></td>
<td><strong>.844</strong></td>
<td><strong>-.570</strong></td>
<td><strong>.000</strong></td>
<td><strong>-.466</strong></td>
</tr>
<tr>
<td>F [11, 39] = 5.199, p &lt; .01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept =18.057 (.84)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique variability = .399</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shared variability = .196</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R = .747</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R² = .557</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R² = .436</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Linear Mixed Model Analyses (two repetitions)

To maintain an acceptable ratio of cases to variables, only significant variables from the most centrally important domains were included in linear mixed model (LMM) analyses, as shown in Table 10.6. Some variables included in the multiple regression but which had low effect sizes were omitted to meet the subject-to-variables ratios. Statistically significant variables are indicated in red.

Wornout scores (per unit change in Wornout scores) were higher when:

- *environmental and informational impediments* were higher (by 3.8%).

Wornout scores (per unit change in Wornout scores) were lower when:

- *SPPCA* was higher (by 5.4%) and
- *increasing workload pressure* (by 3.8%) approached significance.
Table 10.6. Estimates of Fixed Effects Wornout and significant IVs (site two, two repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n = 66)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Effects (%)</td>
</tr>
<tr>
<td>Intercept</td>
<td>17.77</td>
</tr>
<tr>
<td>Too Much To Do in the Available Time</td>
<td>0.99 (1.8)</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-1.72 (3.8)</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>1.05 (1.6)</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>9.70 (2.0)</td>
</tr>
<tr>
<td><strong>Environmental &amp; Informational Impediments</strong></td>
<td>1.91 (3.8)</td>
</tr>
<tr>
<td>Work Variety</td>
<td>-0.98 (2.2)</td>
</tr>
<tr>
<td><strong>SPPCA</strong></td>
<td><strong>-2.83 (5.4)</strong></td>
</tr>
</tbody>
</table>

OVERVIEW OF RESULTS: BOTH SITES

Table 10.7 shows levels of Wornout scores (means, SDs) for each of the sites. At site one the mean values was the same as that previously reported for an Australian sample \( \mu=16.9, \text{SD 8.1} \) (Cox & Griffiths, 1995). At site two, the mean was slightly higher than the normative sample.

Table 10.7. Mean Wornout Scores (both sites all rounds)

<table>
<thead>
<tr>
<th>Round</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whole sample mean (SD)</td>
<td>n</td>
</tr>
<tr>
<td>Round 1</td>
<td>17.1 (7.6)</td>
<td>120</td>
</tr>
<tr>
<td>Round 2</td>
<td>16.8 (8.5)</td>
<td>103</td>
</tr>
<tr>
<td>Round 3</td>
<td>16.9 (8.5)</td>
<td>71</td>
</tr>
<tr>
<td>Grand Mean</td>
<td>16.9 (8.1)</td>
<td>294</td>
</tr>
</tbody>
</table>

While means were marginally higher at site two, a one-way ANOVA confirmed that Wornout scores did not differ significantly between the sites. For ease of comparison, the results of the multivariate analyses for both sites are combined and presented in Table 10.8. This shows all the work and personal factors which were included in the final multivariate analyses, with those that were statistically significant above the .05 level in red, and those with significance between .05 and .10 are in blue.

With just these factors, at site one approximately 62.4% (using R\(^2\)) or 55.2% (adjusted R\(^2\)) and at site two approximately 55.7% (using R\(^2\)) or 43.6% (adjusted R\(^2\)) of the variance in Wornout scores was expla
Table 10.8. Personal & Non-work variables and Job Factors predicting Wornout (both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR (n = 120)</td>
<td>LMM (2 repetitions n = 103)</td>
</tr>
<tr>
<td>Intercept</td>
<td>21.282</td>
<td>20.43</td>
</tr>
</tbody>
</table>

**Personal & Non-work variables**

| Conflict between home and work demands | -1.03 (1.7) | -0.06 | 1.69 (2.8) | 3.16 (5.2)** | -0.99 (1.9) | -0.066 |
| Age | -0.07 (0.1) | -0.085 | -0.09 (0.15)* | -0.10 (0.1)* |

**General & Temporal Work Demands**

| Time Pressure and Deadlines | -0.24 (0.4) | -0.023 | 0.67 (1.1) | 0.29 (0.5) |
| Too Much Work to do in Available Time | 0.61 (1.0) | 0.55 | 0.11 (0.2) | 2.35 (5.6)* | 0.327 | 0.99 (1.8) |
| Increasing Workload Pressure | -0.78 (1.3) | -0.082 | -1.61 (2.6)** | -1.10 (1.8)* | -2.48 (4.6)* | -0.363 | -1.72 (3.8)* |
| Responsibility | 0.42 (0.7) | 0.042 | 0.29 (0.4) |

**Specific Work Demands**

| Static Physical Demands | 0.42 (0.7) | 0.045 | 0.62 (1.0) | 0.66 (1.1) |
| Demand for Care and Vigilance | 4.05 (6.7)** | 0.293 | 3.48 (5.8)** | 2.81 (4.6)** | -0.76 (0.5) | -0.116 |
| Cognitive Demand | -0.52 (0.8) | -0.055 | -0.52 (0.8) |
| Emotional Demands | 0.31 (0.5) | 0.031 | 0.77 (1.2) | 1.45 (2.4)* | 1.84 (3.3) | 0.256 | 1.05 (1.6) |

DV: Wornout Score;  % approximate only;  * p <.05 ** p <.01;  Blue significance between .05 -1

Table 10.8 continued on next page….
Table 10.8. Personal & Non-work variables and Work Factors predicting Wornout (both sites all multivariate analysis methods) cont.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR (n = 120)</td>
<td>LMM (2 repetitions n = 103)</td>
</tr>
<tr>
<td><strong>Intercept</strong></td>
<td>21.282</td>
<td>20.43</td>
</tr>
<tr>
<td><strong>Contextual Demands &amp; Impediments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>1.68(2.8)*</td>
<td>.148</td>
</tr>
<tr>
<td>Environmental and Informational Impediments</td>
<td>2.58 (4.3)*</td>
<td>.195</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>-0.77 (1.2)</td>
<td>-.063</td>
</tr>
<tr>
<td>Workload Variance</td>
<td>-1.56 (2.6)</td>
<td>-.168</td>
</tr>
<tr>
<td>Performance Uncertainty</td>
<td>0.97 (1.6)</td>
<td>.074</td>
</tr>
<tr>
<td><strong>Job Control &amp; Variety</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influence</td>
<td>-1.60 (2.6)</td>
<td>-.145</td>
</tr>
<tr>
<td>Work Variety</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Support</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coworker Cohesion &amp; Relationships</td>
<td>-0.20 (0.3)</td>
<td>-.021</td>
</tr>
<tr>
<td>Supervisor Support this week</td>
<td>-1.20 (2.0)</td>
<td>-.123</td>
</tr>
<tr>
<td>SPPCA</td>
<td><strong>-4.96 (8.2)</strong></td>
<td><strong>-5.41</strong></td>
</tr>
</tbody>
</table>

| $R^2$                                  | .624     |          |          | .557      |
| Adjusted $R^2$                         | .552     |          |          | .436      |

DV: Wornout Score;  % approximate only;  * p <.05  ** p <.01;  Blue significance between .05 -
Additional Data from Job Description

Job Type and Level

Data about job type and level were analysed separately because of the expected high interactions with JLI variables (see Appendix 8, Tables 7.109-111). Significant differences in Wornout scores were detected ($F[4,377] = 2.941, p < .05$) between the job types and these discussed in Chapter 7. In summary, Wornout scores were highest for technical officers and the lowest for IT officers.

As observed in Table 10.8 above, two of the strongest workplace predictors of being Wornout included having too much work to do in available time, and high levels of demand for care and vigilance. These factors were common for the technical officers who had significant pressure preparing and installing equipment, which required significant care and vigilance to avoid or detect errors. In contrast, the IT officers had the lowest Wornout and highest arousal scores, probably due to their interesting and rewarding work in which they also had significant control.

There were differences in the Wornout scores between the job levels at site one ($F[3, 290] = 6.534, p < .01$), but not site two The highest scores were reported by the most junior subjects and the lowest by the contractors. Junior staff had relatively higher requirements to undertake work where there were higher levels of demand for care and vigilance, fewer opportunities for control, and lower financial and other rewards for their efforts.

REVIEW AND DISCUSSION OF RESULTS

In the JLM being Wornout is seen as representing psychological fatigue and as such a ‘wellbeing cost’ arising from a poor ‘job-person’ fit. Overall, a significant proportion of the variance in Wornout scores at both sites were predicted by two personal and non-work factors, sixteen workplace factors, and by peoples’ own assessment of their performance capacity and adequacy.

Effects of Personal & Non-Work Variables

The probable influence of the personal and non-work-related factors on being more or less Wornout, in the face of the same work demands was acknowledged. Accordingly, factors in this domain identified in the preliminary analyses as having a significant effect on Wornout
(see Appendix 10) were entered into the first block of the sequential regressions and included in LMM analyses.

Of the six personal and non-work factors which were measured, only two were included at site one and one at site two. At both sites, while the effects were very small, Wornout scores were lower for older people. This may reflect that older subjects have developed more strategies to deal with their work demands. Not surprisingly, Wornout scores were higher when there was conflict between home and work demands. With just these factors, the F-change in the sequential regression was 8.6% at site one and 4.7% at site two.

**Effects of the Work Demands**

**General and Temporal Job Demands**

Of the six factors in this domain, four were included in the final model for site one, and two for site two. Based on the JLM it was expected that when general and temporal demands were higher, greater effort would be required to meet the performance goals, and as a result Wornout scores would be higher. The relative impact of these factors on the F-change in the MR at both sites was small (5% and 6.8% respectively).

The factors in this domain with the strongest relationships with Wornout scores were, too much to do in the available time, and increasing workload pressure. Surprisingly, Wornout scores were marginally lower when there were higher levels of increasing workload demands (reaching statistical significance at both sites). This result was not expected and implied that this kind of pressure actually improved wellbeing. To explore this relationship further, increasing workload pressures was coded into three groups representing ‘low’, ‘moderate’ and ‘high’ scores. This is shown in Figure 10.3, where it can be seen that Wornout scores were higher for the people in the low increasing workload pressure group, especially at site one.

---

38 conflict between home and work demands, and age
39 age
40 time pressure and deadlines, too much to do in the available time, increasing workload pressure, and responsibility
41 too much to do in the available time, increasing workload pressure
Increasing Workload Pressure

However, a one-way ANOVA of the differences in Wornout scores between these groups did not reach significance. Nevertheless, it was interesting that this ‘low’ group did have significant bivariate correlations of increasing workload pressure with job level. Examination of the ‘low’ group showed that the largest membership was from the junior officers. This result might therefore reflect that these people were undertaking more routine and probably less interesting work. In contrast those with ‘moderate’ but not ‘high’ increasing workload demands scores were probably more aroused, helping them to overcome any effects of psychological fatigue, which would be consistent with Kahneman’s ‘activation model’ (1973).

Daniels (2000) examined aspects of wellbeing including ‘energy/vitality’ (which overlapped with both Wornout and arousal as conceptualised in this study) with two groups in the UK. Interestingly he found significant negative relationships for the subjects in the social-services sample between ‘energy/vitality’ and ‘workload’ and between ‘energy/vitality’ and under/load’ in the university sample. This demonstrates that underload can also be a cause of low vitality.

\[ t .594, p<.01 \text{ compared to } .144, p<.01 \text{ for all scores} \]

43 ‘tired, fatigued, sleep, active, alert, full of energy, angry’ mean = 48.07, SD = 21.79

44 social services employees n=1,436 and university employees n=722

45 Daniels & Guppy’s (1995) measure (mean = 8.12, SD = 3.33) partial correlation=.20, p <001

46 partial correlation=.13, p <001
Wornout scores were higher, especially at site two when levels of *too much to do in the available time* were higher. This pattern was evident at both sites, and is illustrated in Figure 10.4.

![Figure 10.4. Box Plot of Wornout Scores & Time Pressure and Deadlines](image)

Given the current debate about the effects of long working hours, it was interesting that this factor did not meet the inclusion criteria. While the bivariate correlations of Wornout scores with *total hours worked* were positive, they were not significant. To explore if the small effect was due to a curvilinear relationship, five groups of ‘working hours’ were created to compare against the Wornout scores (see Figure 10.5). However, no particular relationship between *total hours worked* and the Wornout scores was apparent, and a one way ANOVA confirmed there were no significant differences between these groups.

---

47 see chapter 8
48 site one $r = .087$, and site two $r = .153$
49 <35 hrs pw; 36-45 hrs pw; 46-55 hrs pw, 56-65 hrs pw and >66 hrs pw
A report by the UK Health and Safety Laboratory (2003) found an association between working long hours and higher levels of fatigue, and some evidence (although this was more equivocal) that this could lead to stress and ill health. Parks et al. (2001) reported only small positive correlations between ‘fatigue at work’ and weekly working hours\(^{50}\). Consistent with this, Williams and Cooper (1998:314) reported moderate negative relationships between working hours and energy levels\(^{51}\).

Lee and Ashforth (1996) conducted a meta-analysis of 61 studies examining the relationships between ‘burnout’ (mainly with human-service providers) work demands, personal resources and attitudes. They found high mean correlations between ‘emotional exhaustion’ (a related concept to Wornout), ‘workload’ and ‘work pressure’.

**Specific Work Demands**

Six factors were grouped in this domain, two factors were included in the final model for both sites\(^{52}\) and two extra ones at site one\(^{53}\). The relative impact of these factors on the F-change in the MR was moderate and significant at site one (12.2% and 10.1%).

---

50 \(r=.125, \ p<.01, \ n=197\)
51 \(r=-.29, \ p<.05' (n=8,503) quantiative load as well as hours of work and 'energy levels' (vitality-exhaustion).
52 demand for care and vigilance, and emotional demands
53 cognitive demands, and static physical demands
At site one, Wornout scores were much higher when there was a demand for care and vigilance. This was not unanticipated as all employees conducted all or a large part of their work on computers. This typically entailed high static and perceptual demands combined with a need for care and vigilance. At both sites there were relative small effects of static physical demands on Wornout scores in the multivariate models. This was probably due to the high intercorrelation of static physical demands with demands for care and vigilance, the latter which was more strongly associated with being Wornout.

Despite its conceptual association with fatigue, at both sites dynamic physical demands was very low, and as a result, no significant relationships with Wornout were demonstrated at these sites. Interestingly, Finkelman (1994) in a physical workload study, found that very physically demanding work was less likely to be associated with fatigue than those jobs with low demands, except where the demands approached peoples’ maximum physical capacity. As will be discussed in Chapter 12, moderate levels of physical activity can help to increase arousal, which in turn can moderate feelings of tiredness.

Klitzman and Stelman (1989) conducted a study of the impact of physical work environments, amongst office workers on aspects of wellbeing, and reported intercorrelations between ‘fatigue and ‘workload demands’. They found that factors which would result in static physical demands which they termed ‘ergonomic stressors’ were the second strongest of the twelve work and job factors which predicted ‘fatigue’.

Finkelman (1994) suggested that fatigue may be the “most parsimonious explanatory consequence” of people functioning at high information processing loads. However, while cognitive demands (for this study the closest approximation of information processing load), were at times objectively and subjectively quite high, in the final model their contribution to being Wornout was modest and non significant.

While the need to respond to the emotional needs of others is inherent in most jobs, objectively for subjects at both sites the overall level of this demand was low. Nevertheless, Wornout scores were higher with higher emotional demands. Others have reported significant associations between the need for ‘emotional labour’ at work, with both stress and fatigue (Adelmann, 1995; Briner, 1999; Bultmann, Kant, Van den Brandt & Kasl, 2002; Cox, 1990; Grandey, 2000; Shirom, 2003). Decades of research on burnout (a severe form of emotional exhaustion) has demonstrated the importance of emotional demands both as a

---

54 site one $r = .649, p<.01$, and site two $r = .260, p<.01$
55 $n=1,830$ ($r = .15$).
56 comfortable chair, desk height, furniture, workspace etc
stressor, and as a source of fatigue and work-related dissatisfaction (Bourbonnais et al., 1998; Leitter, 1991; Maslach, 1993; McManus et al., 2002. Schaufeli & Buunk, 1996; and others).

**Work-related Contextual Demands and Impediments**

Of the seven factors in this domain, three were included in the final model at both sites and two more at site one. The relative impact of these factors on the F-change in the MR was high at both sites (16.1% and 7.5%).

Because contextual demands and impediments increase the effort which is required to meet performance goals, they were considered likely to result in higher Wornout scores. Overall, Wornout scores increased when there were higher levels of *environmental and informational impediments* and *interruptions and disruptions*. In the JLM, their association with poorer wellbeing is also thought to be derived from their role as stressors (see for example Peters & O’Connor, 1980; Eyrolle & Cellier, 2000; Steel & Mento, 1986).

Career uncertainty is a known stressor (e.g. Arnetz et al., 1991; Heaney et al., 1994; Ferrie et al., 1998; Sverke, Hellgren & Näswall, 2002) and in Klitzman and Stellman’s study (1989) they reported that ‘fatigue’ was marginally lower when people felt their job future was secure. However, at these sites this factor’s influence on Wornout scores through multivariate analyses were modest and non significant.

**Job Control and Variety**

Of the four factors in this domain, only *influence* at site one and *work variety* at site two met the inclusion criteria. Others have reported that greater decision and instrumental control can help people to moderate the effects of work demands (for example Karasek, 1989; Marmot et al., 1997). Further, where people have control they can more easily adopt strategies to overcome or reduce contextual demands and impediments (Carayon & Zijlstra, 1999). It was therefore expected that Wornout scores would be lower when there were good levels of decision latitude, influence, work variety, and skill utilisation. However, the relative impact of the job control factors which were included in the final model on the F-change in the MR, was actually overall quite small.

As expected, at site one the Wornout scores were lower when people felt they had *influence* over some of the decisions which were made about their work. Wornout scores were also lower when there people had a *variety* of work tasks. These allowed opportunities for rest and recovery, and people the opportunity to diversify their skills and experiences.

---

57 *interruptions and disruptions, environmental and informational impediments, and career uncertainty*

58 *uncertainty about own performance adequacy, and workload variance*
It had been proposed in the JLM, that Wornout scores would be higher when people felt their skills and expertise were not being used. It was thought that in these circumstances people might be less willing to exert effort and emotionally ‘disengaged’ from the work, resulting in lower arousal levels. While skill utilization was not included in the final model, the bivariate correlations with Wornout scores were both positive and significant\(^59\). A one way ANOVA confirmed a difference between the low, moderate and high skill utilization groups in site one but not site two (see Figure 10.6).\(^60\)

![Figure 10.6. Box Plot of Skill Utilization and Wornout Scores](image)

**Skill Utilization categorized**

While there were no significant relationships between Wornout scores and decision latitude at either of these study sites, other researchers have reported significant correlations. De Jonge, Bosma, Peter and Siegrist (2000) found that people with high ‘psychological’ work demands were at eleven times greater risk of ‘emotional exhaustion’\(^61\) whenever there were high demands and low control compared to those who had low demands but high control. In the same study they found people with high ‘physical’ work demands were at three times greater risk of ‘emotional exhaustion’ when there were high demands but low control, compared to those who had low demands and high control.

\(^{59}\) site one \(r=.233, p<.01\); and site two \(r=.301, p<.01\)

\(^{60}\) \(F(33, 260)= 3.117, p<.001\)

\(^{61}\) measured by Maslach Burnout Inventory (Schaufeli and Van Dierendonck, 1994)
Payne et al. (1999) in a large study found a strong and significant relationship between work characteristics\(^{62}\) and levels of ‘general fatigue’.\(^{63}\) Williams and Cooper (1998) also reported moderate correlations between ‘energy level’ and job ‘control’.\(^{64}\) Finkelman (1994) reported that clerical workers find jobs with low challenge (poor skill utilization, and supervision) more fatiguing than do industrial workers. It was suggested that this may be a function of the higher expectations that clerical workers typically have of their job responsibilities and work conditions.

**Support**

Of the five factors in this domain, in the final model, *coworker cohesion and relationships* at site one, and *supervisor support* at both sites were included. The relative impact of these factors on the F-change in the MR was small (site one 2.4% and site two 2.7%) but significant.

As expected Wornout scores were lower at both sites when there was good *supervisor support*. In site one, *coworker support* was also associated with lower Wornout scores although the size of the effect was quite small.

However, the overall pattern of results in the bivariate correlations (see Appendix 10, Table 10.1) and the results of the final models demonstrated that the support factors had a smaller effect on Wornout scores than was expected based on the literature. Daniels (2000) reported finding significant relationships between high ‘energy/vitality’ with ‘help support’\(^{65}\) amongst social services employees. Lee and Ashforth’s (1996) meta-analysis of ‘burnout’ studies found moderate correlations between ‘emotional exhaustion’ and poor social support.

Bellman et al.’s (2003) study of social support as a moderator of occupational stress in a range of Australian organisations, found weak relationships between ‘exhaustion’\(^{66}\) (energy vitality) and social support but stronger relationships for workload and with low job control.

However, Kalimo et al. (2003) believes that the paths to ‘burnout’ (akin to emotional exhaustion and being Wornout) are different to those to wellbeing. They found that while poor organizational climate, unrewarding work, and a lack of self-worth and efficacy contributed to burnout, wellbeing was based on the presence of strong interpersonal resources and challenging work within a supportive work atmosphere.

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\(^{62}\) this included including autonomy’, ‘role conflict’, ‘role clarity’, and ‘workload’

\(^{63}\) \(r=-.34\)

\(^{64}\) \(r=-.29, p<.05\)

\(^{65}\) adapted from Caplan et al. (1975) and Daniels & Guppy (1995)

\(^{66}\) PMI Williams & Cooper (1998)
It is noteworthy therefore that (with the exception of senior manager attitudes and communications), overall, most people rated support as quite good. It might be that for these subjects, who on the whole had good support and challenging work, this was contributing more strongly to positive wellbeing (which will later be shown is related to both arousal and Job Satisfaction), whereas if support had been poor its effects on Wornout may then have become more apparent. Alternatively, it could be that Wornout scale’s sensitivity to detect the effects of both support and control was comparably low.

SPPCA

Even after all factors in the above domains were added, SPPCA was still the strongest single predictor of being Wornout. The strength of this relationship was plainly demonstrated by the F-change in the MR, which was substantial at both sites (18.1% and 21.3%). This large explained variance might be explained if it is considered that SPPCA not only reflects people’s perception of their performance, but to some extent also those personal, non-work and work factors which, while not measured directly in this study, still contributed to their perceived performance capacity.

Clearly, people who believed that their SPPCA was poorer were significantly more Wornout than those who believed it was good. Conceptually (as based on the JLM), this variable is seen as intervening between the work and job factors and aspects of wellbeing. While this relationship will be explored further in chapter 14, some questions were raised by these results. Was it that good performance is arousing thus helping to overcome psychological fatigue, that poor performance is stressful so more tiring, or that when people are more tired their performance is poorer? In partial answer to these questions, Finkelman (1994) found that employees whose performance was judged to be ‘highly effective’ were less likely to report fatigue. Nonetheless, performance was reported to be worse when ‘workloads’ fell below a minimal threshold which was probably necessary to maintain effective arousal levels.

Working environments where there are low demands are more likely to result in reports of fatigue (Finkelman, 1994). These findings and those reported in this study are again consistent with Kahneman’s ‘activation theory’ (1973).

The multivariate analysis methods assume a linear relationship. However, it is unlikely that the relationship between demands and any of the outcomes of interest, such as fatigue, is absolutely linear. Even during periods of very high demands, under the limited channel capacity model (Wickens, 1984;1993) their impact is likely only to become obvious when there is no longer any reserve processing capacity. Further, under the regulatory model of
compensation control, both motivation and low or high arousal can moderate both the effects of fatigue on performance and effect of workload on fatigue (Hockey, 1997).

At both these worksites, the Job Description had identified that few people were likely to experience extremely low or high work demands and that objectively fatigue-induced errors were not likely to have catastrophic safety consequences. However, from the employees’ perspective, performance adequacy had important implications on employee wellbeing. This study did not differentiate between the effects of acute or cumulative psychological fatigue. While the Wornout scale asked for ratings reflecting feelings and psychological reaction in the last week it is therefore likely that ratings will reflect more recent and more intense feelings. However, it is probably not unreasonable to assume that the results also represent some ‘carry over effect’ from previous weeks work (Åhsberg, 1998; Soames-Job & Dalziel, 2001; Rosa, 2001, 1995).

**MEASUREMENT ISSUES AND GENERAL FINDINGS**

The objective of this part of the study was to explore the relationships between the ‘workload’ factors and fatigue. At the time of the study design and the development of the JLI questionnaire for the reasons outlined in chapter 4, the Wornout scale of the GWBQ was selected to represent psychological fatigue and UBPD physical fatigue. In its favour, the GWBQ was developed for use in occupational (rather than clinical settings) and as such, its objective was not to identify clinical symptoms per se but rather represents an attempt to sensitively “tap the ‘grey area’ between perfect health and obvious illness” (Gotts and Cox (1988:27). The scale was originally generated from symptom descriptors in existing health instruments and then “supplemented with other common and reportable manifestations of behavioural, experiential and physiological states which although abnormal were not necessarily clinically significant in themselves” (Cox, Thirlaway, Gotts and Cox (1988:354). Gotts and Cox (1988:27) state that GWBQ ‘Wornout’ scale appeared to related to ‘fatigue’, ‘emotional fragility’ and ‘confusion’ while the ‘Uptight’ scale related to more ‘tension’, ‘agitation’ and ‘anxiety’. However, there is now a wider range of fatigue measures available which consider the physical and psychological dimensions of fatigue (see discussion in Chapter 5). If the study were being commenced now, it is likely that one of these might be considered to augment or replace the Wornout scale in the JLI questionnaire with scales which more clearly measure these dimensions.

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67 see chapter 9 for a discussion about the limitations of the measure
68 e.g. the Fatigue Assessment Scale (Michielsen, De Vries & Van Heck, 2002); Checklist Individual Strength-20 (Vercoulen, Alberts & Bleijenberg, 1999), Energy and Fatigue subscale from the World Health Organisation Quality of
Nevertheless the Cronbach’s alpha for the GWBQ Wornout scale at both sites was very high, and these results are similar to those reported by Cox, Thirlaway, Gotts and Cox (1983). There was high internal consistency with the subjects over the repeated rounds.69

CONCLUSIONS

Based on the JLM, being Wornout is seen as reflecting psychological fatigue, a negative subjective mood (as measured by the GWBQ Wornout scale) and an underlying (although unmeasured by this study) general psychophysiological phenomenon. It captured a state of low emotional vigour and arousal. Being Wornout is seen as a wellbeing cost which results from a poor person-job match. This state is of concern because it reflects poorer wellbeing, but also because, when extreme, it is likely to be associated with higher accidents and injury rates.

It was expected that Wornout scores would be higher when workload was high. Overall, the results at both sites supported this assumption. A significant proportion of the variance in Wornout scores were predicted by the two personal and non-work factors, sixteen workplace factors and by peoples’ own assessment of their performance capacity and adequacy represented in the regressions.

Despite the considerable interest in effects of long working hours on fatigue, for subjects within this study, long working hours had only a very small effect on being Wornout, probably because the negative effects of working long hours were being moderated by good support and peoples’ opportunities for control. Where demands were high but Wornout levels were low, it is surmised that this is due to the (temporary) moderating influence of arousal on fatigue. The evidence for this assumption is discussed in Chapters 12 and 16.

It was noteworthy that the main predictors of being Wornout were having too much to do in the available time, increasing workload pressure, the Specific Demands, interruptions and disruptions, environmental and informational impediments, and Support and SPPCA. Overall, SPPCA was the single most important predictor of being Wornout.

Life assessment instrument (EF-WHOQOL-10026) and the 10 item Fatigue Assessment Scale (Michielsen, De Vries & Van Heck, 2002).

69 Cronbach’s alpha site one .84 and site two .76; high internal consistency over the rounds demonstrated rounds 1=.92, 2=.93, 3=.94; Guttman split-half =.80 and alpha for part 1 =.79 and part 2 =.70.
This chapter reports relationships between various dimensions of JobLoad and subjects’ Stress levels, represented by scores on the ‘Stress’ dimension of the Stress Arousal Checklist (SACL). In this study, an interactional model of stress is used in which it is viewed as the result of a dynamic interaction between perceived levels of workplace demands and the person’s coping capacity. Work-related stress is considered to be an inherently negative state and an indicator of a lack of employee wellbeing, (Cooper, 1998; Cox, 1990; Gotts & Cox 1988; Hancock & Warm, 1989; Hurrell & McLaney, 1988; Lazarus & Launier, 1978; McEwen, 1998; and others).

Results are presented for site one followed by site two, and the chapter concludes with a summary and discussion of results from both sites. Consistent with the theory and evidence outlined earlier, it was expected that Stress scores would be higher when workload was either too high or too low.

RESULTS: SITE ONE

Figure 11.1, shows the distribution of all scores from all data collection rounds. It can be seen that there is a moderate positive skew and kurtosis, but within acceptable limits. Stress scores did not differ significantly between the three data collection rounds ($F_{[2, 291]} = 1.564, \ p =.221$).
The overall mean score for Stress at site one was 37.5 (SD 10.0) which was close to the mean value of 38.1 (SD 12.8) reported by Gotts & Cox (1988:16) for an Australian sample derived from a heterogenous mix of mainly urban industrial, professional, clinical and student subjects.

IDENTIFICATION OF FACTORS INFLUENCING STRESS

Preliminary Analyses

Bivariate correlations between Stress and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 11.1 of Appendix 11. The results of the preliminary multivariate analyses using MR and LMM as previously described are reported in Appendix 11.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or which were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses included:

- one of the six General and Temporal Demands: *increasing workload pressure*
- one of the seven Specific Work Demands: *cognitive, emotional and dynamic physical demands*
six of the seven Contextual Demands and Impediments: interruptions and disruptions, environmental and informational impediments, uncertain work requirements, career uncertainty, conflict, and workload variance

two of the four Job Control and Variety factors: skill utilization and influence

three of the five Support factors: coworkers support this week, supervisor support this week, supervisor and management attitudes and communication

SPPCA

three of the six Personal and Non-work Variables: conflict between home work demands, age and experience.

MULTIVARIATE ANALYSES

Stepwise Sequential Multiple Regression Analysis (round one data)

Results of the sequential multiple regression (MR) are summarised below, and in Table 11.4 (the F-change one in Table 11.3 below), all IVs are in Z scores. Each model within the sequence was significant:

- Block one - Personal & Non-work factors: \( R^2 = .127, (F[2, 116] = 8.414, p < .01) \). Two factors were included: conflict between home and work demands and gender. These explained approximately 12.7% of the variance in Stress.

- Block two - General and Temporal Job Demands: \( R^2 = .148, (F[7, 111] = 2.756, p < .01) \). Five factors were entered: total hours worked, too much to do in the available time, increasing workload pressure, and unpleasant working hours, and high responsibility. These accounted for 2.1% of the variance.

- Block three - Specific Work Demands: \( R^2 = .169, (F[10, 108] = 2.202, p < .01) \). Three factors were entered: dynamic physical demands and risks, static physical demands, and demand for care and vigilance. These explained 2.1% of the variance in scores.

- Block four - Contextual Demands and Impediments: \( R^2 = .258, (F[14, 104] = 2.390, p < .01) \). Four factors were entered: interruptions and disruptions, environmental and information impediments, uncertainty about work requirements, workload variance and career uncertainty. Together these explained 8.9% of the variance in Stress scores.

- Block five - Job Control and Variety: \( R^2 = .280, (F[16, 102] = 2.315, p < .01) \). Two factors were entered: skill utilization and influence. These factors explained 2.2% of the variance in scores.
• Block six - Support: $R^2 = .289$, ($F_{[18, 100]} = 2.108, p < .01$). Two factors were entered: *coworker support* and *supervisor support*, but explained little.

• Block seven - SPPCA: $R^2 = .442$, ($F_{[20, 98]} = 4.128, p < .01$). *SPPCA* was included as a signal item and explained 16.9% of the variance.

Table 11.3 shows that the F-changes between blocks in the above sequences were significant at the first, fourth, and seventh blocks.

**Table 11.3. Models of Significant IVs and Stress (site one, round one)**

<table>
<thead>
<tr>
<th>Block one - Personal &amp; Non-work factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two - General &amp; Temporal Demands</td>
<td>.127</td>
<td>.127</td>
<td>8.414</td>
<td>.000</td>
</tr>
<tr>
<td>Block three - Specific Work Demands</td>
<td>.148</td>
<td>.021</td>
<td>.557</td>
<td>.733</td>
</tr>
<tr>
<td>Block four - Contextual Demands &amp; Impediments</td>
<td>.169</td>
<td>.021</td>
<td>.922</td>
<td>.433</td>
</tr>
<tr>
<td>Block five - Job Control &amp; Variety</td>
<td>.258</td>
<td>.089</td>
<td>2.467</td>
<td>.037</td>
</tr>
<tr>
<td>Block six - Support</td>
<td>.280</td>
<td>.022</td>
<td>1.559</td>
<td>.215</td>
</tr>
<tr>
<td>Block seven - SPPCA</td>
<td>.442</td>
<td>.153</td>
<td>26.955</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 11.4 below shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients ($sr^2$) and $R^2$, and adjusted $R^2$ value for this set of constructs for the model which includes the variables from blocks one to seven.

With this combination of variables, *conflict between home and work demands, SPPCA* and *coworker support* (in red) differed significantly from zero, and their unique contribution to the $R^2$ was .178. The other IVs in combination contributed another .264 in shared variability. Thus a total of 44.2% (32.9% adjusted) of the variability in Stress scores was predicted by these variables.

Given the strong positive bivariate correlations for *time pressures, environmental information impediments* and *coworker cohesion* with Stress it is likely that an undetermined suppressor variable has influenced the direction of these regression coefficients.
### Table 11.4. Stepwise Sequential Regressions of Significant IVs and Stress Score (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>β</th>
<th>Sig.</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (men)</td>
<td>2.162 (4.0)</td>
<td>1.715</td>
<td>.111</td>
<td>.210</td>
<td>.095</td>
</tr>
<tr>
<td><strong>Conflict between home work demands</strong></td>
<td><strong>-3.54 (6.5)</strong></td>
<td><strong>1.686</strong></td>
<td>-.185</td>
<td>.038</td>
<td>-.159</td>
</tr>
<tr>
<td>Total Hours Worked</td>
<td>.382 (0.7)</td>
<td>.746</td>
<td>.045</td>
<td>.610</td>
<td>.039</td>
</tr>
<tr>
<td>Too much to do in the available time</td>
<td>1.26 (2.3)</td>
<td>1.461</td>
<td>.100</td>
<td>.389</td>
<td>.065</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>.385 (0.7)</td>
<td>1.131</td>
<td>.035</td>
<td>.735</td>
<td>.026</td>
</tr>
<tr>
<td>Unpleasant Working Hours</td>
<td>-.225 (0.4)</td>
<td>.988</td>
<td>-.021</td>
<td>.820</td>
<td>-.017</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.641 (1.1)</td>
<td>1.063</td>
<td>.056</td>
<td>.548</td>
<td>.046</td>
</tr>
<tr>
<td>Static Physical Demands</td>
<td>.686 (1.2)</td>
<td>1.164</td>
<td>.065</td>
<td>.557</td>
<td>.044</td>
</tr>
<tr>
<td>Dynamic Physical Demands</td>
<td>.574 (1.0)</td>
<td>1.083</td>
<td>.044</td>
<td>.597</td>
<td>.040</td>
</tr>
<tr>
<td>Demand for Care &amp; Vigilance</td>
<td>1.54 (2.8)</td>
<td>1.623</td>
<td>.099</td>
<td>.344</td>
<td>.072</td>
</tr>
<tr>
<td>Interruptions &amp; Disruptions</td>
<td>1.00 (1.8)</td>
<td>1.450</td>
<td>.077</td>
<td>.492</td>
<td>.052</td>
</tr>
<tr>
<td>Environ. &amp; Information Impediments</td>
<td>-.741 (1.3)</td>
<td>1.540</td>
<td>-.049</td>
<td>.631</td>
<td>-.036</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>.248 (0.4)</td>
<td>1.456</td>
<td>.018</td>
<td>.865</td>
<td>.013</td>
</tr>
<tr>
<td>Uncertainty about Work Requirements</td>
<td>.208 (0.3)</td>
<td>1.006</td>
<td>.019</td>
<td>.837</td>
<td>.016</td>
</tr>
<tr>
<td>Workload Variance</td>
<td>-1.00 (1.8)</td>
<td>.902</td>
<td>-.096</td>
<td>.266</td>
<td>-.084</td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>-1.80 (3.3)</td>
<td>-1.10</td>
<td>.150</td>
<td>.107</td>
<td>-.123</td>
</tr>
<tr>
<td>Influence</td>
<td>-1.03 (1.9)</td>
<td>-1.346</td>
<td>.083</td>
<td>.444</td>
<td>-.058</td>
</tr>
<tr>
<td>Coworker Support</td>
<td>-1.28 (2.3)</td>
<td>-1.173</td>
<td>.132</td>
<td>.275</td>
<td>-.083</td>
</tr>
<tr>
<td>General Supervisor Support</td>
<td>-.732 (1.3)</td>
<td>-1.133</td>
<td>.067</td>
<td>.520</td>
<td>-.049</td>
</tr>
<tr>
<td><strong>SPPCA</strong></td>
<td><strong>-5.37 (9.9)</strong></td>
<td><strong>-1.036</strong></td>
<td><strong>.518</strong></td>
<td><strong>.000</strong></td>
<td><strong>-.392</strong></td>
</tr>
</tbody>
</table>

\[ F [20, 98] = 4.644, p < .01 \]

Intercept = 38.11 (SE 1.5) (39.1)

Unique variability = .178

Shared variability = .264

R = .665  \( R^2 = .442 \)

Adjusted \( R^2 = .329 \)

### Linear Mixed Model Analyses (two & three repetitions)

To maintain an acceptable ratio of cases to variables, only significant variables from the most centrally important domains were included in LMM analyses, as shown in Table 11.5. The statistically significant variables are indicated in red. However, with three repetitions some variables with low effects were omitted to meet the recommended subject-to-variables ratios. The following variables were associated with the greatest changes in the Stress scores.

Stress scores were higher (% per unit change in SACL score) when there were:

- *conflict between home and work demands* (by approximately 5% and 8%);
- *responsibility* (with three repetitions by approximately 3%);
- *demand for care and vigilance* (with three repetitions by approximately 6%); and
• career uncertainty (with three repetitions by approximately 4%).

Stress scores were lower (per unit change) with:

• workload variance (with both repetitions by approximately 3%);
• supervisor support (with both repetitions by approximately 3%);
• SPPCA was higher (with both repetitions by approximately 9% and 5%); and
• skill utilization (with three repetitions by approximately 4%).

Factors which had significance levels between .05 and .10 including; gender, total hours worked, dynamic physical demands and risks (in blue).
Table 11.5. Estimates of Fixed Effects with Significant IVs and Stress Score (site one, two and three repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n=103)</th>
<th>Three Repetitions (n=71)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated effects (%)</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Intercept</td>
<td>38.84</td>
<td>1.2</td>
</tr>
<tr>
<td>Gender = 1 (Women)</td>
<td>2.55 (4.7)</td>
<td>1.39</td>
</tr>
<tr>
<td>Gender=0 (Men)</td>
<td>0(a)</td>
<td>0</td>
</tr>
<tr>
<td>No conflict home/work demands</td>
<td>-2.89 (5.3)</td>
<td>1.33</td>
</tr>
<tr>
<td>Total Hours Worked</td>
<td>1.19 (2.2)</td>
<td>.62</td>
</tr>
<tr>
<td>Too much to do in the Available Time</td>
<td>1.47 (2.7)</td>
<td>1.14</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-0.08 (0.1)</td>
<td>.93</td>
</tr>
<tr>
<td>Unpleasant working hours</td>
<td>0.24 (0.4)</td>
<td>.80</td>
</tr>
<tr>
<td>Responsibility</td>
<td>1.03 (1.9)</td>
<td>.89</td>
</tr>
<tr>
<td>Static Physical Demands</td>
<td>0.90 (1.6)</td>
<td>1.01</td>
</tr>
<tr>
<td>Dynamic Physical Demands</td>
<td>1.51 (2.8)</td>
<td>.91</td>
</tr>
<tr>
<td>Demand for Care and Vigilance</td>
<td>2.55 (4.7)</td>
<td>1.37</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>0.52 (0.9)</td>
<td>1.10</td>
</tr>
<tr>
<td>Environmental Information Impediments</td>
<td>-0.15 (0.3)</td>
<td>1.23</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>1.91 (3.5)</td>
<td>1.16</td>
</tr>
<tr>
<td>Workload Variance</td>
<td>-1.50 (2.8)</td>
<td>.77</td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>-1.38 (2.5)</td>
<td>.95</td>
</tr>
<tr>
<td>Influence</td>
<td>-1.53 (2.8)</td>
<td>1.09</td>
</tr>
<tr>
<td>Coworker Support and Cohesion</td>
<td>-1.35 (2.5)</td>
<td>.83</td>
</tr>
<tr>
<td>General Supervisor Support</td>
<td>-1.61(2.9)</td>
<td>.81</td>
</tr>
<tr>
<td>SPPCA</td>
<td>-5.14 (9.5)</td>
<td>.80</td>
</tr>
</tbody>
</table>
RESULTS: SITE TWO

The overall mean score for Stress for site two was 40.8 (SD 13.5) which was above the sample mean value of 38.1 (SD =12.89) presented by Gotts & Cox (1988) for an Australian sample derived from an heterogenous mix of mainly urban industrial, professional, clinical and student subjects. Of note is that the Stress score was higher than that reported for site one (mean 37.5 SD 10.0). Figure 11.2, shows the distribution of all scores from all data collection rounds. It can be seen that there was moderate positive skew and kurtosis, but within acceptable limits.

![Graph showing distribution of Stress scores for site two.](image)

**Figure 11.2. Distribution of Stress Scores site two**

Stress scores were lower at the time of the second survey, but this difference was not statistically significant as shown by a one-way ANOVA ($F [2, 291] = 1.564, p = .221$).

IDENTIFICATION OF FACTORS INFLUENCING STRESS

**Preliminary Analyses**

Bivariate correlations between Stress score and values of other measured constructs, grouped into the major domains identified by the JLM, are shown in Appendix 11, Table 11.1. Correlations of 0.3 or higher for at least one survey round, and that were statistically significant for at least one of the rounds, were found for:
two of the six General and Temporal Job Demands: *time pressure, too much to do in the available time*, cf. at site one: *increasing workload pressure*

two of the seven Specific Work Demands: *cognitive demands, dynamic physical demands, emotional demands* cf. at site one: *cognitive, emotional and dynamic physical demands*

four of the seven Contextual Demands and Impediments: *interruptions and disruptions, environmental & informational impediments, uncertain about work requirements, performance uncertainty* cf. at site one: *interruptions and disruptions, environmental and informational impediments, uncertain work requirements, career uncertainty, conflict, and workload variance*

all of the four Job Control and Variety factors: *influence, skill utilization, decision latitude, work variety* cf. at site one *skill utilization, and influence*

four of the five Support factors: *coworker support, coworker cohesion & relationships, supervisor support, general level of supervisor support* cf. at site one: *coworkers support this week, supervisor support this week, supervisor and management attitudes and communication*

SPPCA same as site one

one of the six Personal and Non-work variables: *conflict between home work demands* cf. at site one: *conflict between home work demands, age, and experience.*

**MULTIVARIATE ANALYSES**

**Stepwise Sequential multiple regression analysis (round one data)**

Results of the sequential multiple regression (MR) are summarised below and in Table 11.6.

Each model within the sequence was significant:

- **Block one - Personal & Non-work factors:*** $R^2 = .159$, ($F_{[1, 50]} = 9.460$, $p < .01$). One factor was included *conflict between home and work demands*; this explained approximately 15.9% of the variance in Stress.

- **Block two - General and Temporal Job Demands:*** $R^2 = .263$, ($F_{[3, 48]} = 5.709$, $p < .01$). Two factors were included: *total hours worked* (Z score), and *time pressure* (Z score). These explained 10.4% of the variance in Stress.

- **Block three - Specific Work Demands:*** $R^2 = .336$, ($F_{[5, 46]} = 4.664$, $p < .01$). Two factors were entered: *emotional demands* (Z score), and *dynamic physical demands* (Z score). These explained approximately 7.3% of the variance in Stress.
• Block four - Contextual Demands and Impediments: $R^2 = .408$, ($F [6, 45] = 4.329, p < .01$). One factor was entered: *interruptions and disruptions* (Z score). This explained approximately 7.1% of the variance in Stress.

• Block five - Job Control and Variety: $R^2 = .444$, ($F [7, 44] = 4.282, p < .01$). One factor was included: *skill utilisation* (Z score). This explained 3.6% of the variance.

• Block six - Supports: $R^2 = .450$, ($F [9, 42] = 3.360, p < .01$). Two factors were entered: *coworker support* (Z score), and *supervisor support* (Z score). These explained little.

• Block seven - SPPCA: $R^2 = .568$, ($F [10, 41] = 4.777, p < .01$). This was a single factor and explained approximately 11.7% of the variance in Stress.

Table 11.5. shows that the F-changes between blocks in the above sequences were significant at the first, second and seventh blocks.

### Table 11.5. Models of IVs and Stress in Round 1 (site two, round one)

<table>
<thead>
<tr>
<th>Block one - Personal &amp; Non-work factors</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two - General and Temporal Job Demands</td>
<td>.159</td>
<td>.159</td>
<td>9.460</td>
</tr>
<tr>
<td>Block three - Specific Work Demands</td>
<td>.263</td>
<td>.104</td>
<td>3.383</td>
</tr>
<tr>
<td>Block four - Contextual Demands &amp; Impediments</td>
<td>.336</td>
<td>.073</td>
<td>2.544</td>
</tr>
<tr>
<td>Block five - Job Control &amp; Variety</td>
<td>.408</td>
<td>.071</td>
<td>2.654</td>
</tr>
<tr>
<td>Block six - Support</td>
<td>.450</td>
<td>.007</td>
<td>.257</td>
</tr>
<tr>
<td>Block seven - SPPCA</td>
<td>.568</td>
<td>.118</td>
<td>10.860</td>
</tr>
</tbody>
</table>

Table 11.6 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients ($sr^2_\beta$) and $R^2$, and adjusted $R^2$ value for this set of constructs for the model which includes the variables from blocks one to seven.

With this combination of variables, *SPPCA* (in red) differed significantly from zero, and its unique contribution to the $R^2$ was .117. One factors had significance levels between .05 and .10, *time pressure and deadlines* (in blue). The other IVs in combination contributed another .451 in shared variability. Thus a total of 56.8% (44.9% adjusted) of the variability in Stress scores was predicted by these IVs.
However, of note is the large regression coefficient for conflict between the home and work demand, dynamic physical demands and risks which, while not statistically significant, helped to explain much of the variance in Stress scores.

| Table 11.6 Stepwise Sequential Regression of Significant IVs and Stress Score (site two, round one) |
|----------------------------------|-----------|----------|--------|------|-------|
| Variables                        | B (%)     | SE       | ß      | Sig  | \( sr_1^2 \) |
| Conflict with home and work demands | 2.86 (3.9) | 3.57   | .097  | .428  | .083   |
| Total Hours Worked               | 1.55 (2.1) | 1.50   | .128  | .308  | .107   |
| **Time Pressure and Deadlines**  | **3.47 (4.8)** | **2.00** | **.246** | **.091** | **.180** |
| Dynamic Physical Demands & Risks | -2.25 (3.1) | 1.96   | -.145 | .258  | -.119  |
| Emotional Demands               | 0.90 (1.2) | 1.80   | .068  | .619  | .052   |
| Interruptions & Disruptions     | 0.34 (0.4) | 2.17   | .025  | .877  | .016   |
| Conflict                        | 1.10 (1.5) | 1.66   | .088  | .510  | .069   |
| Skill Utilization               | -1.76 (2.4) | 1.50   | .136  | .248  | -.122  |
| Coworker Support this week      | -0.27 (0.4) | 1.99   | .021  | .892  | -.014  |
| Supervisor Support              | -0.76 (1.0) | 2.07   | .054  | .713  | -.038  |
| **SPPCA**                       | **-5.44 (7.5)** | **1.65** | **-.411** | **.002** | **-.343** |
| \( F(10,41) = 4.777, p < .01 \) | Intercept = 40.650 |

Unique variability = .117   Shared variability = .451   \( R = .754 \)   \( R^2 = .568 \)

Linear Mixed Model Analyses (LMM) (two repetitions data)

To maintain an acceptable ratio of cases-to-variables, only significant variables from the most centrally important domains were included in LMM analyses, as shown in Table 11.9. Some variables included in the multiple regression but which had low effect sizes were omitted to meet the subject to variables ratios. Statistically significant variables are indicated in red.

Only one variable was statistically significant
- Stress scores were higher (% per unit change) by approximately 4.6% when there were higher total working hours.

While not statistically significant, the estimated effects for the variables time pressure and deadlines, interruptions and disruptions, and SPPCA were considerable, and with a larger sample size this may well have reached significance.
Table 11.9. Estimates of Fixed Effects with significant IVs and Stress Score (site two, round one)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n = 66)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated effects (%)</td>
</tr>
<tr>
<td>Intercept</td>
<td>44.22</td>
</tr>
<tr>
<td>Conflict between home &amp; work demands</td>
<td>-3.74 (5.2)</td>
</tr>
<tr>
<td>No conflict between home &amp; work demands</td>
<td>0(a)</td>
</tr>
<tr>
<td>Total Hours Worked</td>
<td>3.21 (4.6)</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td>3.30 (4.5)</td>
</tr>
<tr>
<td>Dynamic Physical Demands &amp; Risks</td>
<td>-2.23 (3.1)</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>2.83 (3.9)</td>
</tr>
<tr>
<td>Conflict</td>
<td>2.35 (3.2)</td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>-0.89 (1.2)</td>
</tr>
<tr>
<td>Supervisor Support</td>
<td>-0.19 (0.2)</td>
</tr>
<tr>
<td>SPPCA</td>
<td>-2.78 (3.8)</td>
</tr>
</tbody>
</table>

OVERVIEW OF RESULTS: BOTH SITES

Table 11.10 shows levels of Stress scores (means, SDs) for each of the sites, with higher means reported in site two compared to site one. A one-way ANOVA ($F [1, 380] = 5.992, p < .01$) confirmed the scores did differ significantly between the sites.

Table 11.10. Means of Stress Scores (both sites all rounds)

<table>
<thead>
<tr>
<th>Round</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whole sample mean (SD)</td>
<td>n</td>
</tr>
<tr>
<td>Round 1</td>
<td>36.8 (8.7)</td>
<td>120</td>
</tr>
<tr>
<td>Round 2</td>
<td>38.9 (10.9)</td>
<td>103</td>
</tr>
<tr>
<td>Round 3</td>
<td>36.7 (10.7)</td>
<td>71</td>
</tr>
<tr>
<td>Grand Mean</td>
<td>37.5 (10.1)</td>
<td>294</td>
</tr>
</tbody>
</table>

Table 11.11 presents key results from both sites. These are discussed below in relation to each of the main domains, followed by a more general discussion and conclusions from these analyses.

Overall, a reasonable proportion of the variance in Stress scores was explained by the two personal and non-work factors, and the seventeen work factors and SPPCA. At site one, approximately 45% (using $R^2$), and 34% (using adjusted $R^2$) and at site two approximately 56% (using $R^2$) and 45% (using adjusted $R^2$) of the variance in Stress scores was explained by these factors. More of the variance was predicted at site two despite the use of fewer IV
Table 11.11. Multivariate Analyses Final Models Stress Scores (both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR (n = 120)</td>
<td>LMM (2 repetitions n = 103)</td>
</tr>
<tr>
<td>Intercept</td>
<td>B (%)</td>
<td>β</td>
</tr>
<tr>
<td></td>
<td>38.11 (39.1)</td>
<td>38.84</td>
</tr>
<tr>
<td><strong>Personal &amp; Non-work variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conflict between home -work demands</td>
<td>2.162 (4.0)</td>
<td>.111</td>
</tr>
<tr>
<td>Gender (men)</td>
<td><strong>-3.54 (6.5)</strong></td>
<td><strong>-2.55 (4.7)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>General Job Demands (High)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Hours Worked</td>
<td>.382 (0.7)</td>
<td>.045</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too Much to do in the Available Time</td>
<td>1.26 (2.3)</td>
<td>.100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>.385 (0.7)</td>
<td>.035</td>
</tr>
<tr>
<td>Unpleasant Working Hours</td>
<td>-.225 (0.4)</td>
<td>-.021</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.641 (1.1)</td>
<td>.056</td>
</tr>
<tr>
<td><strong>Specific Work Demands (High)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static Physical Demand</td>
<td>.686 (1.2)</td>
<td>.065</td>
</tr>
<tr>
<td>Dynamic Physical Demands and Risks</td>
<td>.574 (1.0)</td>
<td>.044</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand for Care and Vigilance</td>
<td>1.54 (2.8)</td>
<td>.099</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DV: Stress * p<.05 ** p<.01; blue p .5-1.0 % % approximate only

Table 11.11 continued on next page....
Table 11.11. Multivariate Analyses Final Models Stress Scores (both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MR</strong> (n = 120)</td>
<td><strong>LMM</strong> (2 repetitions n = 103)</td>
<td><strong>LMM</strong> (3 repetitions n = 71)</td>
</tr>
<tr>
<td><strong>B (%)</strong></td>
<td><strong>β</strong></td>
<td><strong>Estimated effects (%)</strong></td>
</tr>
<tr>
<td>Intercept</td>
<td>38.11 (39.1)</td>
<td>38.84</td>
</tr>
<tr>
<td><strong>Contextual Demands and Impediments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>1.00 (1.8)</td>
<td>.077</td>
</tr>
<tr>
<td>Environ Information Impediments</td>
<td>-.741 (1.3)</td>
<td>-.049</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>.248 (0.4)</td>
<td>.018</td>
</tr>
<tr>
<td>Uncertainty about Work Requirements</td>
<td>.208 (0.3)</td>
<td>.019</td>
</tr>
<tr>
<td>Workload Variance</td>
<td>-1.00 (1.8)</td>
<td>-.096</td>
</tr>
<tr>
<td><strong>Conflict</strong></td>
<td></td>
<td>1.10 (1.5)</td>
</tr>
<tr>
<td><strong>Job Control &amp; Variety</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>-1.80 (3.3)</td>
<td>-.150</td>
</tr>
<tr>
<td>Influence</td>
<td>-1.03 (1.9)</td>
<td>-.083</td>
</tr>
<tr>
<td><strong>Supports</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coworker Support this week</td>
<td>-1.28 (2.3)</td>
<td>-.113</td>
</tr>
<tr>
<td>Supervisor Support</td>
<td>-.732 (1.3)</td>
<td>-.067</td>
</tr>
<tr>
<td>SPPCA</td>
<td>-5.37 (9.9)**</td>
<td>-.518</td>
</tr>
</tbody>
</table>

| R² | .442 | .568 |
| Adjusted R² | .329 | .449 |

DV: Stress Score * p<.05 ** p<.01; blue p .5-1.0 % approximat
Additional Data from Job Analysis

Job Type and Level

Job type and level data were analysed separately because of the expected high interactions with JLI variables (see Chapter 7, Tables 7.112–114). Significant differences were detected in Stress scores between the job types\(^{70}\). The highest scores were from the clerical officers in site two, and the lowest by communications and help-desk officers.

Significant differences in the Stress scores were detected in site two (F \([2,85] = 3.866, p < .05\)) but not site one. The highest scores were reported by the most senior staff and the lowest scores were by job level two. This result was not unexpected as, overall, the more senior staff reported higher emotional demands, interruptions and disruptions, conflict, and poorer levels of support.

REVIEW AND DISCUSSION OF RESULTS

In the JLM, stress is seen as a negative affective state (a wellbeing cost) which reflects the person’s appraisal that they are unable to meet the performance requirements with their current coping capacity. While the overall mean Stress scores at site one were close to that for an Australian sample (Gotts & Cox, 1988), those at site two were higher than the mean, the reasons for which will be discussed in the next section.

Effects of Personal & Non Work Variables

Personal and non work factors are known to shape peoples’ appraisal of their capacity to meet demands. Accordingly, factors of this type identified in the preliminary analyses as being significant (see Appendix 11) were entered into the first block of the sequential regressions and included in LMM analyses. While personality type, coping strategies, and stress resilience will also influence susceptibly to stress, these were considered outside the scope of the current study.

Of the six personal and non-work factors which were measured, two\(^{71}\) met the inclusion criteria for the final models. Nonetheless these predicted a significant proportion of the overall variance in scores, together explaining (using F-change) 12.7% at site one and 15.9% of the variance at site two.

At both sites, Stress scores were strongly related to conflict between home and work demands, which overall was one of the most powerful predictors. In site one, women reported higher Stress

\(^{70}\) F\([4,377] = 3.320, p > .01\)

\(^{71}\) age, conflict between home work demands
scores than the men. Other authors (e.g. Hall, 1992; Brisson, 1999; Duxbury & Higgins, 2001 Luecken et al., 1997) have reported similar findings which they attributed to the stress associated with trying to balance home and work life.

**Effects of the Work Demands**

**General and Temporal Job Demands**

Of the six factors in this domain, all were included in the final model for site one, and two for site two. It was expected that Stress scores would be higher when the general and temporal job demands were high and overall this view was supported. Together these demands explained (using F-change) little in site one, but approximately 10.4% of the variance in Stress scores at site two.

Some of the strongest relationships with Stress in this domain were found for the factors *total hours worked*, *responsibility*, and the temporal demands *time pressure and deadlines*, and *too much to do in the available time*.

The factor *total hours worked* met the inclusion criteria for both sites and was associated with modest increases in Stress scores, particularly at site two. While the mean working hours were higher at site one compared to site two, the job analysis had revealed that participants at site one expected that their jobs would involve long work hours. However, at site two, the occasional need to work long hours was seen as an imposition and an indication of poor senior management and planning (see comments Appendix 8).

To determine if the modest relationship was due to a curvilinear relationship with working hours and Stress (that is extremes of either too low or too high working hours were associated with high Stress levels and moderate levels with low Stress levels) five groups of working hours were compared (see Figure 11.3 below).

---

72 *total hours worked, too much to do, increasing workload pressure, unpleasant working hours, responsibility*

73 *total hours worked, time pressure*

74 site one $\mu=47.6, SD=14.4$; site two $\mu=42.9, SD=9.1$

75 <35 hrs pw; 36-45 hrs pw; 46-55 hrs pw; 56-65 hrs pw and >66 hrs pw
Figure 11.3. Box Plot of Working Hours and Stress Scores (Both Sites)

From Figure 11.4, there does not appear to be any particular relationship between stress and working hours and this was confirmed by a one way ANOVA. A similar small effect was observed between long working hours and being Wornout, where it was conjectured that where people have reasonable levels of job control (as at both sites), they may elect to work longer to conversely manage the risks and crises that would threaten performance.

Two papers on job demands and stress were identified where the results reported were able to be fairly easily compared with the methods which were used in this study, with conflicting results. A meta-analysis by Sparks, Cooper, Fried and Shirom (1997) examined the psychological and physical health effects of long working hours (excluding shift work unless consecutive workdays resulted in more than 48 hours of work each week). They found a weighted observed correlation of $r = .146$ between long working hours and poor ‘psychological health’ (measured in terms of factors such as ‘depression’, ‘hostility’, ‘irritability/tension’, ‘mood symptoms’ and ‘general mental stress’). Ganster and Bates (2003) in their study of self-reported working hours and stress symptoms (after controlling for moderating variables such as good job design) found a correlation of $r = .190$, $p < .01$. Parks et al. (2001) in their study of the effects of long working hours on health ($n=197$) reported small positive correlations between stress responses and weekly working hours ($r = .188$, $p < .01$).
Hobson and Beach (2000) in a study of managers (n=51) found no relationship between measures of psychological health and objective recordings of working hours. However, these authors concluded that the working hours are indirectly associated with measures of psychological health through the individual’s own perception of workplace stressors and workloads. This idea was also discussed in Stansfield and colleagues (1995) study of work characteristics and psychiatric health among civil servants.

In a recent review of 27 studies where the effects of working hours were compared with psychological health (measured in a variety of ways) there was an association between extended work hours and ‘social dysfunction’, higher levels of ‘depression’ and ‘confusion’ (but not with ‘tension’ and ‘anger’) (van der Hulst, 2003). Clearly, while working excessive hours has potential for negative health consequences (e.g. Ganster and Bates, 2003; Jex & Bliese, 1999; Sparks et al., 1997; Spurgeon, Harrington & Cooper, 1997 and others) it is inadequate just to measure the hours that people spend at work in order to predict their stress levels.

In both the stress and workload literatures, temporal demands are acknowledged as an important predictor of stress (e.g. Carayon & Zijlstra, 1999; Cox & Griffith, 1995,1996; Hart & Staveland, 1988; Reid & Nygren, 1988; Landy et al., 1991 and others). Not surprisingly, temporal demands at both sites were associated with higher Stress scores. The temporal demands appeared to be a more potent stressor for subjects in site two (given the means were quite comparable).

At site two, the bivariate correlations of Stress with time pressure and deadlines were both positive and significant. Again, the bivariate correlations of Stress with too much to do in the available time were higher at site two.

Studies which isolate temporal demands from all other job demands are not common but, in a study on clerical workers, Carayon (1993) found significant relationships between high ‘workload’ levels and ‘daily life stress’ and ‘physical health symptoms’, but not ‘tension-anxiety’. Bültmann, Kant, Schröer & Kasl (2002:263-4) found significant relationships between ‘psychological demands’ and ‘psychological distress’ in women and men.

76 Measured by the General Health Questionnaire
77 time pressure and deadlines site one µ=4.8[SD 1.1]; and site two µ=4.9[SD 1.2] and too much to do site one µ=4.6[SD 1.2]; and site two µ= 3.4[SD 1.6]
78 site two $r$.480, p<.01; cf. site one of $r$.112 ns
79 site two $r$.439, p<.01; cf. site one $r$.164, ns
80 comparable to sum of time pressure and deadlines and too much to do
81 comparable to the SACL stress score
82 ‘included - excessive work, insufficient time, working fast, working hard, conflicting demands’
83 GHQ-12
At site one, the job analysis had established that many people were required to work longer hours, undertake shift work, and that the organisation was undergoing ‘downsizing’, which had been in progress for nearly three years. In site one there were modest increases in Stress when there was a perceived need to work at inconvenient times (unpleasant working hours) and with increasing workload pressure. In site two, where most subjects worked standard public service hours the issue of ‘unpleasant’ hours, did not arise, and where there was no external/objective evidence of any general trend for increasing workload.

Two studies are referred to that represent typical findings for general job demands and stress. Klitzman and Stellman (1989) in a study of psychosocial wellbeing of office workers reported that when ‘workload demands’ were high there was increased ‘generalised distress’ and ‘irritation’. Macdonald (2003) investigated the effects of job demands and workload on stress in manufacturing industries, using the SACL and ‘workload’ items which overlapped with those used in this study, found there were higher Stress scores when workloads were high.

Responsibility was associated with higher Stress scores in both sites (see Appendix 11) but was only included in the final model for site one. Here it was modestly associated with increased Stress, reaching statistical significance using LMM (three data repetitions) and explaining 3% of the variance in Stress scores.

The JLM proposes that if responsibility exceeds the person’s coping capacity it will be viewed as a stressor. Alternatively, if the level of responsibility (perhaps because it is accompanied by appropriate support) is within the coping capacity it may be viewed positively and help to lower Stress. Based on this assumption, for these subjects responsibility would appear to have been viewed as a stressor.

Specific Work Demands

Of the six factors in this domain, three factors were included in the final model for site one and two for site two. The hypothesis that Stress scores would be higher when specific work demands were high was generally supported. Overall, (using F-change) the specific work demands together explained 2.1% in site one and over 7.3% in site two, of the variance in Stress scores.

84 ‘hard work, fast work, make decisions, job freedom’
85 ‘anxious, feel like crying, worried, low spirits’ r = .10, p < .001, and B = .04, ns
86 ‘irritated, aggravated, angry, frustrated’ r = .14, p < .001, and B = .08, p < .01
87 NASA TLX scale
88 B = .39, β = .42, p < .001
89 static physical demands, dynamic physical demands, and demand for care and vigilance
90 dynamic physical demands, and emotional demands
The job analysis revealed in site one that, during the tasks which were undertaken by the technical, IT and communications and help desk officers, there was a need for both care and vigilance. Hence, the association between this demand and higher Stress scores was not surprising, reaching statistical significance using LMM (three repetitions). At site one this was one of the strongest predictor of factors from this domain.

While emotional demands are potentially quite powerful stressors, the job analysis showed that (except for occasions when the communications and help desk officers’ client queues were long), in both sites the type of work conducted were not overly emotionally demanding. However, in site two these were associated with modest increases in Stress scores. The one-way ANOVA between job level and emotional demands demonstrated that more senior staff not only had higher emotional demands but also higher Stress levels. Bültmann, Kant, Schröer, & Kasl (2002:263-4) found significant relationships between high ‘emotional demands’, ‘conflict’ and ‘psychological distress’ in both women and men.

At site one dynamic physical demands and risks were associated with higher Stress scores, whereas at site two Stress scores were lower when this demand was high. The direction of the effect might be explained by considering that in site one objectively (based on the job analysis), for the technical and IT officers there were real risks of injury and occasions of quite heavy manual handling, so that for dynamic physical demands and risks to be perceived as a stressor was quite justified. Whereas in site two, dynamic physical demands appeared to provide a welcomed opportunity to move around and so helped to reduce Stress levels.

Objectively and subjectively, all subjects had periods of high static physical demands associated with their computer-based activity. While this factor was not in the final models, the bivariate correlations showed that, as expected, higher static physical demands were related to higher Stress scores in both sites (see Appendix 11).

Bültmann et al. (2002) in a prevalence study of psychological distress and fatigue in 12,095 employees found relationships between high ‘physical demands’ and ‘psychological distress’ in both women (OR=1.21, 95% CI=0.97-1.50) and men (OR=1.74, 95% CI=1.51-2.01).

In a previously reported study Klitzman and Stelman (1989) found intercorrelations between high ‘generalised distress’ and ‘workload demands’ ($r=.10$) and ‘poor ergonomic factors’ ($r=.24$). After controlling for occupation, psychosocial working conditions and demographics, they found

---

$91 F [2, 84] = 4.307, p < .01$
$92 F [2, 84] = 4.171, p < .01$
$93$ GHQ-12
that ‘ergonomic stressors’ (factors which would result in high static physical demands\textsuperscript{94}) remained one of the more powerful stressors in this very large study (B=0.07, p < .05).

**Work-related Contextual Demands and Impediments**

Of the seven factors in this domain, five were included in the final model for site one\textsuperscript{95} and two for site two\textsuperscript{96}.

The hypothesis that Stress scores would be higher when the contextual demands and impediments were high was generally supported. Examination of the MR shows the F-change was 8.9\% in site one and 7.1\% in site two.

As Cox and Griffiths (1995) observe, that while the context in which the job is carried out as well as the content of work tasks is less visible, they are nevertheless just as important psychosocial hazards. *Career uncertainty* is known to increase anxiety and impede performance by making it more difficult for individuals to use effective coping strategies (Lazarus & Folkman, 1984; Sverke et al., 2002). ‘Job insecurity’ was found to effect ‘depressive mood’ in the Belstress study for men (OR=2.10, p < .001) and for women (OR=1.49 p < .001) (Pelfrene et al., 2003). Klitzman and Stelman (1989) found correlations between generalised distress amongst office workers and job ‘good future prospects’ of ($r$=-.19).

As expected there was an increase in Stress scores when ratings of *career uncertainty* were high, reaching statistical significance using LMM (three data repetitions). As site one was in the throes of organisational ‘downsizing’, some anxiety was probably justified. In contrast, at site two where 95\% of staff were recent recruits (due to relocation to a new city) job insecurity was not realistically an issue.

Uncertainty about what and how to do a job is theoretically a potent stressor (see Discussion, Chapter 3). However at both sites *uncertainty about work requirements* was associated with lower Stress scores and, while the effect size using multiple regression was quite small, it was statistically significant using LMM (two and three data repetitions). It is assumed that the direction of the sign has been influenced by an undetected suppressor variable as the bivariate correlations of this factor with the Stress score were not only positive but also significant\textsuperscript{97}. As is illustrated in Figure 11.4, there is a modest increase in Stress as uncertainty increases.

\textsuperscript{94}comfortable chair, desk height, furniture, workspace etc
\textsuperscript{95}interruptions and disruptions, environmental and informational impediments, career uncertainty, and uncertainty about own performance adequacy
\textsuperscript{96}interruptions and disruptions, and conflict
\textsuperscript{97}site one .201, p<.05 and site two .223, p<.05
While the effects were small and as expected, interruptions and disruptions, environmental and informational impediments, low workload variance, uncertainty about own performance adequacy and conflict, were all associated with higher Stress scores.

**Job Control & Variety**

Of the four factors in this domain, two factors were included in the final model for site one and one for site two. Overall, the F-change was 2.2% at site one and 3.6% at site two.

From a review of the literature it was assumed that Stress scores would be higher when motivating job control and variety (decision latitude, influence, work variety, skill utilisation) were lower. In both sites, skill utilisation levels was associated with lower Stress, reaching significance at site one using LMM (two repetitions). In both sites when people had influence over decisions which were affecting their work, they reported lower Stress scores. This is illustrated in Figure 11.5.
While decision latitude did not meet the inclusion criteria, the bivariate correlations with Stress was statistically significant for site two\(^{100}\). In comparable studies similar results have been found. For example, Baker, Israel, and Schuman’s (1996) study of the importance of demands, control and support reported that ‘depression’ and ‘negative job feelings’\(^{101}\) increased when there was poor ‘general contingency control’, and little ‘influence’ at the job level\(^{102}\) and low ‘decision authority’ (Baker et al., 1996:1152).

Pousette & Hanse (2002) found significant relationships between ‘psychological ill health’ and low levels of ‘job autonomy’ and ‘skill discretion’ amongst blue and white collar workers. Bültmann \textit{et al.} (2002) also found small effects of ‘low decision latitude’\(^{103}\) on ‘psychological distress’ for both women and men. Carayon (1993) found significant relationships between low job ‘control’\(^{104}\) and high ‘tension-anxiety’, and also with ‘depression’.\(^{105}\) In the same study, he reports that when there was poor ‘skill’ utilization there were higher ‘tension-anxiety’ and ‘depression’.

\(^{100}\) \(r=-.250, \text{ p } <.01\)
\(^{101}\) tense, frustrated, drained discouraged
\(^{102}\) using CES-D scale
\(^{103}\) this construct was a combination score of skill utilisation and autonomy
\(^{104}\) comparable to decision latitude
\(^{105}\) comparable to the SACL stress score
In a previously quoted study, de Jonge, Bosma, Peter and Siegrist (2000) found workers who have high psychological demands and high demands/low control (compared to those with high demands/high control) were three times more likely to report psychosomatic symptoms. When there were high demands/low rewards they were four times more likely to report symptoms of distress. Those with high physical demands and high demands/low control (compared to those with high demands/high control) were three times more likely to report psychosomatic symptoms. When there were high demands/low rewards they were five times more likely to report symptoms of distress.

Support

Of the five factors were grouped in the ‘support’ domain, two\textsuperscript{106} were included in the final model at both sites. The assumption was that when social and management support is perceived as lower, Stress scores will be higher. This was supported, and overall poor support was one of the strongest predictors of Stress at site one.

In the final models, even with other task and job variables and personal variables included, \textit{supervisor support} was one of the most powerful predictors of Stress at site one, reaching statistical significance using the LMM. While it did not reach significance, \textit{coworker support} was also associated with higher Stress scores at site one.

These results have been widely reported by others. For example, Baker \textit{et al.} (1996) found that when all work factors were considered together, ‘depression’ was much higher when there was poor ‘general contingency control’ and when there was poor affective coworker support. Klitzman and Stelman (1989) in a study of office workers (after controlling occupations, psychosocial working conditions and demographics) found that ‘generalised distress’ was related to decision latitude, supervisor support and coworker support. Jex and Thomas, (2003) remind us that “stressors in organisations are associated not only with individual-level strain”, but also with “more negative perceptions” of others in the work group. While the effect on team performance of stress was not measured, it is not unreasonable to assume that poor workplace relationships will also negatively affect team performance.

Effects of SPPCA

Within the JLM, it is assumed that SPPCA will reflect not only people’s perception of their own performance, but also indirectly capture those personal, non-work and work factors which, while not measured in this study, still contributed to ability to cope with the work demands. At both

\textsuperscript{106}coworker support, coworker cohesion, supervisor support, general level of supervisor support, senior management attitudes
sites, even after all other factors were entered, SPPCA was the strongest work factor predicting stress. In the MR the F-change at site one was 15.3% and site two 11.7%. That is, when SPPCA was poor, Stress was significantly higher.

This result accords with the view that as people become more stressed, their performance will deteriorate -except at that point where stress may still not be extreme and some anxiety may motivate people to overcome barriers to poor performance (see Chapter 14). When peoples’ appraisal is they are not meeting the performance standards, they are more likely to feel insecure and have poorer self-worth and efficacy, in turn escalating their feelings of stress. In turn, stress can be moderated by a positive ‘self-belief and efficacy’ (Jex & Bliese, 1999; Seeman et al., 1995) as might arise when SPPCA was high.

MEASUREMENT ISSUES

Stress was measured using the SACL scale created by Gotts & Cox (1988). While Gotts and Cox report a high Cronbach’s alpha of .90, in this study it was quite low for site one (.50), it was very good at site two (.93). Over the repeated rounds at site one the scale consistency varied (1=.58, 2=.85, 3=.22) with a Guttman Split-half =.46 and Alpha for part 1 =.23 and part 2 =.57. These values were much higher at site two (1=.93, 2=.94) and a Guttman Split-half =.88 and Alpha for part 1 =.90 and part 2 =.88. Overall, these results verify the underlying strong construct validity of this scale.

CONCLUSION

It was postulated that there would be increases or decreases in Stress scores associated with the various work factors. In the main, the expected relationships were confirmed and a significant proportion of the variance in Stress scores at both sites was predicted by the two personal and non-work, seventeen workplace factors, and SPPCA.

It was noteworthy that, as with other wellbeing measures, the temporal, specific, contextual demands and impediments explained proportionally more variance in Stress scores than did total hours worked, which challenges the common assumption that workload, as it relates to stress, can be represented simply by long working hours.

In both study sites, the collection of information about specific work demands provided interesting insights into the contribution they make to JobLoad and to stress. The JLM proposed
that impediments to performance would be perceived as frustrating and ultimately stressful; this proposition was well supported by the data.

The recognized central importance of job control and support (e.g. Baker, Israel, and Schumans, 1996) is such that few studies on work-related stress would fail to consider both. In this study, the expected relationships between the control factors and stress were confirmed, but the effect size was modest. In contrast, for this group of subjects, lack of support was one of the most powerful workplace predictors of stress at both sites.

A final note is that it is apparent from this study that while the demand, control and support factors were associated with stress as expected, inclusion of the specific work demands and of SPPCA – in accord with the JobLoad Model – was useful in explaining additional variance. If these are not measured, some of the variance explained by them may be erroneously attributed to organisational level factors with which they were correlated.

In this Chapter the effects of workplace factors on stress as measured by the SACL were considered. In a linking Chapter 12, the related concept of arousal will be discussed and, in Chapter 15, physiological indicators of stress (the adrenocortical hormones) will be discussed.
This chapter reports relationships between various dimensions of JobLoad and subjects’ arousal levels as represented by scores of that dimension from the SACL. Based on the JLM, it is hypothesised that arousal is an affect-neutral state which will vary with affective states to produce particular moods. The arousal score is an indicator of the underlying physiological state or activation and vigour. Results are presented for site one followed by site two, and the chapter concludes with a summary and discussion of results from both sites.

RESULTS: SITE ONE

The distribution of arousal scores for each of the three rounds combined is displayed in Figure 12.1, below. The distribution of scores are acceptably slightly negatively skewed with moderate kurtosis. A one-way ANOVA showed scores did not differ significantly between the three data collection rounds.

The mean score for arousal at site one was 31.2 (SD 8.8) which was close to the mean value of 31.9 (SD 8.3) reported by Gotts & Cox (1988:16) for an Australian sample derived from a heterogenous mix of subjects.
IDENTIFICATION OF FACTORS INFLUENCING AROUSAL

Preliminary Analyses

Bivariate correlations between arousal and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 12.1 of Appendix 12. The results of the preliminary multivariate analyses using MR and LMM as previously described are reported in Appendix 12.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses included:

- four of the six General and Temporal Demands: time pressure, too much to do, increasing workload pressure, and unpleasant working hours
- four of the seven Specific Work Demands: static physical demands, cognitive demands, demands for care and vigilance, dynamic physical demands
- one of the seven Contextual Demands and Impediments: career uncertainty
- three of the four Job Control and Variety factors: skill utilization, work variety, influence
- three of the five Support factors: supervisor support this week, general level of supervisor support last six months, supervisor and management attitudes and communication
- none of the six Personal and Non-work Variables.

MULTIVARIATE ANALYSES

Stepwise Sequential multiple regression analysis (round one data)

Results of the sequential multiple regression (MR) are summarised below and in Tables 12.1 and 12.2. All blocks within the sequence except the first were significant:

- Block one - Personal & Non-work Factors: $R^2 = .086, (F [2, 117] = .437, p = .647)$. Two factors were entered: stress at home and physical injuries however, these explained little variance.
- Block two - General and Temporal Job Demands: $R^2 = .394, (F [7, 112] = 2.946, p < .01)$. Five factors were entered: too much to do (z score), time pressure and deadlines (z score), increasing workload pressure (z score), unpleasant working hours (z score) and responsibility (z score). These factors accounted for 15% of the variance.
- Block three - Specific Work Demands: $R^2 = .469, (F [12, 107] = 2.516, p < .01)$. Five factors were entered: static physical demands (z score), dynamic physical demands (z score) demand for
care and vigilance (z score) cognitive demands (z score) and emotional demands (z score). These factors accounted for 6.5% of variance.

- Block four - Contextual Demands and Impediments: $R^2 = .479$, ($F[13, 106] = 2.434, p < .01$). One factor was entered conflict (z score) but explained little variance.

- Block five - Job Control and Variety: $R^2 = .514$, ($F[15, 104] = 2.485, p < .01$). Two factors were entered: skill utilization (z score) and influence (z score). These factors explained 3% of variance in scores.

- Block six - Support: $R^2 = .565$, ($F[19, 100] = 2.464, p < .01$). Three factors were entered: coworker support (z score), supervisor support (z score), and supervisor and senior management attitudes and communications (z score) explaining 5.5% of the variance.

- Block seven - SPPCA: $R^2 = .708$, ($F[20, 99] = 4.970, p < .01$). SPPCA (z score) was included as a single factor and explained approximately 18% of the variance in arousal scores.

Table 12.2 shows that the F-changes between blocks in the above sequence were significant (in red) at the second and seventh blocks.

<table>
<thead>
<tr>
<th>Table 12.1. Models of Arousal &amp; Significant IVs (site one, round one)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Block One- Personal &amp; Non-work factors</td>
</tr>
<tr>
<td>Block Two- General &amp; Temporal Job Demands</td>
</tr>
<tr>
<td>Block Three- Specific Work Demands</td>
</tr>
<tr>
<td>Block Four- Contextual Demands Impediments</td>
</tr>
<tr>
<td>Block Five- Job Control &amp; Variety</td>
</tr>
<tr>
<td>Block Six- Support</td>
</tr>
<tr>
<td>Block Seven- SPPCA</td>
</tr>
</tbody>
</table>

Table 12.3 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients ($\text{s}r^2$), and $R^2$ and adjusted $R^2$ values for the factors in the above regression analysis.

With this combination of variables, static physical demands and SPPCA (in red) differed significantly from zero, and their unique contribution to the $R^2$ was .210. One factor (in blue) reached significance levels between .05 and .10; unpleasant working hours. The other IVs in combination contributed another .291 in shared variability. Thus a total of 50.1% (40% adjusted) of the variability in arousal scores were predicted by these variables.
However, of note is the large regression coefficient for stress at home, unpleasant working hours, coworker and supervisor support, which was associated with changes in arousal scores. With a larger sample size this factor may have become significant.

Table 12.2 Sequential Multiple Regression with Arousal and Significant IVs (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>β</th>
<th>Sig.</th>
<th>sri2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Injury</td>
<td>.693</td>
<td>2.207</td>
<td>0.025</td>
<td>.754</td>
<td>.022</td>
</tr>
<tr>
<td>Stress at Home</td>
<td>-2.43</td>
<td>1.810</td>
<td>-0.116</td>
<td>.181</td>
<td>0.096</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td>.774</td>
<td>1.445</td>
<td>0.062</td>
<td>.593</td>
<td>0.038</td>
</tr>
<tr>
<td>Too Much Work to do</td>
<td>.922</td>
<td>1.492</td>
<td>0.071</td>
<td>.538</td>
<td>0.044</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>.885</td>
<td>1.096</td>
<td>0.079</td>
<td>.421</td>
<td>0.057</td>
</tr>
<tr>
<td><strong>Unpleasant Working Hours</strong></td>
<td>-1.94</td>
<td>.993</td>
<td>-0.174</td>
<td>.053</td>
<td>0.139</td>
</tr>
<tr>
<td>Responsibility</td>
<td>1.06</td>
<td>1.066</td>
<td>0.091</td>
<td>.320</td>
<td>0.071</td>
</tr>
<tr>
<td>Static Physical Demands</td>
<td>-2.70</td>
<td>1.130</td>
<td>-0.248</td>
<td>0.019</td>
<td>0.170</td>
</tr>
<tr>
<td>Dynamic Physical Demands</td>
<td>1.25</td>
<td>1.018</td>
<td>0.094</td>
<td>0.221</td>
<td>0.087</td>
</tr>
<tr>
<td>Demand for Care and Vigilance</td>
<td>-3.54</td>
<td>1.663</td>
<td>-0.022</td>
<td>.832</td>
<td>0.015</td>
</tr>
<tr>
<td>Cognitive Demand</td>
<td>.125</td>
<td>1.062</td>
<td>0.011</td>
<td>.907</td>
<td>0.008</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>.360</td>
<td>1.063</td>
<td>0.031</td>
<td>.736</td>
<td>0.024</td>
</tr>
<tr>
<td>Conflict This Week</td>
<td>1.72</td>
<td>1.184</td>
<td>0.139</td>
<td>.148</td>
<td>0.104</td>
</tr>
<tr>
<td>Influence</td>
<td>.422</td>
<td>1.235</td>
<td>0.033</td>
<td>.734</td>
<td>0.024</td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>.450</td>
<td>1.096</td>
<td>0.036</td>
<td>.682</td>
<td>0.029</td>
</tr>
<tr>
<td>Coworker Support</td>
<td>1.55</td>
<td>1.206</td>
<td>0.133</td>
<td>.202</td>
<td>0.091</td>
</tr>
<tr>
<td>Supervisor Support this week</td>
<td>1.14</td>
<td>1.044</td>
<td>0.010</td>
<td>.274</td>
<td>0.078</td>
</tr>
<tr>
<td>General Supervisor Support last six months</td>
<td>1.80</td>
<td>1.104</td>
<td>0.157</td>
<td>.106</td>
<td>0.116</td>
</tr>
<tr>
<td>Senior Mgmt Attitudes Communications</td>
<td>.828</td>
<td>1.071</td>
<td>0.070</td>
<td>.441</td>
<td>0.055</td>
</tr>
<tr>
<td><strong>SPPCA</strong></td>
<td><strong>5.41</strong></td>
<td><strong>.900</strong></td>
<td><strong>.508</strong></td>
<td><strong>.000</strong></td>
<td><strong>.427</strong></td>
</tr>
</tbody>
</table>

F [20, 99] = 4.970, p < .01
Intercept = 32.796 (1.54)

Unique variability = .210 Shared variability = .291

R = .708 R^2 = .501 Adjusted R^2 = .400

Linear Mixed Model Analyses (two and three repetitions)

Using LMM the following variables were associated with the greatest changes in the arousal scores (see Table 12.3). Arousal scores were higher (% per unit change in arousal) when:

- **general supervisor support** was higher(with both repetitions by 4.8% and 4%)
- **SPPCA** was better (with both repetitions by 14%)

The factor demand for care and vigilance and skill utilization approached significance between the .05 to .10 level
Table 12.3. Estimates of Fixed Effects for Arousal with Significant IVs (site one, two and three repetitions)

<table>
<thead>
<tr>
<th></th>
<th>Two Repetitions (n =103)</th>
<th>Three Repetitions (n = 71)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Effects (%)</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Fixed Effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>32.39</td>
<td>2.01</td>
</tr>
<tr>
<td>No Stress at home</td>
<td>.97 (2.7)</td>
<td>1.22</td>
</tr>
<tr>
<td>Stress at home</td>
<td>0(a)</td>
<td>0</td>
</tr>
<tr>
<td>Physical injury</td>
<td>1.40 (3.9)</td>
<td>2.05</td>
</tr>
<tr>
<td>No Physical injury</td>
<td>0(a)</td>
<td>0</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td>.68 (1.9)</td>
<td>1.23</td>
</tr>
<tr>
<td>Too Much Work To Do</td>
<td>-1.39 (3.8)</td>
<td>1.18</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>.866 (2.4)</td>
<td>.82</td>
</tr>
<tr>
<td>Unpleasant Work Hours</td>
<td>-.139 (0.3)</td>
<td>.73</td>
</tr>
<tr>
<td>Responsibility</td>
<td>1.05 (2.9)</td>
<td>.81</td>
</tr>
<tr>
<td>Static Physical Demands</td>
<td>-.734 (2.0)</td>
<td>.91</td>
</tr>
<tr>
<td>Dynamic Physical Demands</td>
<td>1.01 (2.8)</td>
<td>.79</td>
</tr>
<tr>
<td>Demand Care &amp; Vigilance</td>
<td>-2.20 (6.1)</td>
<td>1.26</td>
</tr>
<tr>
<td>Cognitive Demands</td>
<td>1.00 (2.7)</td>
<td>.80</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>1.01 (2.8)</td>
<td>.86</td>
</tr>
<tr>
<td>Conflict</td>
<td>.618 (1.7)</td>
<td>.87</td>
</tr>
<tr>
<td>Influence</td>
<td>.939 (2.6)</td>
<td>.92</td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>1.04 (2.9)</td>
<td>.87</td>
</tr>
<tr>
<td>Coworker Support</td>
<td>.002 (0.0)</td>
<td>.87</td>
</tr>
<tr>
<td>Supervisor Support</td>
<td>.202 (0.5)</td>
<td>.88</td>
</tr>
<tr>
<td>General Supervisor Support</td>
<td>1.74 (4.8)</td>
<td>.89</td>
</tr>
<tr>
<td>last six mths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior Management Attitudes</td>
<td>.766 (2.1)</td>
<td>.84</td>
</tr>
<tr>
<td>&amp; Communications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPPCA</td>
<td>4.94 (13.7)</td>
<td>.70</td>
</tr>
</tbody>
</table>
RESULTS: SITE TWO

Figure 12.2, shows the distribution of scores from all data collection rounds for site two, where it can be seen that there was a slight negative skew and kurtosis. A one-way ANOVA showed scores did not differ significantly between the two rounds.

![Figure 12.2. Distribution of Arousal Scores (site two)](image)

The overall mean for arousal at site one was 32.0 (SD 7.9) which was close to the value of 31.9 (SD 8.3) reported by Gotts & Cox (1988:16) for an Australian sample.

IDENTIFICATION OF FACTORS INFLUENCING AROUSAL

Preliminary Analyses

Bivariate correlations between arousal and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 12.1 of Appendix 12. The results of the preliminary multivariate analyses, using MR and LMM as previously described, are reported in Appendix 12.
Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses were:

- None of the six General and Temporal Demands cf at site one: time pressure, too much to do, increasing workload pressure, and unpleasant working hours
- two of the seven Specific Work Demands: cognitive demands, errors have important consequences cf at site one: static physical demands, cognitive demands, demands for care and vigilance, dynamic physical demands
- none of the seven Contextual Demands and Impediments cf at site one: career uncertainty
- one of the four Job Control and Variety: skill utilization cf site one: skill utilization, work variety, influence
- two of the five Support factors: supervisor support this week, general level of supervisor support last six months cf site one: supervisor support this week, general level of supervisor support last six months, supervisor and management attitudes and communications
- none of the six Personal and Non-work Variables same as site one.

MULTIVARIATE ANALYSES

Stepwise Sequential multiple regression analysis (round one data)

Results of the sequential multiple regression (MR) are summarised below and in Tables 12.4 and 12.5. In the model all blocks except the first two were significant:

- Block one - Personal & Non-work Factors: \( R^2 = .012, (F_{1, 47} = .553, p = .461) \). One factor was entered: physical injury, however this explained little variance.

- Block two - General and Temporal Job Demands: \( R^2 = .047, (F_{3, 45} = .741, p = .533) \). Two factors were entered: total hours worked (z score) and time pressure and deadlines (z score). These explained 3.5% of the variance in arousal scores.

- Block three - Specific Work Demands: \( R^2 = .214, (F_{5, 43} = 2.339, p = .058) \). Two factors were entered: cognitive demands (z score) and errors have important consequences (z score). These accounted for 16.7% of variance in arousal scores.
• Block four - Contextual Demands and Impediments: \( R^2 = .253, (F [6, 43] = 2.375, p < .05) \). Since none of the factors were significant a general impediments score was entered representing all factors within that domain. This accounted for 4% of the variance.

• Block five - Job Control and Variety: \( R^2 = .289, (F [7, 41] = 2.381, p < .05) \). One factor was entered influence (z score). This factor explained 3.6% of the variance in arousal.

• Block six - Support: \( R^2 = .324, (F [9, 39] = 2.076, p < .06) \). Two factors were entered these were supervisor support (z score), and senior management attitudes and communication (z score). This explained 3.5% of the variance in scores.

• Block seven - SPPCA: \( R^2 = .385, (F [10, 38] = 2.375, p < .05) \). SPPCA explained 6.1% of the variance in arousal.

Table 12.4 shows that the F-changes between blocks in the above sequence were significant at the third and approached significance at the seventh blocks.

<table>
<thead>
<tr>
<th>Block one – Personal &amp; Non-work factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two – General &amp; Temporal Job Demands</td>
<td>.047</td>
<td>.035</td>
<td>.837</td>
<td>.440</td>
</tr>
<tr>
<td><strong>Block three – Specific Work Demands</strong></td>
<td>.214</td>
<td>.167</td>
<td>4.559</td>
<td>.016</td>
</tr>
<tr>
<td>Block four – Impediments Score</td>
<td>.253</td>
<td>.040</td>
<td>2.222</td>
<td>.144</td>
</tr>
<tr>
<td>Block five – Job Control &amp; Variety</td>
<td>.289</td>
<td>.036</td>
<td>2.061</td>
<td>.159</td>
</tr>
<tr>
<td>Block six – Supports</td>
<td>.324</td>
<td>.035</td>
<td>1.005</td>
<td>.375</td>
</tr>
<tr>
<td><strong>Block seven – SPPCA</strong></td>
<td>.385</td>
<td>.061</td>
<td>3.747</td>
<td>.060</td>
</tr>
</tbody>
</table>

Table 12.5 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient (β), the semipartial correlation coefficients (sr_i^2) and \( R^2 \), and adjusted \( R^2 \) value for this set of constructs.

With this combination of variables, errors have important consequences (in red) differed significantly from zero, and its unique contribution to the \( R^2 \) was .066. Two factors (in blue) reached significance levels of between .05 and .10, time pressure and deadlines and SPPCA. The other IVs in combination contributed another .319 in shared variability. Thus a total of 38.5% (22.3% adjusted) of the variability in arousal scores were predicted by these IVs.

---

107 As this has been found by others to be significant
Table 12.5. Stepwise Sequential MR of Arousal with Significant IVs (site two, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>β</th>
<th>Sig.</th>
<th>sri2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Injuries</td>
<td>1.59 (0.9)</td>
<td>2.91</td>
<td>-0.078</td>
<td>.588</td>
<td>-0.070</td>
</tr>
<tr>
<td>Total Hours Worked</td>
<td>1.01 (1.3)</td>
<td>1.05</td>
<td>0.154</td>
<td>.343</td>
<td>.122</td>
</tr>
<tr>
<td><strong>Time Pressure and Deadline</strong></td>
<td><strong>2.60 (1.8)</strong></td>
<td><strong>1.36</strong></td>
<td><strong>0.336</strong></td>
<td><strong>0.063</strong></td>
<td><strong>0.243</strong></td>
</tr>
<tr>
<td>Cognitive Demands</td>
<td>1.03 (1.1)</td>
<td>1.28</td>
<td>0.134</td>
<td>.425</td>
<td>.103</td>
</tr>
<tr>
<td><strong>Errors have important consequences</strong></td>
<td><strong>-2.53 (2.1)</strong></td>
<td><strong>1.25</strong></td>
<td><strong>-0.360</strong></td>
<td><strong>0.051</strong></td>
<td><strong>-0.257</strong></td>
</tr>
<tr>
<td>Impediments Score</td>
<td>.163 (1.2)</td>
<td>1.22</td>
<td>0.026</td>
<td>.895</td>
<td>.017</td>
</tr>
<tr>
<td>Influence</td>
<td>-.350 (0.9)</td>
<td>1.24</td>
<td>-.049</td>
<td>.779</td>
<td>-.036</td>
</tr>
<tr>
<td>Supervisor Support last six months</td>
<td>.827 (1.1)</td>
<td>1.26</td>
<td>.116</td>
<td>.518</td>
<td>.083</td>
</tr>
<tr>
<td>Senior Management Attitudes Communications</td>
<td>1.49 (1.9)</td>
<td>1.22</td>
<td>.217</td>
<td>.229</td>
<td>.156</td>
</tr>
<tr>
<td><strong>SPPCA</strong></td>
<td><strong>1.95 (2.6)</strong></td>
<td><strong>1.01</strong></td>
<td><strong>.279</strong></td>
<td><strong>.060</strong></td>
<td><strong>.246</strong></td>
</tr>
</tbody>
</table>

$F [11, 40] = 2.767, \ p < .01$

Intercept $=31.628 \ (31.9)$ SE 1.03

Unique Variance .066
Shared Variance .319

R = .620
$R^2 = .385$
Adjusted $R^2 = .223$

**Linear Mixed Model Analyses (two repetitions)**

To maintain an acceptable ratio of cases to variables, only significant variables from the most centrally important domains were included in linear mixed model (LMM) analyses, as shown in Table 12.6. Some variables included in the multiple regression but which had low effect sizes, were omitted to meet the subject-to-variables ratios. Statistically significant variables are indicated in red; with this combination of variables only SPPCA was significant. Arousal scores were higher (by approximately 9.7%) when SPPCA was higher.

Table 12.6. Estimates of Fixed Effects of Arousal with Significant IVs (Site Two)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n = 66)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Effects (%)</td>
</tr>
<tr>
<td>Intercept</td>
<td>33.47 (69.7)</td>
</tr>
<tr>
<td>Physical Injury</td>
<td>2.02 (4.2)</td>
</tr>
<tr>
<td>No Physical injury</td>
<td>-0(a)</td>
</tr>
<tr>
<td>Time Pressure</td>
<td>.459 (0.9)</td>
</tr>
<tr>
<td>Cognitive Demands</td>
<td>.562 (1.1)</td>
</tr>
<tr>
<td>Errors have Important Consequences</td>
<td>-.687 (1.4)</td>
</tr>
<tr>
<td>Impediments Score</td>
<td>-.836 (1.4)</td>
</tr>
<tr>
<td>Senior Management Attitudes Communications</td>
<td>1.18 (1.7)</td>
</tr>
<tr>
<td><strong>SPPCA</strong></td>
<td><strong>4.46 (9.3)</strong></td>
</tr>
</tbody>
</table>


OVERVIEW OF RESULTS: BOTH SITES

Table 12.7 shows levels of arousal scores (means, SDs) for each of the sites, with virtually the same means reported in both sites. A one-way ANOVA confirmed that arousal scores did not differ significantly between the two sites.

Table 12.7. Means of Arousal Scores (both sites all rounds)

<table>
<thead>
<tr>
<th>Round</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whole sample mean (SD)</td>
<td>n</td>
</tr>
<tr>
<td>Round 1</td>
<td>31.7 (8.8)</td>
<td>120</td>
</tr>
<tr>
<td>Round 2</td>
<td>31.0 (8.9)</td>
<td>103</td>
</tr>
<tr>
<td>Round 3</td>
<td>30.3 (8.8)</td>
<td>71</td>
</tr>
<tr>
<td>Grand Mean</td>
<td>31.1 (8.8)</td>
<td>294</td>
</tr>
</tbody>
</table>

Table 12.8 presents key results from both sites. These are discussed below in relation to each of the main domains, followed by a more general discussion and conclusions from these analyses. Data from two groups of subjects in two different work organisations are reported separately. Overall, a small proportion of the variance in arousal scores was explained by the two personal and non-work factors and the seventeen work factors and SPPCA. At site one, this percent variance was approximately 50.1% (using $R^2$) and 40% (using adjusted $R^2$) and, at site two, approximately 38.5% (using $R^2$) and 22.3% (using adjusted $R^2$) of the variance in arousal scores.
Table 12.8. Significant IVS Factors predicting Arousal Scores – (both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site One (LMM 2 repetitions n = 103)</th>
<th>Site One (LMM 3 repetitions n = 71)</th>
<th>Site Two</th>
<th>Site Two (LMM 2 repetitions n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>32.796</td>
<td>32.39</td>
<td>31.18</td>
<td>31.628</td>
<td>33.47 (69.7)</td>
</tr>
<tr>
<td><strong>Personal &amp; Non-work variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Injury</td>
<td>2.43 (6.7)</td>
<td>.116</td>
<td>1.40 (3.9)</td>
<td>1.59(0.9)</td>
<td>.078</td>
</tr>
<tr>
<td>Stress at Home</td>
<td>-.693 (1.9)</td>
<td>-.025</td>
<td>-.97 (2.7)</td>
<td>-.217 (0.69)</td>
<td></td>
</tr>
<tr>
<td><strong>General Job Demands (High)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Working Hours</td>
<td>.774 (2.1)</td>
<td>.062</td>
<td>.68 (1.9)</td>
<td>2.60(1.8)</td>
<td>.336</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td>.922 (2.5)</td>
<td>.071</td>
<td>-.139 (3.8)</td>
<td>.248 (0.69)</td>
<td></td>
</tr>
<tr>
<td>Too Much to Do</td>
<td>.885 (2.4)</td>
<td>.079</td>
<td>.866 (2.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-.693 (1.9)</td>
<td>-.025</td>
<td>-.97 (2.7)</td>
<td>-.217 (0.69)</td>
<td></td>
</tr>
<tr>
<td>Unpleasant Working Hours</td>
<td>-1.94 (5.4)</td>
<td>-.174</td>
<td>-.139 (0.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility</td>
<td>1.06 (2.9)</td>
<td>.091</td>
<td>1.05 (2.9)</td>
<td>.992 (2.7)</td>
<td></td>
</tr>
<tr>
<td><strong>Specific Work Demands (High)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static Physical Demand</td>
<td>2.70(7.5)**</td>
<td>-.248</td>
<td>-.734 (2.0)</td>
<td>-.945 (2.6)</td>
<td></td>
</tr>
<tr>
<td>Dynamic Physical Demands and Risks</td>
<td>1.25 (3.4)</td>
<td>.094</td>
<td>1.01 (2.8)</td>
<td>1.02 (2.8)</td>
<td></td>
</tr>
<tr>
<td>Demand for Care and Vigilance</td>
<td>-.354 (0.9)</td>
<td>-.022</td>
<td>-2.20 (6.1)</td>
<td>-.104 (0.2)</td>
<td></td>
</tr>
<tr>
<td>Cognitive Demands</td>
<td>.125 (0.3)</td>
<td>.011</td>
<td>1.00 (2.7)</td>
<td>-.63 (1.7)</td>
<td>1.03(1.1)</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>.360 (1.0)</td>
<td>.031</td>
<td>1.01 (2.8)</td>
<td>.345 (0.96)</td>
<td></td>
</tr>
<tr>
<td>Errors have important consequences</td>
<td>-2.53(2.1)*</td>
<td>-.360</td>
<td></td>
<td>-.687 (1.4)</td>
<td></td>
</tr>
</tbody>
</table>

DV: Arousal % approximate only  * p <.05 ** p <.01; blue significance levels between .05 and 1.

Table 12.8 continued on next page….
Table 12.8. Significant IVS Factors predicting Arousal Scores (both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR (n = 120)</td>
<td>LMM (2 repetitions n = 103)</td>
</tr>
<tr>
<td>Intercept</td>
<td>32.796</td>
<td>32.39</td>
</tr>
<tr>
<td></td>
<td>Estimated effects (%)</td>
<td>Estimated effects (%)</td>
</tr>
<tr>
<td>Contextual Demands and Impediments (High)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impediments Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conflict</td>
<td>1.72 (4.7)</td>
<td>.139</td>
</tr>
<tr>
<td>Job Control &amp; Variety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influence</td>
<td>.422 (1.1)</td>
<td>.033</td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>.450 (1.2)</td>
<td>.036</td>
</tr>
<tr>
<td>Supports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coworkers Support -this week</td>
<td>1.55 (4.3)</td>
<td>.133</td>
</tr>
<tr>
<td>Supervisor Support this week</td>
<td>1.14 (3.2)</td>
<td>.102</td>
</tr>
<tr>
<td>General Supervisor Support</td>
<td>1.80 (5.0)</td>
<td>.157</td>
</tr>
<tr>
<td>Senior Management Attitudes</td>
<td>.828 (2.3)</td>
<td>.070</td>
</tr>
<tr>
<td>Supports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPPCA</td>
<td>5.41 (15.0)**</td>
<td>.508</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$R^2$</td>
<td>.501</td>
</tr>
<tr>
<td></td>
<td>$Adjusted R^2$</td>
<td>.400</td>
</tr>
<tr>
<td>DV: Arousal</td>
<td>% approximate only</td>
<td>* p &lt; .05 ** p &lt; .01; blue significance levels between .05 and 1.</td>
</tr>
</tbody>
</table>
Additional Data from Job Description

Job Type and Level

Significant differences in arousal scores between the job types (both sites combined) were detected ($F[4,377] = 3.250, p < .01$) at site one, but not site two. These are outlined in Chapter 7 (details can be found in Appendix 8, Tables 7.115-117).

In summary, the IT officers had the highest arousal scores and the communications and help-desk officers the lowest. As observed in Table 12.8 two of the strongest predictors of low arousal scores were high static physical demands and unpleasant working hours. Both these factors were most prominent for communications officers who were required to continuously monitor screens, with few opportunities for breaks, and to undertake shift work. The IT officers had the highest arousal scores and also experienced high temporal demands, the best skill utilisation and generally good levels of supervisor support.

Significant differences in arousal scores between the job levels were detected at site one but not site two ($F[3, 290] = 4.780, p < .01$), again these are outlined in Chapter 7 (see Appendix 8, Tables 7.108-110.). The highest arousal scores were reported by the most senior subjects (Job Level Three-four) and by the Contractors and the junior subjects (Job Level One).

REVIEW AND DISCUSSION OF RESULTS

The SACL arousal scores were considered an indicator of the person’s physiological state of preparedness for activity, which is an essential requirement for, but also an outcome of, work-related activity (Hockey, 1997; Kahneman, 1973). While arousal is affect ‘neutral’, when paired with affective states it can combine to create ‘moods’ which themselves are perceived as either psychologically unpleasant or pleasant (Gotts & Cox, 1988). In the JLM at work, moderately high levels of arousal are viewed as desirable, reflecting a positive vigorous state of activation.

The overall mean score for arousal at both sites matched that for an Australian sample (Gotts & Cox, 1988). As expected, given the arousing nature of work activity, scores were skewed toward higher ranges.

Effects of Personal & Non Work Variables

These factors were entered into the first block of the sequential regressions and included in linear mixed analyses. At both sites, arousal scores were higher when subjects reported that they has a physical injury, and lower when there was stress at home, however neither was significant.

Together these demands explained (using F-change) nothing at site one and very little at site two.
Effects of the Work Demands

General and Temporal Job Demands

Of the six factors in this domain, five factors were included in the final model for site one \(^{108}\) and two for site two \(^{109}\). Overall, the F-change was large and significant at site one (14.8%) but small non-significant at site two (3.5%).

The most powerful factor in this group was *unpleasant working hours* and arousal scores were *lower* when there was a perceived need to work at inconvenient times. It is assumed that this was due to increasing tiredness and the impact of circadian rhythms. Stronger effects were evident at site one where people were required to work longer hours, undertake shift work, and the organisation was currently undergoing ‘downsizing’.

*Time pressure and deadlines* was associated with higher arousal scores at both sites, and this approached significance at site two. In site one, having *too much to do* was associated with higher arousal scores.

One of the few workplace studies reported which explores the effects of temporal demands on arousal (as conceptualised in the SACL) is Macdonald (2003). In this study of manufacturing workers in 22 sites, she reported that the main significant predictors of arousal were working to ‘deadlines’, high ‘effort’ \(^{110}\) (using TLX effort scale) and the ‘motivating potential score’ \(^{111}\). She interpreted the increases in arousal scores when there were deadlines, as subjects’ perceiving the deadlines as ‘enjoyable challenges’ rather than as unpleasant work demands.

It had been hypothesised that arousal scores would be higher when general quantitative work demands were perceived as high (in relation to perceived performance capacity). At site one, *increasing workload pressure* was associated with higher arousal scores. While arousal scores did also increase at site two when the *total working hours* were higher, the effect was marginal.

As this may have been due to curvilinear relationship between *total hours worked* and arousal (that is extremes of either low or high working hours being associated with low arousal levels) arousal scores at five different working hours groups were compared (see Figure 12.3).

---

\(^{108}\) *time pressure and deadlines, too much to do in the available time, increasing workload pressure, unpleasant working hours and responsibility*

\(^{109}\) *total hours worked and responsibility*

\(^{110}\) *includes work hard big effort which are in this studies factor *time pressure and deadlines*

\(^{111}\) *a high MPS score shows evidence of all five core job characteristics including ‘skill variety’, ‘task identity’, and ‘task significance’ ‘autonomy’ and ‘feedback’ Hackman & Oldham (1976;1980)*
Figure 12.3. Box Plot of Working Hours and Arousal Scores (Both Sites)

From the Figure 12.3, the relationship between arousal and total hours worked appears linear and this was confirmed by a one way ANOVA\(^\text{112}\). However, a post-hoc evaluation (using Tukey HSD) between arousal scores and working hours only approached significance between the groups: <35 hours pw week and > 66 hours per week\(^\text{113}\). This suggests that only at these very low or high working hours will there be an impact on arousal levels. At both sites, higher responsibility was associated with increased arousal scores.

Daniels (2000) examined aspects of wellbeing including ‘energy/vitality’\(^\text{114}\) (items overlapping with arousal and Burnout) where he reported significant relationships between high ‘energy/vitality’ and ‘workload’\(^\text{115}\), and for university employees between ‘energy/vitality’ and ‘under/overload’\(^\text{116}\).

Specific Work Demands

Of the six factors in this domain, five factors were included in the final model for site one\(^\text{117}\) and two for site two\(^\text{118}\). The F-change at site one was small (6.5%) but substantial at site two (16.7%), with the strongest effects on arousal observed with static physical demands, dynamic physical demands, and a demand for care and vigilance.

---

\(^{112}\) F\([4,377]\) = 2.995, p < .01

\(^{113}\) Mean difference = -.536, p = .056.

\(^{114}\) ‘tired, fatigued, sleep, active, alert, full of energy, angry’ mean = 48.07, SD = 21.79

\(^{115}\) Daniels & Guppy (1995) measure μ = 8.12, SD 3.33; partial correlation = .20, p < .001

\(^{116}\) partial correlation = .13, p < .001

\(^{117}\) cognitive demands, static physical demands, dynamic physical demands, demand for care and vigilance, emotional demands

\(^{118}\) cognitive demands, and errors have importance consequences
All subjects undertook computer-based activity, which objectively had high static physical and perceptual demands (termed in this study *demands for care and vigilance*). As expected, whenever peoples’ work involved considerable *static physical demands* and/or *demand for care and vigilance*, arousal scores were lower. It is likely that both these results can be attributed to reduced physiological arousal associated with prolonged sitting when these demands are present.

McAtamney (1994) while examining the risk factors for upper limb disorders in VDU operators, reported that SACL arousal scores were significantly lower when subjects were exposed to the combined effects of, ‘poor posture’ (which included static muscle loading), task pacing and low cognitive content.

At both sites, arousal scores increased when there were high *dynamic physical demands and risks* and this factor was included in the final model in site one, increasing arousal scores by approximately 3%.

Macdonald (2003) in her studies of 22 worksites using the SACL has reported relationships between arousal and high ‘postural demands’119, and ‘working carefully’120, although neither reached significance. She observed that while arousal was influenced by ‘workload’ levels it was better predicted by job demands such as ‘effort’ and by specific task demands such as the need to work carefully.

In site two, arousal scores were higher when *errors had important consequences*, reaching significance at site two. This result was not expected as importance tasks were assumed to be relatively more arousing.

**Contextual Demands and Impediments**

Of the seven factors in this domain, only one factor was included in the final model at each site. At site one the factor *conflict* and at site two *impediments* score was used. The F-change indicated that these factors contributed virtually nothing to the variance explained at site one and 4% at site two. Arousal scores were higher in site one when there was workplace *conflict* and at site two when the score for *impediments* was included.

This was one of the few outcomes where factors in this domain contributed very little to explaining variance.

119 mix of dynamic and static physical demands
120 similar to the *demand for care and vigilance*
Job Control and Variety

Of the four factors in this domain, two factors were included in the final model for site one\textsuperscript{121} and one for site two.\textsuperscript{122} Based on the F-change these factors explained approximately 3.4\% and 3.6\% of the variance in arousal scores.

Based on the JLM, it was expected that arousal would be higher when motivating job control and variety such as decision latitude, influence, work variety, skill utilisation were higher. Skill utilisation and influence were associated with higher arousal scores at both sites. So when people perceived that they are given adequate opportunities to use their skills and knowledge and to participate in organisational level decision making, there was a concurrent increase in arousal levels as they ‘engaged’ and invested greater effort.

A small non-significant relationships between high ‘energy/vitality’ and (good) ‘job autonomy’\textsuperscript{123} (partial correlation=.01, ns) were also reported by Daniels (2000) in a study of university employees.

Support

Of the five factors in this domain, four factors were included in the final model for site one\textsuperscript{124}, and two at site two\textsuperscript{125}. The F-change in the MR indicated that these factors together contributed 5.8\% at site one and 3.5\% at site two, to the variance in arousal scores.

As expected, social and management support was perceived as good as arousal scores were higher. In site one, coworker support was associated with higher arousal scores. A similar size but stronger effect was also found in site one for general supervisor support which reached significance using LMM.

Daniels (2000) reported finding statistically significant relationships between high ‘energy/vitality’ with (good) ‘help support’\textsuperscript{126} (partial correlation .14, p <0.01) for a sample social-services employees.

\textsuperscript{121} skill utilization, and
\textsuperscript{122} influence
\textsuperscript{123} Haywood-Farmer & Stuart (1990) four-item task independence scale (mean = 21.55, SD = 4.70).
\textsuperscript{124} coworker support, supervisor support, general level of supervisor support last six months, supervisor and senior management attitudes and communications last six months
\textsuperscript{125} supervisor support, and general level of supervisor support last six months
\textsuperscript{126} adapted from Caplan et al. (1975) and Daniels & Guppy (1995)
Effects of SPPCA

After all factors in the above domains were added, SPPCA was still the strongest predictor of arousal. The F-change in the MR indicated that SPPCA contributed 18.2% at site one and 6.1% at site two to the variance explained in arousal scores.

While SPPCA appeared to influence arousal scores, it is also likely that people who are perform well are also more likely to be more aroused (Yerkes-Dodson, 1908; Broadbent, 1971; Kahneman, 1973).

To explore if high arousal was associated with good performance and low arousal with poor performance, SPPCA was divided into three groups ‘very good’, ‘average’ and ‘very poor’. The ANOVA confirmed that there were significant differences in arousal levels between these groups\textsuperscript{127}. However, Figure 12.4 shows the relationship is linear rather than curvilinear as has been proposed by others (for example Broadbent, 1971 and Kahneman, 1973).

![Box Plot of SPPCA Scores & Arousal](image)

\textbf{Figure 12.4. Box Plot of SPPCA Scores & Arousal}

Nevertheless, given that 80% of people rated their SPPCA as \textit{average to extremely good}, some caution should be shown interpreting results of those in the very poor group, although the pattern is consistent across all groups (see Chapter 14).

\textsuperscript{127} F \([2,379] = 46.579, p < .01\)
MEASUREMENT ISSUES

The SACL was created by Gotts & Cox (1988) for use as a field tool to measure psychological Stress and arousal. It proved easy to use and its validity and reliability has been independently confirmed by other (see Van Karwyk, Fox, Spector and Kelloway, 2002). But to date its relatively infrequent citation in the literature has made it more difficult to compare the result of this study with others using the same measure.

The Cronbach’s alpha for the arousal scale reported by Gotts & Cox (1988) was .90 and was found in this study to be, for site one, .76 and .93 at site two. The scale consistency over the repeated rounds at site one was good (round 1=.64, 2=.89, 3=.83) and a Guttman Split-half =.76 and Alpha for part 1 =.73 and part 2 =.55; and at site two of (round 1=.84, 2=.89) and a Guttman Split-half =.87 and Alpha for part 1 =.67 and part 2 =.81), suggesting good construct validity.

CONCLUSIONS

Overall, a modest proportion of the variance in Arousal scores at both sites was predicted by the factors measured. The most powerful predictors of Arousal at these sites were SPPCA, unpleasant working hours, static physical demands, demand for care and vigilance, and supervisor support.

Given that Kahneman’s (1973) original model of attention explicitly identified physiological arousal as a factor in attentional capacity (and implicitly performance), it was therefore of interest that SPPCA was amongst the strongest predictors of arousal in these samples.

A review of the literature indicated that there are very few studies which examine the impact on arousal as conceptualised by Gotts and Cox (1988) on the range of factors considered in this study.

This study has revealed some of the job factors which may have an impact on arousal levels. When considering workloads of whole jobs, these results indicate it is important to understand how the specific task demands will impact on employee arousal. In both study sites, the collection of information about these factors provided interesting insights into the contribution they can make on JobLoad, Arousal, Stress, and the opportunities for job redesign.
This chapter reports the relationships between various dimensions of JobLoad and Job Satisfaction, reflecting the subject’s cognitive judgment about the adequacies or inadequacies of the job, the organisation, working environment, interactions with others and the perceived equity of treatment and rewards for effort (Oshagebemi, 1999; Wanous, Reichers & Hudy, 1997).

Satisfaction is viewed as being on a continuum from a highly dissatisfied to a highly satisfied state. However, except in extreme situations, most individuals will sit at a point dictated by their normal dispositional state, until specific events occur to alter this to one of more or less satisfied (Schwartz & Strack, 1999).

The JLM proposes that ‘work-related satisfaction’ is an outcome of a good ‘fit’ (or an adequate margin) between work demands, the individual’s coping capacities, the job motivators and the person’s goals and attitudes.

For this study, measures of satisfaction were derived from components of the Job Diagnostic Survey (Hackman & Oldman, 1980), and NIOSH Generic Job Stress Questionnaire (Hurrell & McLaney, 1988) in the main section of the JobLoad Index. A seven-point rating scale was used for all items. Scores were generated from individual JLI items for Job Satisfaction, satisfaction with rewards (four items); satisfaction with organisational change, and satisfaction with own performance, however the last factor was not included because of its high conceptual relationship and bivariate correlation with SPPCA at both sites.

RESULTS: SITE ONE

Figure 13.1 shows the distribution of Job Satisfaction which was slightly negatively skewed with moderate kurtosis but within acceptable limits. The overall mean for Job Satisfaction for site one was 4.7 (SD 0.9).

---

128 1 = highly dissatisfied 4 = neutral and 7 = highly satisfied
129 Seven items Reliability coefficient site one Cronbach’s Alpha = .79 and site two for Alpha = .84
130 Reliability coefficient Site One Cronbach’s Alpha = .98 and for Site Two Cronbach’s Alpha=.67
131 Reliability coefficient Site One Cronbach’s Alpha = .52 and for Site Two Cronbach’s Alpha = .82
132 Site One $r= .497$, p<.0; Site Two $r= .729$, p<.01
The Job Satisfaction scores between surveys rounds were quite similar, indeed a one-way ANOVA showed no difference between the three survey rounds.

IDENTIFICATION OF FACTORS INFLUENCING JOB SATISFACTION

Preliminary Analyses

Bivariate correlations between Job Satisfaction and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 13.1 of Appendix 13. The results of the preliminary multivariate analyses using MR and LMM as previously described are reported in Appendix 13.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses were:

- four of the six General and Temporal Demands: total hours worked, too much to do in available time, time pressure, and increasing workload pressure
- five of the seven Specific Work Demands: static physical demands, dynamic physical demands, demand for care and vigilance, emotional and cognitive demands,
− four of the seven Contextual Demands and Impediments factors: environmental and informational impediments, career uncertainty, conflict, workload variance
− four of the Job Control and Variety factors: skill utilization, work variety, decision latitude and influence.
− four of the five Support factors: coworkers support this week, coworkers cohesion & relationships, supervisor support this week, supervisor and management attitudes and communication
− SPPCA
− three of the four Satisfaction factors: reward satisfaction, satisfied with own performance, satisfied performance appraisal
− one of the six Personal and Non-work variables: physical injury

MULTIVARIATE ANALYSES

Stepwise Sequential Multiple Regression Analysis (Round One Data)

The same strategy adopted for multivariate analyses as has been previously described in Chapter 7 and used for the other DVs was used. Results of the sequential multiple regression (MR) are summarised below and in Tables 13.1 and 13.2:

• Block one – Personal & Non-Work Factors: \( R^2 = .013, (F [1, 118] = 1.516, p = .221) \). The only factor included in the analysis within the domain ‘personal and non-work factors’ was conflict between home and work demands. It explained 1.3% of the variance in scores.

• Block two – General & Temporal Demands: \( R^2 = .078, (F [5, 115] = 1.921, p = .096) \). Factors entered were: total hours worked (z score), too much to do (z score), time pressure (z score) and increasing workload pressure (z score). These explained approximately 6.3% of the variance.

• Block three – Specific Work Demands: \( R^2 = .146, [10,109] = 1.866, p = .058 \). Four factors were entered: static physical demands (z score), dynamic physical demand and risk (z score), cognitive demands (z score) emotional demands (z score), and demand for care and vigilance (z score). These factors explained 7.1% of the variance.

• Block four – Contextual Demands and Impediments: \( R^2 = .417, (F [15, 104] = 4.969, p < .01) \). The factors entered were: interruptions and disruptions (z score), environmental & informational impediments (z score), career uncertainty (z score), workload variance (z score) and conflict (z score). These accounted for 27% of the variance in scores.
• Block five - Job Control and Variety: $R^2 = .550$, ($F [19, 100] = 6.440, p < .01$). Two factors were entered: decision latitude (z score), skill utilization (z score), work variety (z score), and influence (z score). Together these explained 12.2% of the variance in scores.

• Block six – Support: $R^2 = .604$, ($F [21, 98] = 7.109, p < .01$). Two factors were entered: coworkers cohesion (z score), and general supervisor support last six months (z score). These explained a further 5.8%.

• Block seven– SPPCA: $R^2 = .608$, ($F [22,97] = 6.849, p < .01$). SPPCA accounted for little variance.

• Block eight- Other Sources of Satisfaction: $R^2 = .627$, ($F [24,95] =6.654, p < .01$). Two factors were entered: satisfaction with organizational change and reward satisfaction. These accounted for 1.9% of the variance.

Table 13.1 shows that the F-changes between blocks in the above sequence were significant at the fourth, fifth and sixth blocks.

Table 13.1. Models of IVs and Job Satisfaction (site one, round one)

<table>
<thead>
<tr>
<th>Block one - Personal &amp; Non-work factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two- General &amp; Temporal Demands</td>
<td>.013</td>
<td>.013</td>
<td>1.516</td>
<td>.221</td>
</tr>
<tr>
<td>Block three- Specific Work Demands</td>
<td>.078</td>
<td>.065</td>
<td>2.009</td>
<td>.098</td>
</tr>
<tr>
<td>Block four – Contextual Demands Impediments</td>
<td>.146</td>
<td>.068</td>
<td>1.748</td>
<td>.130</td>
</tr>
<tr>
<td>Block five- Job Control &amp; Variety</td>
<td>.550</td>
<td>.133</td>
<td>7.382</td>
<td>.000</td>
</tr>
<tr>
<td>Block six – Support</td>
<td>.604</td>
<td>.053</td>
<td>6.607</td>
<td>.002</td>
</tr>
<tr>
<td>Block seven –SPPCA</td>
<td>.608</td>
<td>.005</td>
<td>1.155</td>
<td>.285</td>
</tr>
<tr>
<td>Block eight – Other Sources of Satisfaction</td>
<td>.627</td>
<td>.019</td>
<td>2.372</td>
<td>.099</td>
</tr>
</tbody>
</table>

Table 13.2 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients (sr$_{i}^{2}$), $R^2$, and adjusted $R^2$ value for this set of constructs.

With this combination of variables, career uncertainty, influence skill utilization, coworker relationships and cohesion, and reward dissatisfaction (in red) differed significantly from zero, and their unique contribution to the $R^2$ was .164. Two factors (in blue) had a significance level between .05 and .10, dynamic physical demands and workload variance. The other IVs in combination contributed another .468 in shared variability. Thus a total of 62.7% (53.3% adjusted) of the variability in Job Satisfaction scores were predicted by these IVs.
Table 13.2. Sequential Multiple Regression of Job Satisfaction with Significant IVs (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>β</th>
<th>Sig</th>
<th>sri2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical injuries</td>
<td>-0.304 (4.3)</td>
<td>0.193</td>
<td>-0.109</td>
<td>0.119</td>
<td>-0.099</td>
</tr>
<tr>
<td>Total Hours Worked Score</td>
<td>-0.085 (1.2)</td>
<td>0.067</td>
<td>-0.095</td>
<td>0.210</td>
<td>-0.079</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td>-0.119 (1.7)</td>
<td>0.131</td>
<td>-0.095</td>
<td>0.366</td>
<td>-0.057</td>
</tr>
<tr>
<td>Too Much Work To Do</td>
<td>-0.038 (0.5)</td>
<td>0.155</td>
<td>-0.029</td>
<td>0.808</td>
<td>-0.015</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>0.013 (0.1)</td>
<td>0.097</td>
<td>0.012</td>
<td>0.891</td>
<td>0.009</td>
</tr>
<tr>
<td>Static Physical Demands</td>
<td>-0.116 (1.6)</td>
<td>0.102</td>
<td>-0.106</td>
<td>0.261</td>
<td>-0.071</td>
</tr>
<tr>
<td><strong>Dynamic Physical Demands</strong></td>
<td><strong>-0.165 (2.3)</strong></td>
<td><strong>0.091</strong></td>
<td><strong>-0.123</strong></td>
<td><strong>0.072</strong></td>
<td><strong>-0.114</strong></td>
</tr>
<tr>
<td>Demand for Care and Vigilance</td>
<td>0.121 (1.7)</td>
<td>0.158</td>
<td>0.075</td>
<td>0.444</td>
<td>0.048</td>
</tr>
<tr>
<td>Cognitive Demand</td>
<td>0.033 (0.4)</td>
<td>0.093</td>
<td>0.029</td>
<td>0.727</td>
<td>0.022</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>0.043 (0.6)</td>
<td>0.100</td>
<td>0.037</td>
<td>0.669</td>
<td>0.027</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>0.094 (1.3)</td>
<td>0.121</td>
<td>0.070</td>
<td>0.442</td>
<td>0.048</td>
</tr>
<tr>
<td>Environ/ Informational Impediments</td>
<td>0.041 (0.6)</td>
<td>0.132</td>
<td>0.026</td>
<td>0.760</td>
<td>0.019</td>
</tr>
<tr>
<td><strong>Career Uncertainty</strong></td>
<td><strong>0.331 (4.7)</strong></td>
<td><strong>0.143</strong></td>
<td><strong>0.228</strong></td>
<td><strong>0.023</strong></td>
<td><strong>0.145</strong></td>
</tr>
<tr>
<td>Conflict This Week</td>
<td>0.049 (0.7)</td>
<td>0.107</td>
<td>0.039</td>
<td>0.649</td>
<td>0.029</td>
</tr>
<tr>
<td><strong>Workload Variance</strong></td>
<td><strong>-0.137 (1.9)</strong></td>
<td><strong>0.082</strong></td>
<td><strong>-0.126</strong></td>
<td><strong>0.096</strong></td>
<td><strong>-0.105</strong></td>
</tr>
<tr>
<td>Decision Latitude</td>
<td>0.044 (0.6)</td>
<td>0.087</td>
<td>0.040</td>
<td>0.616</td>
<td>0.031</td>
</tr>
<tr>
<td><strong>Influence</strong></td>
<td><strong>0.268 (3.8)</strong></td>
<td><strong>0.123</strong></td>
<td><strong>0.207</strong></td>
<td><strong>0.032</strong></td>
<td><strong>0.136</strong></td>
</tr>
<tr>
<td><strong>Skill Utilization</strong></td>
<td><strong>0.352 (5.0)</strong></td>
<td><strong>0.097</strong></td>
<td><strong>0.282</strong></td>
<td><strong>0.000</strong></td>
<td><strong>-0.228</strong></td>
</tr>
<tr>
<td>Work Variety</td>
<td>0.103 (1.4)</td>
<td>0.129</td>
<td>0.072</td>
<td>0.423</td>
<td>0.050</td>
</tr>
<tr>
<td><strong>Coworker Cohesion Relationship</strong></td>
<td><strong>0.245 (3.5)</strong></td>
<td><strong>0.087</strong></td>
<td><strong>0.216</strong></td>
<td><strong>0.006</strong></td>
<td><strong>0.176</strong></td>
</tr>
<tr>
<td>Supervisor Support this week</td>
<td>0.082 (1.1)</td>
<td>0.089</td>
<td>0.073</td>
<td>0.357</td>
<td>0.058</td>
</tr>
<tr>
<td>Self Rated Performance</td>
<td>0.099 (1.4)</td>
<td>0.091</td>
<td>0.092</td>
<td>0.279</td>
<td>0.068</td>
</tr>
<tr>
<td><strong>Reward Satisfaction</strong></td>
<td><strong>0.254 (3.6)</strong></td>
<td><strong>0.123</strong></td>
<td><strong>0.194</strong></td>
<td><strong>0.041</strong></td>
<td><strong>0.130</strong></td>
</tr>
<tr>
<td>Satisfaction with Organizational Change</td>
<td>-0.151 (2.1)</td>
<td>0.088</td>
<td>-0.153</td>
<td>0.089</td>
<td>-0.108</td>
</tr>
</tbody>
</table>

\[ F_{[24, 95]} = 6.654, p < .01 \]
Intercept = 3.284 [SE .063] (46.941)

R = .792
R² = .627
Adjusted R² = .533

** p < .01; * p < .05
Unique variability = .164
Shared variability = .468

Linear Mixed Model Analyses (two and three repetitions) all subjects

LMM analysis was used to extend the investigation to encompass results from second and third repetitions of data within subjects. Results are shown in Table 13.3.

The variables which had the greatest effect (% per unit change in Job Satisfaction scores) are listed below. Job Satisfaction was higher when:

- **skill utilization** was higher (with both repetitions by 6.1% and 4.8%)
- **influence** was higher (with both repetitions by 2.7% and 4.9%)
- **coworker relationships and cohesion** was better (with both repetitions by approximately 3.1% and 3.5%); and
• SPPCA was higher (with both repetitions by approximately 3.7% and 3.1%)
• dynamic physical demands and risk were higher (with both repetitions by approximately 2.3% and 2.7%).

Job Satisfaction was lower when there was:
• career uncertainty was higher (with both repetitions by approximately 5.7% and 4.9%).

Two factors had a significance level between .05 and .10 (in blue), emotional demands and supervisor support
Table 13.3. Estimates of Fixed Effects Job Satisfaction & significant IVs (site one, two and three repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n = 103)</th>
<th>Three Repetitions (n = 71)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated effects (%)</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Intercept</td>
<td>3.14 (44.9)</td>
<td>.17</td>
</tr>
<tr>
<td>Physical Injury</td>
<td>- .195 (2.7)</td>
<td>.17</td>
</tr>
<tr>
<td>No Physical injury</td>
<td>0 (a)</td>
<td>0</td>
</tr>
<tr>
<td>Total Hours Worked</td>
<td>.057 (0.8)</td>
<td>.04</td>
</tr>
<tr>
<td>Static Physical Demands</td>
<td>-.029 (0.4)</td>
<td>.07</td>
</tr>
<tr>
<td>Dynamic Physical Demands</td>
<td>-.161 (2.3)</td>
<td>.06</td>
</tr>
<tr>
<td>Demand for Care &amp; Vigilance</td>
<td>.073 (1.0)</td>
<td>.11</td>
</tr>
<tr>
<td>Cognitive Demands</td>
<td>.056 (0.8)</td>
<td>.06</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>-.107 (1.5)</td>
<td>.06</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>.070 (1.0)</td>
<td>.07</td>
</tr>
<tr>
<td>Workload Variance</td>
<td>.084 (1.2)</td>
<td>.05</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>-.402 (5.7)</td>
<td>.08</td>
</tr>
<tr>
<td>Influence</td>
<td>.190 (2.7)</td>
<td>.08</td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>.427 (6.1)</td>
<td>.07</td>
</tr>
<tr>
<td>Work Variety</td>
<td>-.084 (1.2)</td>
<td>.09</td>
</tr>
<tr>
<td>Coworker Relationships &amp; Cohesion</td>
<td>.221 (3.1)</td>
<td>.06</td>
</tr>
<tr>
<td>Supervisor Support</td>
<td>.067 (0.9)</td>
<td>.06</td>
</tr>
<tr>
<td>SPPCA</td>
<td>.265 (3.7)</td>
<td>.05</td>
</tr>
</tbody>
</table>

a This parameter redundant. DV: Job Satisfaction
RESULTS: SITE TWO

Figure 13.2 shows that the distribution for Job Satisfaction was slightly negatively skewed with moderate kurtosis but within acceptable limits. The overall mean for Job Satisfaction for site one was 4.7 (SD 1.3).

A one-way ANOVA showed no difference between the survey rounds.

IDENTIFICATION OF FACTORS INFLUENCING JOB SATISFACTION

Preliminary Analyses

The results of the preliminary multivariate analyses using MR and LMM as previously described are reported in Appendix 13.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses were:

- one of the six General and Temporal Demands: responsibility cf. at site one: total hours worked, too much to do
- four of the seven Specific Work Demands: demand for care/vigilance, cognitive demands, emotional demands, and important consequences of errors, cf. one at site one: static physical, dynamic physical, emotional and cognitive demands,
- two of the seven Contextual Demands and Impediments factors: career uncertainty, workload variance cf. three at site one: career uncertainty, workload variance, conflict.
- two of the four Job Control and Variety factors: skill utilization, decision latitude, cf. site one: skill utilization, work variety, decision latitude and influence.
- two of the five Support factors: coworkers cohesion & relationships, supervisor and management attitudes and communication, cf. four at site one: coworkers support this week, coworkers cohesion & relationships, supervisor support this week, supervisor and management attitudes and communication
- SPPCA same as site one
- all of the four Satisfaction factors: reward satisfaction, satisfaction organisational change, satisfied with own performance, cf. three at site one: reward satisfaction, satisfied with own performance, satisfied performance appraisal
- one of the six Personal and Non-Work Variables: physical injury cf. at site one: age.

MULTIVARIATE ANALYSES

Stepwise Sequential multiple regression analysis (round one data)

Results of the sequential multiple regression are summarised below and in Tables 13.4-5:

- Block one - Personal & Non-Work Factors: \( R^2 = .035, (F [1, 50] = 1.819, p = .184) \). Included here was: conflict with home and work demands. This explained 3.5% of the variance in scores.
- Block two - General & Temporal Demands: \( R^2 = .098, (F [2, 49] =2.659, p = .08) \). One factor was entered: responsibility (z score) explained 6.3% of the variance in scores.
- Block three - Specific Work Demands: \( R^2 = .183, [3, 48] =3.596, p < .01 \). One factor was entered: demand for care and vigilance (z score). This explained 8.6% of the variance.
- Block four - Contextual Demands and Impediments: \( R^2 = .519, (F [6, 45] =8.084, p < .01) \). The factors entered were: interruptions and disruptions (z score), career uncertainty (z score), and conflict (z score). These accounted for an additional 33.5% of the variance in scores.
• Block five - Job Control and Variety: $R^2 = .714$, ($F [9, 51] = 11.655, p < .01$). Three factors were entered: decision latitude (z score), skill utilization (z score), and work variety (z score). These factors explained 19.5% of the variance in scores.

• Block six - Support: $R^2 = .785$, ($F [11, 40] = 13.293, p < .01$). The two factors were entered: coworker relationships support & cohesion (z score), and general supervisor support (z score). These factors explained a further 7.1%.

• Block seven - SPPCA: $R^2 = .816$, ($F [12, 39] = 14.386, p < .01$). SPPCA, accounted for 3.1% of the variance in scores.

• Block eight - other Sources of Satisfaction: $R^2 = .819$, ($F [14, 37] = 11.952, p < .01$). Two factors were entered: satisfaction with organizational change and reward satisfaction, but these accounted for little of the variance.

Table 13.4 shows that the F-changes between blocks in the above sequence were significant at the third, fourth, fifth, sixth and seventh blocks.

Table 13.4 Models of IVs and Job Satisfaction (site two, round one)

<table>
<thead>
<tr>
<th>Block one Personal &amp; Non-Work Factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.035</td>
<td>.035</td>
<td>1.819</td>
<td>.184</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block two- General &amp; Temporal Demands</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.098</td>
<td>.063</td>
<td>3.411</td>
<td>.071</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block three- Specific Work Demands</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.183</td>
<td>.086</td>
<td>5.032</td>
<td>.030</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block four– Contextual Demands &amp; Impediments</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.519</td>
<td>.335</td>
<td>10.449</td>
<td>.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block five- Job Control &amp; Variety</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.714</td>
<td>.195</td>
<td>9.565</td>
<td>.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block six – Support</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.785</td>
<td>.071</td>
<td>6.622</td>
<td>.003</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block seven – SPPCA</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.816</td>
<td>.031</td>
<td>6.458</td>
<td>.015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block eight – other Satisfaction factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.819</td>
<td>.003</td>
<td>.327</td>
<td>.723</td>
</tr>
</tbody>
</table>

Table 13.5 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients ($sr_i^2$) and $R^2$, and adjusted $R^2$ value for this set of constructs.

With this combination of variables, demand for care and vigilance, career uncertainty, skill utilization, work variety, coworker relationships and cohesion and self-perceived performance capacity and adequacy (in red) differed significantly from zero. Their unique contribution to the $R^2$ was .266. The other IVs in combination contributed another .533 in shared variability. Thus a
total of 81.9% (75% adjusted) of the variability in Job Satisfaction scores were predicted by these IVs at this site.

Table 13.5. Sequential Multiple Regression of Job Satisfaction with Significant IVs Z Scores

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>β</th>
<th>Sig.</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict with home and work demands</td>
<td>-.293 (4.1)</td>
<td>.297</td>
<td>-.091</td>
<td>.330</td>
<td>-.069</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.150 (2.1)</td>
<td>.127</td>
<td>.104</td>
<td>.242</td>
<td>.083</td>
</tr>
<tr>
<td><strong>Demand for Care and Vigilance</strong></td>
<td>-.276 (3.9)</td>
<td>.121</td>
<td>-.203</td>
<td>.028</td>
<td>-.160</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>.175 (2.5)</td>
<td>.136</td>
<td>.120</td>
<td>.206</td>
<td>.090</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>-.115 (1.6)</td>
<td>.147</td>
<td>-.078</td>
<td>.441</td>
<td>-.055</td>
</tr>
<tr>
<td>High Conflict</td>
<td>-.006 (0.8)</td>
<td>.139</td>
<td>-.004</td>
<td>.966</td>
<td>-.003</td>
</tr>
<tr>
<td><strong>Skill Utilization</strong></td>
<td>.840 (11.9)</td>
<td>.152</td>
<td>.592</td>
<td>.000</td>
<td>.387</td>
</tr>
<tr>
<td><strong>Work Variety</strong></td>
<td>.404 (5.7)</td>
<td>.145</td>
<td>.277</td>
<td>.008</td>
<td>-.196</td>
</tr>
<tr>
<td>Decision Latitude</td>
<td>.229 (3.2)</td>
<td>.165</td>
<td>.160</td>
<td>.173</td>
<td>.097</td>
</tr>
<tr>
<td>Coworker Relationships &amp; Cohesion</td>
<td>.111 (1.5)</td>
<td>.141</td>
<td>.077</td>
<td>.438</td>
<td>.055</td>
</tr>
<tr>
<td><strong>Supervisor Support</strong></td>
<td>.435 (6.2)</td>
<td>.163</td>
<td>.283</td>
<td>.011</td>
<td>.187</td>
</tr>
<tr>
<td>SPPCA</td>
<td>.297 (4.2)</td>
<td>.128</td>
<td>.205</td>
<td>.026</td>
<td>.163</td>
</tr>
<tr>
<td>Reward Satisfaction</td>
<td>.084 (1.2)</td>
<td>.155</td>
<td>.060</td>
<td>.589</td>
<td>.038</td>
</tr>
<tr>
<td>Satisfaction Organizational Change</td>
<td>.116 (1.6)</td>
<td>.150</td>
<td>.081</td>
<td>.446</td>
<td>.054</td>
</tr>
<tr>
<td><strong>F [14, 37] =11.952, p &lt; .01</strong></td>
<td>Intercept =3.247 [SE .132] (46.380)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[
R = .905 \quad R^2 = .819 \quad \text{Adjusted } R^2 = .750
\]

Unique variability = .266 \quad \text{Shared variability} = .533

Linear Mixed Model Analyses (two and three repetitions) all subjects

LMM analysis was used to extend the investigation to encompass results from second and third repetitions of data within subjects. Results are shown in Table 13.6.

The variables listed below had the greatest effect (% per unit change in scores) on the Job Satisfaction scores. Job Satisfaction was higher when:

- *skill utilization* was higher (by 12.6%);
- *work variety* was higher (by 5.2%); and
- *coworker relationships and cohesion* were better (by 5%); and
- *SPPCA* was better (by 3.2%).

Job Satisfaction was lower when:
- *demand for care and vigilance* was higher (by 5%); and
- *career uncertainty* was higher (by 4%).
Table 13.6. Estimates of Fixed Effects Job Satisfaction & significant IVs (site two, two repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n = 66)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Effects (%)</td>
</tr>
<tr>
<td>Intercept</td>
<td>3.55 (50.8)</td>
</tr>
<tr>
<td>Conflict with home and work demands</td>
<td>-.287 (4.1)</td>
</tr>
<tr>
<td>No Conflict with home and work demands</td>
<td>0(a)</td>
</tr>
<tr>
<td>Demand for Care and Vigilance</td>
<td>-.351 (5.0)</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>-.285 (4.0)</td>
</tr>
<tr>
<td>Skill Utilization</td>
<td>.884 (12.6)</td>
</tr>
<tr>
<td>Work Variety</td>
<td>.365 (5.2)</td>
</tr>
<tr>
<td>Coworker Relationships &amp; Cohesion</td>
<td>.356 (5.0)</td>
</tr>
<tr>
<td>SPPCA</td>
<td>.218 (3.1)</td>
</tr>
</tbody>
</table>

a This parameter is redundant. DV: Job Satisfaction

OVERVIEW OF RESULTS: BOTH SITES

Table 13.7 shows Job Satisfaction scores (means, SDs) for each of the sites, with virtually the same mean were reported in both sites. A one-way ANOVA confirmed that scores did not differ significantly between the sites. Table 13.7 shows that, overall, people were slightly more satisfied than dissatisfied.

Table 13.7. Means of Job Satisfaction (both sites all rounds)

<table>
<thead>
<tr>
<th></th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whole sample mean (SD)</td>
<td>n</td>
</tr>
<tr>
<td>Round 1</td>
<td>4.7 (0.8)</td>
<td>120</td>
</tr>
<tr>
<td>Round 2</td>
<td>4.5 (1.0)</td>
<td>103</td>
</tr>
<tr>
<td>Round 3</td>
<td>4.7 (1.0)</td>
<td>71</td>
</tr>
<tr>
<td>Grand Mean</td>
<td>4.6 (0.9)</td>
<td>294</td>
</tr>
</tbody>
</table>

In site one over 62.9% (cf. site two 59.1%) of the respondents were extremely satisfied to satisfied with their jobs, 23.5% (cf. site two 22.7%) felt neutral, and 13.6% (cf. site two 18.2%) felt dissatisfied to extremely dissatisfied with their jobs.

Figure 13.3 illustrates that satisfaction levels with both the job and rewards were proportionally greater than satisfaction with organizational change at both sites.
For ease of comparison, the results of all the multivariate analyses for both sites are combined and presented in Table 13.8 (on next page). This shows all the work characteristics, and personal and non-work factors, which were included in the final multivariate analyses, with those that were significant at $p < .05$ shown in red. At site one the included factors explained approximately 62.7% ($R^2$) or 53.3% (adjusted $R^2$) and at site two 81.0% ($R^2$) or 75% (adjusted $R^2$) of the variance in Job Satisfaction.

Figure 13.3. Means Scores for Satisfaction (both sites)
Table 13.8. Multivariate Analyses Final Models Job Satisfaction -(both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR (n = 120)</td>
<td>LMM (2 repetitions n = 103)</td>
<td>LMM (3 repetitions n = 71)</td>
</tr>
<tr>
<td>Intercept</td>
<td>3.284 (46.9)</td>
<td>3.14 (44.9)</td>
</tr>
</tbody>
</table>

**Personal & Non-work variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Injury</td>
<td>-.304 (4.3)</td>
<td>-.109</td>
</tr>
<tr>
<td>Conflict between home/work Demands</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General& Temporal Job Demands**

<table>
<thead>
<tr>
<th>Demand</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hours Worked</td>
<td>-.085 (1.2)</td>
<td>-.095</td>
</tr>
<tr>
<td>Time Pressure and Deadlines</td>
<td>-.119 (1.7)</td>
<td>-.095</td>
</tr>
<tr>
<td>Too Much Work To Do</td>
<td>-.038 (0.5)</td>
<td>-.029</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>.013 (0.1)</td>
<td>.012</td>
</tr>
<tr>
<td>Responsibility</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Specific Work Demands**

<table>
<thead>
<tr>
<th>Demand</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Physical Demands</td>
<td>-.116 (1.6)</td>
<td>-.106</td>
</tr>
<tr>
<td>Dynamic Physical Demands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand Care &amp; Vigilance</td>
<td>-.165 (2.3)</td>
<td>-.123</td>
</tr>
<tr>
<td>Cognitive Demands</td>
<td>.121 (1.7)</td>
<td>.075</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>.033 (0.4)</td>
<td>.029</td>
</tr>
</tbody>
</table>

Table 13.8 continued on next page
Table 13.8. Multivariate Analyses Final Models Job Satisfaction— (both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR (n = 120)</td>
<td>LMM (2 repetitions n = 103)</td>
</tr>
<tr>
<td>Intercept</td>
<td>3.284 (46.9)</td>
<td>3.14 (44.9)</td>
</tr>
</tbody>
</table>

**Contextual Demands & Impediments**

- **Interruptions & Disruptions**: .094 (1.3) .070 .070 (1.0) .087 (1.2) .175 (2.5) .120
- **Environ Inform Impediments**: .041 (0.6) .026
- **Workload Variance**: -.137 (1.9) -.126 .084 (1.2)
- **Career Uncertainty**: -.331 (4.7)* .228 -.402 (5.7)** -.343 (4.9)** -.115 (1.6) -.078 -.285 (4.0)**
- **Conflict**: .049 (0.7) .039

**Job Control & Variety**

- **Decision Latitude**: .044 (0.6) .040 .229 (3.2) .160
- **Influence**: .268 (3.8)* .207 .190 (2.7)** .346 (4.9)**
- **Skill Utilization**: .352 (5.0)** .282 .427 (6.1)** .341 (4.80** .840 (11.9)** .592 .884 (12.6)**
- **Work Variety**: .103 (1.4) .072 .084 (1.2) .126 (1.8) .404 (5.7)** .277 .365 (5.2)**

**Support**

- **Coworker Cohesion**: .245 (3.5)** .216 .221 (3.1)** .249 (3.5)** .111 (1.5) .077 .356 (5.0)**
- **Supervisor Support**: .082 (1.1) .073 .067 (0.9) .114 (1.6) .435 (6.2)** .283
- **SPPCA**: .099 (1.4) .092 .265 (3.7)** .220 (3.1)** .297 (4.2)* .205 .218 (3.1)**

**Satisfactions**

- **Reward Satisfaction**: .254 (3.6)* .194
- **Satisfaction Org Change**: -.151 (2.1) -1.53

<table>
<thead>
<tr>
<th>DV: Job Satisfaction</th>
<th>R²</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.627</td>
<td>.819</td>
</tr>
<tr>
<td></td>
<td>.533</td>
<td>.750</td>
</tr>
</tbody>
</table>

*p<.05, **p<.01 blue indicates significance levels; between .05 and 1.
Additional Data from Job Description

Job Type and Level

The relationship between Job Satisfaction and job type and level were analysed separately because of the expected high interactions with JLI variables (see Appendix 8 ,Tables 7.118-120.). There were significant differences between the job types in the scores for Job Satisfaction\(^{133}\), with the highest scores reported by the clerical officers (Site One) the lowest by the technical officers.

These results were congruent with the information gathered from the focus groups, which had revealed that the technical officers felt that their work was interesting, valuable and had higher levels of decision latitude and pay, when compared with positions available outside their organization. Both the IT and communications officers had reported that their duties were highly specialized and regarded as ‘essential to the success of the organization’. In contrast, (in this branch of the organization) the clerical officers’ duties, compared with the other job types, were regarded as less critical and of lower status.

There were also significant differences between the Job Satisfaction scores for the different job levels at site one (but not for site two) with the most senior officers the most satisfied\(^{134}\).

Motowidlo (1996) noted that older workers tend to be more satisfied than younger workers because they occupy better jobs with higher pay, but also because they have lower and more realistic expectations about work.

Participants’ open comments on Performance – Site Two Only

At the request of the employees’ union and Chief Executive Officer, subjects at site two were asked some additional questions relating to work-related satisfaction, not asked at site one.

In relation to the question ‘Is this a better place to work than your last employer? 55.7% agreed and 40.9% disagreed, and 3.4% declined to respond. Subjects at site two were also asked a question relating to intention to leave ‘If you were offered a permanent move at the same level in another agency in the next three months would you accept it?’ 49.1% said they would leave and 45.5% indicated that they would stay with 6.4% declining to respond.

The percentage of people stating they ‘would leave’ with the number of people saying they were satisfied with their job may be due to the phrasing of this question, prompting people to assume a more polarised position. Alternatively while people were reasonably satisfied with their job and

\(^{133}\) F [3, 377] = 2.405, p < .05  
\(^{134}\) F [3, 290] = 15.354, p > .01
the kind of work they undertook, they were dissatisfied with the organisation as a whole. This latter sentiment was clearly expressed in the open comments section at site two (see Appendix 13) and seen in Figure 13.3 above.

Subjects were also asked to comment on what ‘things/ actions would increase staff satisfaction’. Responses indicated that there was a general sentiment for a need to: reduce impediments to performance, improve the ‘climate of trust’, openness and fairness, effectiveness of communications with senior managers and overall staffing levels (see Appendix 13).

**REVIEW AND DISCUSSION OF RESULTS**

In the JLM, Job Satisfaction is viewed as a desirable state reflecting positive work-related wellbeing. Higher levels of Job Satisfaction indicate that the person-demand match is good.

**Effects of Personal & Non Work Variables**

Factors in this domain were entered into the first block of the sequential regressions and included in LMM analyses. Job Satisfaction was lower when there was *conflict between home and work demands* and when people had a *physical injuries*, while these were included in the final models neither reached significance and the F-change was not significant. In the previous Chapters, imbalance between work and home demands has emerged as a common factor detracting/influencing work-related wellbeing.

**Effects of the Work Demands**

**General and Temporal Job Demands**

Of the factors in this domain, four were included in the final model at site one 135 and one at site two 136. Overall, these factors (based on the F-change) explained 6.3% of variance at both sites. Job Satisfaction scores were higher when *total hours worked* were longer. Although this did not reach significance, it did also reflect the pattern of significant positive bivariate correlations at site one, and contributed virtually all of the variance explained in this domain.

---

135 *total hours worked, increasing workload pressure, time pressure and too much to do*

136 *responsibility,
Figure 13.4 shows a clear relationship between higher loads and higher Job Satisfaction. The one-way ANOVA was significant at site one\textsuperscript{137} but not site two. This result contrasts with the finding reported by others. For example, Hall and Spector (1991) in a study of correctional officers (n=135) found significant negative correlations between Job Satisfaction and high workloads, and observed that the magnitude of correlations in their study replicated results found by Spector (1987), Spector \textit{et al.} (1988) and Spector and Jex (1989).

It was noted that working longer hours was satisfying for subjects in site one, but not site two. Given that in site one (based on the Job Description) those people who worked longer hours were usually the technical, IT or more senior officers (see Chapter 7), their need to work longer was often associated with completing important projects (high task significance). Calnan, Wainwright and Almond (2000) in an examination of 700 general medical practitioners, found powerful positive effects of job control and rewards on satisfaction levels, but observed that despite claims to the contrary, ‘workload’ had relatively little impact. Perhaps for subjects in the current study, it was the \textit{kind} of work activities undertaken during the extended working hours which were satisfying, which was reflected by this result, rather than the act of working long hours itself.

\textsuperscript{137} F[4, 289]= 4.093, p<.01
In Australia, Wooden and Warren (2003)\textsuperscript{138} found, as people’s hours of work increase, their Job Satisfaction tends to decline. But interestingly, this appeared to be more related to the positive impact of part-time working hours than to the negative impact of long hours \textit{per se.}

Weston, Gray, Qu and Stanton (2003) in a study of the effects of long working hours on Australian fathers\textsuperscript{139} reported that as hours of work increased, their perceptions of negative work-to-family spillover increased. They reported that men working 60 hours or more per week had lower ‘vitality’ and marginally lower satisfaction with life.

In site two, \textit{responsibility} was also included in the final model, where Job Satisfaction was increased when this factor was rated higher. This sentiment was strongly expressed during the Job Description when site two subjects complained that they were given insufficient responsibility and opportunity to lead others. This last point is illustrated in the high bivariate correlation between Job Satisfaction and skill utilization at site two\textsuperscript{140}.

**Specific Work Demands**

Of the six factors in this domain, five factors were included in the final model for site one\textsuperscript{141} and one for site two\textsuperscript{142}. Overall, these factors (based on the F-change) explained additional variance of 6.8% at site one and 8.6% at site two.

Job Satisfaction scores were lower when there was a demand for care and vigilance, reaching significance at both sites. As has been discussed in Chapter 7, this demand was highest for the communications officers, who worked on fairly routine screen-based tasks, where there was both low control and few opportunities to take a break. Similarly, in site two, these demands occurred when fairly routine works were undertaken. It is noteworthy that this was the only factor in this domain included in the final model for site two, yet its explained variance was nearly as much as the five factors in site one.

At site one, when \textit{dynamic physical demands} were higher, Job Satisfaction scores were higher. This result is attributed to the opportunity provided by this kind of demand for workers to move around. At site one, \textit{emotional, cognitive and static physical demands} were included in the final models, but with all other factors included, explained little variance and were not significant. However, in the Job Description it was clear that cognitively interesting and challenging work

\textsuperscript{138} Household, Income and Labour Dynamics in Australia survey
\textsuperscript{139} Used the SF-36 Scale (Ware, Snow, Kosinski, & Gandek, B 2000) measure of general health, \textit{Vitality} scale (where low scores indicate feeling tired and “worn out”, and high scores indicate feeling “full of life” and “having lots of energy”, \textit{Mental Health} scale (where low scores tap feeling nervous and unhappy and high scores tap a sense of peace and happiness).
\textsuperscript{140} r=.736, p<.01
\textsuperscript{141} cognitive demands, static physical demands, dynamic physical demands, demand for care and vigilance, emotional demands
\textsuperscript{142} demand for care and vigilance

244
that was within their coping capacity) was viewed as desirable whereas emotional and static physical demands were undesirable. Cognitively demanding work, probably because it contributes to 'job enrichment'\textsuperscript{143} is desirable. However the increasingly common pattern of work intensification, job enlargement (adding requirements to the job for doing more components of an overall task, and knowledge enlargement (requiring more knowledge about related procedures and processes), especially where rewards are not commensurate for the extra effort, are associated with poorer satisfaction (Brief, 1998; Campion and McClelland, 1993).

Klitzman and Stellman (1989) in a large study of office workers (n=1830) reported that ergonomic stressors (such as static physical demands) were associated with lower Job Satisfaction ($r = -.38$). A study of truck drivers (n=1181) De Croon et al. (2002) found that there were significant increases in the R\textsuperscript{2} from .000 to .025 when job control and quantitative workload were entered, and, when physical demands and supervisor demands (support) were added, these accounted for 7% of the additional variance in Job Satisfaction levels.

It is postulated that the small effects in this study were found because the overall ergonomic demands were quite low, so their relative impact compared to other measured factors was therefore smaller.

**Contextual Demands and Impediments**

Of the seven factors in this domain, five factors were included in the final model for site one\textsuperscript{144} and three for site two\textsuperscript{145}. Overall, these factors (based on the F-change) explained 27% at site one and 33.5 % at site two of the variance in Satisfaction scores, which was significantly more than factors in any of the other domains.

As expected based on the JLM, impediments, probably because they demand extra effort which should not be required, increase frustration and stress and so was associated with lower Job Satisfaction. Strong associations were found between career uncertainty and lower Job Satisfaction at both sites, reaching significance at the .01 level. These were expected given the large bivariate correlations\textsuperscript{146}. A similar strong relationship was also found by Sverke, Hellgren and Näswall (2002) in their meta-analysis of the consequences of job insecurity, based on over 28,000 subjects from 50 studies.

\textsuperscript{143} increasing diversity and control overs segments of the work
\textsuperscript{144} interruptions and disruptions, environmental and informational impediments, conflict, , workload variance and career uncertainty
\textsuperscript{145} interruptions and disruptions, conflict, and career uncertainty
\textsuperscript{146} site one $r=.488$, p<.01; site two $r=.608$, p<.01
The contextual demands and impediments - interruptions and disruptions, environmental and informational impediments and workplace conflict were included in the final regression models, and as expected showed a modest but negative association with Job Satisfaction.

**Job Control and Variety**

All four factors in this domain were included in the final model for site one\textsuperscript{147} and three at site two\textsuperscript{148}. Based on the JLM, it was expected that Job Satisfaction would be higher when there were higher levels of decision latitude, skill utilization, influence, and work variety. This hypothesis was strongly confirmed except for work variety. Overall, these factors (based on the F-change) explained an additional 13.3\% of variance at site one and 7.1 \% at site two. This was the second most powerful domain in the sequential regressions.

Job Satisfaction scores were higher when there was skill utilization reaching significance at both sites. When people perceived that they had influence in their organisation, their Job Satisfaction was higher, reaching significance at site one. Given the high and significant bivariate correlations at both sites, with a larger sample size site two may have met the inclusion criteria for the final multivariate model\textsuperscript{149}.

De Croon et al. (2002) reported that job control buffered the detrimental effects of quantitative workload. Copper and Bramwell (1992) in a study of brewery managers and production workers, reported that pressure arising from the demands of the physical environment were not nearly as important as factors such as ‘monotony’, ‘being undervalued’, ‘external locus of control’, and ‘organizational structure and climate’ in predicting Job Satisfaction. Fried (1991) in a meta-analytical review demonstrated that Job Satisfaction was higher when there was higher job identity, autonomy, variety and feedback. 

Job Satisfaction scores was also higher when there was a high work variety at site one, and at site two this reached significance. In this study, Job Satisfaction scores were higher when there was decision latitude. While the regression effects were small, the bivariate correlations, especially for site two, were moderately large.\textsuperscript{150}

Payne et al. (1999) (n=9,327) when examining work characteristics (‘autonomy’, ‘role conflict’, ‘role clarity’, ‘workload’), ‘satisfaction with the work itself’ and ‘extrinsic satisfaction’\textsuperscript{151}

\textsuperscript{147} decision latitude, skill utilization, influence, and work variety 
\textsuperscript{148} decision latitude, skill utilization, and work variety 
\textsuperscript{149} site one $r=.465$, p<.01; site two $r=.467$, p<.01 
\textsuperscript{150} site one $r=.237$, p<.01 site two $r=.468$, p<.01 
\textsuperscript{151} ‘work conditions’, ‘pay’, ‘management’
reported significant relationships between work characteristics and extrinsic satisfaction ($F [1, 8812] = 1,766.3, p < .001$) and intrinsic satisfaction ($F [1, 8812] = 2,392.4, p < .001$).

Klitzman and Stelman (1989) in their study of office workers reported intercorrelations between satisfaction\(^{152}\) and ‘workload demands’ ($r = .15$), ‘decision latitude’ ($r = .31$), job future ($r = .47$), coworker support ($r = .10$), supervisor support ($r = .44$), office satisfaction ($r = .45$). After controlling for occupation, psychosocial working conditions and demographics they found that factors which influenced satisfaction the most were the ‘ergonomic stressors’, supervisor support, decision latitude, and a positive job future.

In conclusion, there is a substantial body of empirical evidence that supports the finding of this study that job control (as represented by the factors measured) is strongly associated with Job Satisfaction (for example Calnan, Wainwright and Almond, 2000; De Jonge, Bosma, Peter and Siegrist, 2000; Hurrell, & McLaney, 1988a; Payne et al., 1999; Sousa-Poza & Sousa-Poza, 2000).

**Support**

There were five factors in this domain: *coworker support, coworker relationships and cohesion, supervisor support, general level of supervisor support and supervisor and senior management attitudes and communications*. Based on the first stage of multivariate analyses, *poor coworker relationships and cohesion and supervisor support* were included in the final multivariate models at both sites. These factors were significant and overall (based of F-change) predicted 5.3% in site one and 7.1% in site two of the variance in Job Satisfaction scores.

At both sites, Job Satisfaction scores were higher when there were good *relationships and cohesion* and when there was good *supervisor support*. The results of this study are in accord with those reported by others, that support and work relationships are associated with Job Satisfaction (Baker et al., 1996; Tetrick, 1992; Rhodes and Eisenberger, 2002; Sauter, Murphy & Hurrell, 1992; Undén 1996; and others).

**Effects of SPPCA**

While there were significant positive bivariate correlations (site one $r = .482$, $p < .01$; and at site two $r = .475$, $p < .01$) between *job dissatisfaction* with *SPPCA* in all the data sets, this factor contributed little to the variance in Job Satisfaction when added later in the regression sequence. Overall (based of F-change) this factor predicted nothing at site one and 3.1% at site two of the variance in Job Satisfaction.

\(^{152}\) items derived from the Quality of Employment Surveys Quinn & Shepard (1977)
Other Satisfactions

Two factors from this domain reward dissatisfaction and dissatisfaction with organizational change were included in the final block of the MR model to test their ability to add the prediction of Job Satisfaction. They were not included in the LMM because their effect could not be isolated from other factors. However, what was surprising was that, despite the conceptual overlap, these factors contributed little (based of F-change) to explained variance in Job Satisfaction (1.9% at site one and nothing at site two) when added last in the regression sequence.

It was considered likely that these factors would covary with Job Satisfaction. When reward satisfaction was considered in isolation with Job Satisfaction, the bivariate correlations were quite strong and consistent between sites. At both sites the correlations with Job Satisfaction and satisfaction with organizational change were positive. The relationship was weaker at site one even though the means were quite similar.

De Jonge, Bosma, Peter and Siegrist (2000) found that where there were high psychological demands, Job Satisfaction levels were one-fifth of those with high effort/low rewards compared with those with low efforts/high rewards. Where there were high physical demands, those with high effort/low rewards Job Satisfaction levels were one-sixth of those with low efforts/high rewards. These authors believe that those with effort/reward imbalance showed more pronounced risk of emotional exhaustion, psychosomatic health problems, physical health complaints and job dissatisfaction compared to those reporting ‘job strain’.

While positive work characteristics contribute to Job Satisfaction, Brief (1998) commented that those that are satisfied with their job also tend to perceive the levels of autonomy, variety, and task identity as higher. While this study did not assume a causal relationship Sevastos (1996) suggests that it is intrinsic Job Satisfaction which leads to affective wellbeing, rather than the alternative.

MEASUREMENT ISSUES

The Job Satisfaction scale was created for the purposes of this study based on concepts used by others (Hackman & Oldman, 1980; and Hurrell & McLaney, 1988). The Cronbach’s alpha for this scale was good and there was high scale consistency over the repeated rounds at both sites.

The Job Description allowed those job factors that were most likely to be pertinent to the

---

153 site one \( r = .435, p < .01 \), site two \( r = .489, p < .01 \)
154 site one \( r = .174, p < .01 \), site two \( r = .529, p < .01 \)
155 site one round 1 \( r = .81 \), 2 \( r = .80 \), 3 \( r = .81 \) and at site two (1 \( \alpha = .89 \), 2 \( \alpha = .80 \). At site one the Guttman Split-half = .66 and Alpha for part 1 \( \alpha = .79 \) and part 2 \( \alpha = .83 \) (all rounds combined), and at site two Guttman Split-half = .82 and Alpha for part 1 \( \alpha = .76 \) and part 2 \( \alpha = .88 \) (all rounds combined).
particular job types and circumstance of this study to be included in the JLI, enhancing the study’s capacity to measure the most important predictors of Job Satisfaction.

This study used measures of satisfaction and workplace factors derived for the purposes of the current study. Because in the area of work-related satisfaction, this is a common approach and that ratings are also a function of the workplace factors and of the occupational group, comparability of results between studies and across different occupational groups is more problematic (Oshagbemi, 1999).

The small subject numbers at both sites restricts the extrapolation and reliability of findings. Further, the limited variation in score range probably reduced the study’s sensitivity to detect some of the less powerful satisfaction predictors.

CONCLUSION

Based on the JLM, Job Satisfaction was seen as reflecting people’s cognitive judgment about the ‘fit’ between the work demands, job factors, and the individual’s coping capacities, goals and attitudes. Given that, overall most people reported being slightly more satisfied than dissatisfied, it appears that this fit was viewed as largely acceptable by many.

A substantial proportion of the variance in Job Satisfaction scores at both sites were predicted by the nineteen (at site one) and thirteen (at site two) workplace factors, other sources of Satisfactions and by peoples’ own assessment of their performance capacity and adequacy. At site one approximately 62.7% (using $R^2$), or 53.3% (using adjusted $R^2$), or 35.1% (using MLM); and at site two approximately 82% (using $R^2$), or 75% (using adjusted $R^2$), or 39% (using MLM) of the variance in Job Satisfaction scores were explained by these factors.

The constructs which explained the most variance were those that fell within the contextual demands and impediments, job control and support domains. Of these, the single most important predictors were career uncertainty, skill utilization, influence, coworker relationship and cohesion, reward satisfaction and self-perceived performance capacity and adequacy. However, some additional variance was explained by the specific work demands, especially the need for care and vigilance.

The significant results for aspects of job control and support were not unexpected and are often reported by others (for example Ferrie et al., 1998; Parker and Wall, 1998; Reissman et al., 1999; Swanson and Power, 2001; Vahtera, Kivimäki & Pentti, 1997). More uniquely, this study also looked at the impact of specific work demands and performance on Job Satisfaction. The results
from both sites suggest that collections of data about these factors is useful in explaining sources of Job Satisfaction which may be used in job redesign.

Significant associations were also found between career uncertainty with both stress and with job satisfaction. Carayon (1993) observed that this concern is often neglected compared to other job elements in the job design research literature. He supposes that this may be because career uncertainty tends to be viewed as an external (hygiene) factor, and there is a belief that it is the ‘internal’ factors (motivators) which are most responsible for satisfaction. Given Australia’s recent history for downsizing, career uncertainty is now a real problem and clearly this issue should be considered in all measurement of work-related stress and satisfaction.

The effects of long working hours were of special interest given its current industrial relations importance. It has been empirically demonstrated that there are working hours above which it is neither safe nor productive for people to work (for example Daniels, 2000; Hockey, 1989; Sparks, Copper, Fired, & Shirom, 1997 and others). However, at site one, working longer hours was modestly associated with higher Job Satisfaction scores. This finding needs to be contextualized. Most people worked only moderately long hours (site one $\mu=47.6$ [SD 14.4] and site two $\mu=42.9$ [SD 9.12]) and those working extremely long hours usually only did so for short periods to meet specific performance goals. The Job Description had revealed that working longer hours was a deliberate strategy used by many to improve their performance, with a flow-on effect on Job Satisfaction levels. The issue of choice is also pertinent, as low decision latitude (for example having little freedom to decide working hours) and conflict between home and work demands both increased Job Satisfaction.
Chapter 14

JOBLOAD AND THE STRESS HORMONES

This chapter reports the relationships between various dimensions of JobLoad, aspects of wellbeing and some personal factors and the ‘stress hormone’ levels [adrenaline (A), noradrenaline (NA) and cortisol (C)].

As discussed in Chapter 3, extensive research has been undertaken on the neuroendocrine responses to a wide range of physical and psychosocial workplace demands and associated changes in the employees’ subjective wellbeing. There is general agreement that:

1. Adrenaline is a non-specific indicator of mental arousal, for example due to work pressure, emotional demands, responsibility, or conflict. Adrenaline levels tend to be correlated with the general intensity of affective experience whether positive or negative in nature.

2. Noradrenaline is a non-specific indicator of physical arousal levels that are mainly associated with physical exertion, and posture.

3. Cortisol is a non-specific indicator of emotional states. It is likely to increase during negative affective states (e.g. associated with chronic stress, fatigue, depression and/or burnout), and to decrease during positive affective states (e.g. due to pleasure associated with success or effective support etc).

PARTICIPATION RATES

Urine samples from site one subjects were assayed to determine levels of free cortisol, adrenaline, and noradrenaline, as outlined in Chapter 5 and comprehensively described in Appendix 5.4-5.5.

A total of 68 subjects provided samples that met the inclusion criteria (described in Chapter 5). As expected, there was some attrition during the course of the study, primarily due to staff leaving the organization, so that by the second round of data collection the number of subjects who met the inclusion criteria (see Appendix 5.4-5) had dropped to 55 and to 40 by the final round. To facilitate comparison of results, the same metric has been used for all three of the stress hormones: that is, the estimated daily amounts excreted (nanomoles/24 hours) expressed as a z score.
RESULTS: ADRENALINE

Reported levels of urinary free adrenaline vary widely between studies due to differences in the nature and levels of exposure to specific stressors, differences in assaying techniques, and to the very large inter-individual variability. Figure 14.1 shows the distribution of adrenaline levels in the present study (with all rounds combined). It can be seen that there is a strong positive skew and some outliers.

The decision was taken both to retain outliers and not to transform the data, as extremely elevated or diminished responses may be from those subjects who are experiencing the most distress (Aguilera, 1994; Buckingham et al., 1997; Cacioppo et al., 1998; Heilm et al., 2000; Frankenhauser, 1991; Pike et al., 1997) and this information would be minimised by data transformation. In fact, the mean levels were close to those reported by Armando and Amador (1999) (see Appendix 8, Table 8.124).\(^{156}\) A one-way ANOVA between data collection periods did not reach significance (\(F[2,157] = 2.704, p = .07\)), with levels higher in round one (Dunnett \(t = 7.57, p< .05\), two-sided).

\(^{156}\) There are no "normal" catecholamine levels (although pathological levels can be found in association with conditions such as adrenal tumours).
IDENTIFICATION OF FACTORS INFLUENCING ADRENALINE LEVELS

Preliminary Analyses

Bivariate correlations between UBPD and other measured constructs, grouped into the major
domains identified by the JLM, are shown in Table 14.1 of Appendix 14. The results of the
preliminary multivariate analyses using MR and LMM as previously described are reported in
Appendix 14.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that
were statistically significant for at least one of the rounds, or which were found to be significant
in the multivariate analyses were:

- three of the six General and Temporal Demands: too much to do in the available time,
increasing workload pressure and responsibility
- three of the five Specific Work Demands: demand for care and vigilance, emotional demands
  and errors important consequences
- none of the seven Contextual Demands & Impediments
- none of the four Job Control & Variety factors
- none of the five Support factors
- not SPPCA
- one of the five Satisfaction factors: reward satisfaction
- one of the five other Aspects of Wellbeing: LBPD
- none of the nine Personal and Non-work variables

MULTIVARIATE ANALYSES

Stepwise Sequential multiple regression analysis (round one data)

Results of the sequential regression are summarised below and in Table 14.2.

- Block one - Personal & Non-Work Factors: $R^2 = .001$, ($F [1, 60] = .001$, $p = .917$). Only age
  was entered here, and it explained virtually none of the variance in adrenaline levels.
- Block two - General & Temporal Job Demands: $R^2 = .122$, ($F [4, 57] = 1.812$, $p = .139$).
  Three factors were entered: too much to do in the available time (z score), increasing workload
  pressure (z score) and responsibility (z score). These accounted for 12.2% of the variance and
  the F-change approached significance.
- Block three - Specific Work Demands: $R^2 = .141$, ($F [7, 54] = 1.129$, $p = .359$). Three factors
  were entered: demand for care and vigilance (z score), emotional demands (z score) and errors
have important consequences (z score); the F-change was not significant and these variables explained 1.9% of variance.

- Block four - Job Control & Variety: $R^2 = .151$, ($F [8, 53] = .842, p = .398$). Decision latitude (z score) was included but the F-change was not significant.
- Block five - Satisfaction: $R^2 = .181$, ($F [9, 52] = 1.170, p = .333$). Reward Satisfaction (z score) was included and explained 2.9% of the variance but the F-change was not significant.
- Block six - other Aspects of Wellbeing: $R^2 = .223$, ($F [12, 49] = 1.123, p = .364$). Three factors were included: Stress (z score), Arousal (z score) and Upper Body Part Discomfort (z score); and these explained 4.3% of the variance, but again the F-change was not significant.

Table 14.2 shows the F-changes between blocks in the above sequence.

**Table 14.2. Models of Significant IVs Z Scores and Adrenaline Z Score (site one, round one)**

<table>
<thead>
<tr>
<th>Block one - Personal &amp; Non-Work Factors</th>
<th>$R^2$</th>
<th>$R^2$ Change</th>
<th>$F$-change</th>
<th>Sig. $F$-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two - General &amp; Temporal Job Demands</td>
<td>.122</td>
<td>.122</td>
<td>2.499</td>
<td>.069</td>
</tr>
<tr>
<td>Block three - Specific Work Demands</td>
<td>.141</td>
<td>.019</td>
<td>.376</td>
<td>.771</td>
</tr>
<tr>
<td>Block four - Job Control and Variety</td>
<td>.151</td>
<td>.010</td>
<td>.575</td>
<td>.452</td>
</tr>
<tr>
<td>Block five - Satisfaction</td>
<td>.181</td>
<td>.029</td>
<td>1.757</td>
<td>.191</td>
</tr>
<tr>
<td>Block six - other Aspects of Wellbeing</td>
<td>.223</td>
<td>.043</td>
<td>.840</td>
<td>.479</td>
</tr>
</tbody>
</table>

Table 14.3 shows unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients ($sr^2_i$) and $R^2$, and adjusted $R^2$ value for this set of factors drawn from blocks one to six.

Overall, the regression model did not reach significance. The score in red indicates the one variable that was significant: *too much to do in the available time*. Its unique variance was .106 and all the factors contributed .117 in shared variance. A total of 23.3% (2% adjusted) of the variability in adrenaline scores were predicted by these IVs.
Table 14.3. Stepwise MR of Significant IVs Z Scores & Adrenaline Z Score (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>ß</th>
<th>Sig.</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-.004</td>
<td>.023</td>
<td>-.030</td>
<td>.851</td>
<td>-.025</td>
</tr>
<tr>
<td>Too Much To Do</td>
<td>-.689</td>
<td>.274</td>
<td>-.420</td>
<td>.016</td>
<td>-.326</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-.028</td>
<td>.232</td>
<td>-.019</td>
<td>.906</td>
<td>-.015</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.047</td>
<td>.269</td>
<td>.031</td>
<td>.862</td>
<td>.023</td>
</tr>
<tr>
<td>Demand for Care and Vigilance</td>
<td>-.148</td>
<td>.328</td>
<td>-.070</td>
<td>.654</td>
<td>-.059</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>.128</td>
<td>.211</td>
<td>.088</td>
<td>.547</td>
<td>.079</td>
</tr>
<tr>
<td>Errors have Important Consequences</td>
<td>.144</td>
<td>.164</td>
<td>.135</td>
<td>.383</td>
<td>.114</td>
</tr>
<tr>
<td>Decision Latitude</td>
<td>.263</td>
<td>.215</td>
<td>.187</td>
<td>.228</td>
<td>.159</td>
</tr>
<tr>
<td>Reward Satisfaction</td>
<td>.277</td>
<td>.226</td>
<td>.180</td>
<td>.226</td>
<td>.159</td>
</tr>
<tr>
<td>Lower Body Part Discomfort</td>
<td>-.211</td>
<td>.148</td>
<td>-.199</td>
<td>.160</td>
<td>-.186</td>
</tr>
<tr>
<td>SACL Arousal Score</td>
<td>.024</td>
<td>.182</td>
<td>.021</td>
<td>.897</td>
<td>.017</td>
</tr>
<tr>
<td>SACL Stress Score</td>
<td>.073</td>
<td>.200</td>
<td>.055</td>
<td>.716</td>
<td>.048</td>
</tr>
</tbody>
</table>

F[12,49] = 1.123, p = .364
Intercept = .483 (.940)
Unique variability = .106 Shared variability = .117
R = .472 R² = .223 Adjusted R² = .020

Linear mixed model (LMM) analyses (two and three repetitions)

To maintain an acceptable ratio of cases to variables, only significant variables from the most centrally important domains were included in LMM analyses, as shown in Table 14.4 where the statistically significant variables are indicated in red.

Adrenaline levels were lower when:

- **Too Much to Do** scores were higher (by .28 standard deviations with two repetitions and by 21 SD [approached significance] with three repetitions);
- **Increasing Workload Pressure** scores were higher (by .32 standard deviations with three repetitions);
- **Low Body Part Discomfort** scores were higher (by .20 standard deviations with three repetitions).

Adrenaline levels were higher when:

- **Reward Satisfaction** scores were higher (by .27 standard deviations with two repetitions).

Three other variables approached significance for one of the data repetitions: **responsibility, emotional demands, decision latitude** and **Stress**.
Table 14.4. Estimates of Fixed Effects Model with significant IV Z Scores and Adrenaline Z Score (site one, two and three repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n=57)</th>
<th>Three Repetitions (n=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated effects</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.075</td>
<td>0.07</td>
</tr>
<tr>
<td>Too Much To Do</td>
<td>-0.281</td>
<td>0.12</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>0.179</td>
<td>0.12</td>
</tr>
<tr>
<td>Responsibility</td>
<td>-0.136</td>
<td>0.12</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>0.120</td>
<td>0.11</td>
</tr>
<tr>
<td>Errors have important consequences</td>
<td>-0.013</td>
<td>0.08</td>
</tr>
<tr>
<td>Decision Latitude</td>
<td>0.163</td>
<td>0.10</td>
</tr>
<tr>
<td>Reward Satisfaction</td>
<td>0.276</td>
<td>0.12</td>
</tr>
<tr>
<td>Lower Body Part Discomfort</td>
<td>-0.106</td>
<td>0.08</td>
</tr>
<tr>
<td>SACL Stress Score</td>
<td>0.116</td>
<td>0.07</td>
</tr>
</tbody>
</table>
RESULTS: NORADRENALINE

As for adrenaline, levels of urinary free noradrenaline vary widely between studies. Figure 14.2 shows the distribution of noradrenaline levels in nmol/24 hours (with all rounds combined). There is a positive skew which is exacerbated by the presence of outliers. As for adrenaline, outliers were retained and values were not transformed.

![Estimated Daily Noradrenaline in nmol/24hrs](image)

**Figure 14.2. Noradrenaline nmol/24 hours (site one, all rounds combined)**

Noradrenaline levels for each round are shown in Table 14.5. Means were close to those reported by Suilter et al. (2000). A one-way ANOVA of differences between different rounds approached significance: \( F[2,157] = 2.86, p = .06 \). Post hoc evaluation (Dunnett t, two-sided) showed no differences.

IDENTIFICATION OF FACTORS INFLUENCING NORADRENALINE

Preliminary Analyses

Bivariate correlations between noradrenaline and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 14.7 of Appendix 14. The results of the
preliminary multivariate analyses using MR and LMM, as previously described, are reported in Appendix 14.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least one of the rounds, or which were found to be significant in the multivariate analyses were:

- one of the six General and Temporal Demands: *too much to do*,
- none of the five Specific Work Demands
- three of the seven Contextual Demands and Impediments: *uncertainty about own performance adequacy, environmental and informational impediments and career uncertainty*
- none of the four Job Control and Variety factors
- none of the five Support factors
- not SPPCA
- one of the five Satisfaction factors: *Job Satisfaction*
- one of the five other Aspects of Wellbeing: *LBPD*
- one of the nine Personal and Non-work variables: *age*.

**MULTIVARIATE ANALYSES**

**Stepwise Sequential multiple regression analysis (round one data)**

Results of the sequential regression are summarised below and in Table 14.6. One of the blocks in the following sequence was significant.

- **Block one - Personal & Non-Work Factors**: $R^2 = .005$, ($F [1, 57] = .262, p = .611$). While *age* was included, F-change was not significant and this variable explained virtually none of the variance in scores.
- **Block two - General & Temporal Job Demands**: $R^2 = .075$, ($F [2, 56] = 2.281, p = .112$). One factor was *too much to do in the available time* (z score) and this accounted 7.1% of the variance.
- **Block three - Contextual Demands & Impediments**: $R^2 = .130$, ($F [5, 53] = 1.585, p = .180$). Three factors *environmental and informational impediments* (z score), *uncertainty about work requirements* (z score) and *career uncertainty* (z score) were entered, these explained 5.5% but the F-change was not significant.
- **Block four - Satisfaction**: $R^2 = .144$, ($F [6, 52] = 1.458, p = .211$). Only *Job Satisfaction* (z score) was entered but explained little variance.
- Block five - Other Aspects of Wellbeing: \( R^2 = .166, (F_{[8, 50]} = 1.242, p = .295) \). Two wellbeing variables were used Stress (z score) and lower body part discomfort (z score). These explained 2.2% of the variance while the F-change was not significant.

Table 14.5 shows the results for each block and it can be seen that the F-change was significant only from blocks one to two.

### Table 14.5. Models of Significant IVs Z Scores and Noradrenaline Z Score (site one, round one)

<table>
<thead>
<tr>
<th>Block one - Personal &amp; Non-work Factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two - General &amp; Temporal Job Demands</td>
<td>.075</td>
<td>.071</td>
<td>4.286</td>
<td>.043</td>
</tr>
<tr>
<td>Block three - Contextual Demands Impediments</td>
<td>.130</td>
<td>.055</td>
<td>1.111</td>
<td>.353</td>
</tr>
<tr>
<td>Block four - Satisfaction</td>
<td>.144</td>
<td>.014</td>
<td>.847</td>
<td>.362</td>
</tr>
<tr>
<td>Block five - Other Aspects of Wellbeing</td>
<td>.166</td>
<td>.022</td>
<td>.651</td>
<td>.526</td>
</tr>
</tbody>
</table>

Table 14.6 below shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient (\( \beta \)), the semipartial correlation coefficients (\( sr_i^2 \)) and \( R^2 \), and adjusted \( R^2 \) values for this set of factors drawn from blocks one to five.

Neither the regression model nor any of the regression coefficients were significant. A total of 16.6% (3.2% adjusted) of the variability in noradrenaline scores were predicted by these IVs.

### Table 14.6. Stepwise MR of Significant IVs Z Scores and Noradrenaline Z Score (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>( \beta )</th>
<th>Sig.</th>
<th>( sr_i^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.001</td>
<td>.019</td>
<td>.004</td>
<td>.978</td>
<td>.004</td>
</tr>
<tr>
<td>Too Much to Do</td>
<td>-.266</td>
<td>.235</td>
<td>-.172</td>
<td>.263</td>
<td>-.146</td>
</tr>
<tr>
<td>Environmental &amp; Informational Impediments</td>
<td>-.417</td>
<td>.325</td>
<td>-.195</td>
<td>.206</td>
<td>-.166</td>
</tr>
<tr>
<td>Performance Uncertainty</td>
<td>.188</td>
<td>.267</td>
<td>.119</td>
<td>.485</td>
<td>.091</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>.266</td>
<td>.249</td>
<td>.148</td>
<td>.290</td>
<td>.138</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>.120</td>
<td>.289</td>
<td>.079</td>
<td>.679</td>
<td>.054</td>
</tr>
<tr>
<td>Lower Body Part Discomfort</td>
<td>.158</td>
<td>.171</td>
<td>.126</td>
<td>.359</td>
<td>.119</td>
</tr>
<tr>
<td>SAACL Stress Score</td>
<td>-.085</td>
<td>.155</td>
<td>-.085</td>
<td>.587</td>
<td>-.071</td>
</tr>
</tbody>
</table>

\( F_{[8, 50]} = 1.242, p = .295 \)

Intercept = .178 (.774)

Unique variability = .019 Shared variability = .136

R = .407 \( R^2 = .166 \) Adjusted \( R^2 = .032 \)
Linear Mixed Model Analyses (two and three repetitions)

To maintain an acceptable ratio of cases to variables, only significant variables from the most centrally important domains were included in LMM analyses, as shown in Table 14.7. Statistically significant variables are shown in red.

The following variables were associated with the greatest changes in the noradrenaline levels. Noradrenaline scores were higher when subjects reported:

- uncertainty about the adequacy of their own work performance; (by .249 and .29 standard deviations with two and three repetitions) and
- career uncertainty (by .34 standard deviations with three repetitions).

Noradrenaline scores were lower although it only approached significance when subjects reported Low Body part Discomfort.

Table 14.7. Estimates of Fixed Effects Model with significant IV and NA Z Scores (site one, two and three repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n=57)</th>
<th>Three Repetitions (n=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated effects</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.678</td>
<td>.36</td>
</tr>
<tr>
<td>Age</td>
<td>.012</td>
<td>.00</td>
</tr>
<tr>
<td>Too Much to Do</td>
<td>-.055</td>
<td>.10</td>
</tr>
<tr>
<td>Environ/Informational</td>
<td>-.151</td>
<td>.133</td>
</tr>
<tr>
<td>Performance Uncertainty</td>
<td>.249</td>
<td>.12</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>.155</td>
<td>.13</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>.052</td>
<td>.13</td>
</tr>
<tr>
<td>SACIL Stress Score</td>
<td>.044</td>
<td>.07</td>
</tr>
<tr>
<td>Lower Body Part Discomfort</td>
<td>-.046</td>
<td>.07</td>
</tr>
</tbody>
</table>

RESULTS: CORTISOL

As for catecholamines, levels of urinary free cortisol vary widely between studies due to differences in the nature and levels of exposure to specific stressors, assaying techniques, and to the very large and significant inter-individual variability. However, the direction of effects is reasonably consistent between studies.
Figure 14.3 shows the distribution of urinary cortisol levels (n/mols per 24 hours) with all rounds combined. One-way ANOVA showed no difference in levels between rounds ($F_{[2,157]} = 2.8$, $p = .06$).

As with the catecholamines, the decision was taken both to retain outliers and not to transform the data. Cortisol levels are shown in Appendix 8, Table 8.126. Levels were close to the reference values published by the National Committee for Clinical Laboratory Standards (1995) (see Appendix 8, Table 8.126).\textsuperscript{157}

\textsuperscript{157} Urinary free (i.e. unconjugated) cortisol values vary widely (Murphy, 1999). However, the direction of effects is reasonably consistent between studies. Extreme values are associated with pathological disorders.
IDENTIFICATION OF FACTORS INFLUENCING CORTISOL LEVELS

Preliminary Analyses

Bivariate correlations between cortisol and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 14.1 of Appendix 14. The results of the preliminary multivariate analyses using MR and LMM as previously described are reported in Appendix 14.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round or that were statistically significant for at least one of the rounds, or which were found to be significant in the multivariate analyses, were:

- two of the six General and Temporal Demands: unpleasant working hours and responsibility
- two of the five Specific Work Demands: cognitive demands and errors important consequences
- one of the seven Contextual Demands and Impediments: conflict
- none of the four Job Control and Variety factors
- one of the five Support factors: coworker cohesion and relationships
- not SPPCA
- one of the five Satisfaction factors: satisfaction with own performance
- one of the five other Aspects of Wellbeing: Wornout
- two of the nine Personal and Non-Work variables: gender and conflict between home and work demands)

MULTIVARIATE ANALYSES

Stepwise Sequential multiple regression analysis (round one data)

Results of the sequential regression are summarised below and in Table 14.10 where each model was significant.

- Block one - Personal & Non-Work Factors: $R^2 = .124$, ($F [2, 59] = 4.191$, $p < .05$). Two factors were included: gender and conflict between home and work demands. These factors explained 11.7% of the variance.
- Block two - General & Temporal Job Demands: $R^2 = .185$, ($F [4, 57] = 3.241$, $p < .01$). Two factors unpleasant working hours (z score) and responsibility (z score) accounted for 6.6% of the variance but the F-change was not significant.
• Block three - Support: \( R^2 = .201, (F [5, 56] = 2.813, p < .05) \). One factor as entered: *coworker cohesion and relationships* (z score) but explained little variance.

• Block four - Contextual Demands & Impediments: \( R^2 = .257, (F [6, 55] = 3.168, p < .01) \). Only *conflict* (z score) was used, it explained 3.6% but the F-change was not significant.

• Block five - Satisfaction: \( R^2 = .285, (F [7, 54] = 3.071, p < .01) \). *Satisfaction with own work performance* (z score) was added but explained little of the variance in scores.

• Block six – Other Aspects of Wellbeing: \( R^2 = .286, (F [8, 53] = 2.655, p < .01) \). *Wornout* (z score) was included but explained little of the variance the F-change was not significant.

Table 14.8 shows the F-change which was significant at the first and fourth blocks.

**Table 14.8. Models of Significant IVs Z Scores and Cortisol Z Score (site one, round one)**

<table>
<thead>
<tr>
<th>Block one – Personal &amp; Non-Work Factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two –General &amp; Temporal Job Demands</td>
<td>.124</td>
<td>.124</td>
<td>4.191</td>
<td>.020</td>
</tr>
<tr>
<td>Block three –Contextual Demands &amp; Impediments</td>
<td>.185</td>
<td>.061</td>
<td>2.130</td>
<td>.128</td>
</tr>
<tr>
<td><strong>Block four – Supports</strong></td>
<td><strong>.257</strong></td>
<td><strong>.056</strong></td>
<td><strong>4.151</strong></td>
<td><strong>.046</strong></td>
</tr>
<tr>
<td>Block five- Satisfaction</td>
<td>.285</td>
<td>.028</td>
<td>2.108</td>
<td>.152</td>
</tr>
<tr>
<td>Block six- Aspects of Wellbeing</td>
<td>.286</td>
<td>.001</td>
<td>.103</td>
<td>.750</td>
</tr>
</tbody>
</table>

Table 14.9 below shows the unstandardized regression coefficients (\( B \)) and intercept, the standardized regression coefficient (\( \beta \)), the semipartial correlation coefficients (\( sr^2 \)) and \( R^2 \), and adjusted \( R^2 \) value for this set of factors drawn from blocks one to six. The statistically significant variables are shown in red.

With this combination of variables, only *gender* and *conflict* differed significantly from zero, and their unique contribution to the \( R^2 \) was .126. The factor *conflict between home and work demands* approached significance. The other the IVs in combination contributed another .112 in shared variability. Thus a total of 28.6% (17.8% adjusted) of the variability in cortisol scores were predicted by these variables.
Table 14.9. Stepwise MR of Significant IVs Z Scores and Cortisol Z Score (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>Sig.</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-.483</td>
<td>.243</td>
<td>-.237</td>
<td>.052</td>
<td>-.263</td>
</tr>
<tr>
<td><strong>Conflict between home &amp; work demands</strong></td>
<td>.557</td>
<td>.300</td>
<td>.250</td>
<td>.069</td>
<td>.247</td>
</tr>
<tr>
<td>Unpleasant Working Hours</td>
<td>-.067</td>
<td>.146</td>
<td>-.056</td>
<td>.649</td>
<td>-.063</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.243</td>
<td>.160</td>
<td>.185</td>
<td>.134</td>
<td>.204</td>
</tr>
<tr>
<td><strong>Conflict</strong></td>
<td>.281</td>
<td>.138</td>
<td>.249</td>
<td>.046</td>
<td>.270</td>
</tr>
<tr>
<td>Coworker Cohesion and Relationships</td>
<td>-.118</td>
<td>-.150</td>
<td>.100</td>
<td>.435</td>
<td>-.107</td>
</tr>
<tr>
<td>Satisfaction with Own Work Performance</td>
<td>-.308</td>
<td>.215</td>
<td>-.198</td>
<td>.159</td>
<td>-.193</td>
</tr>
<tr>
<td>Wornout</td>
<td>-.050</td>
<td>.156</td>
<td>-.047</td>
<td>.750</td>
<td>-.044</td>
</tr>
</tbody>
</table>

\[ F [7,54] = 2.430, p < .05 \]

| | Unique variability = .241 | \( R = .535 \) | \( R^2 = .286 \) |
|-----------------|--------------------------|-----------------|
| | Shared variability = .045 | Adjusted \( R^2 = .178 \) | 

**Linear Mixed Model Analyses (two and three repetitions)**

To maintain an acceptable ratio of cases to variables, only significant variables from the most centrally important domains were included in LMM analyses, as shown in Table 14.10. Where the variables were statistically significant they are in red. The following variables were associated with the greatest changes in the cortisol levels. Cortisol levels were lower:

- when people were *satisfied with their own work performance* (by .31 standard deviations with two repetitions) and

- for *women* (by .38 standard deviations with two repetitions).

Cortisol levels were higher when people had high levels of *responsibility* and when there was workplace *conflict* although these only approached significance.
Table 14.10 Estimates of Fixed Effects Model with significant IVs Z Scores and Cortisol Z Scores (site one, two and three repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n= 56)</th>
<th>Three Repetitions (n= 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate effects</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Intercept</td>
<td>-.124</td>
<td>.18</td>
</tr>
<tr>
<td>Female</td>
<td>-.379</td>
<td>.19</td>
</tr>
<tr>
<td>Male</td>
<td>0(a)</td>
<td>0</td>
</tr>
<tr>
<td>Conflict between home and work demands</td>
<td>.316</td>
<td>.214</td>
</tr>
<tr>
<td>No conflict between home and work demands</td>
<td>0(a)</td>
<td>0</td>
</tr>
<tr>
<td>Unpleasant Working Hours</td>
<td>-.023</td>
<td>.11</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.225</td>
<td>.12</td>
</tr>
<tr>
<td>Conflict</td>
<td>.063</td>
<td>.13</td>
</tr>
<tr>
<td>Coworker support cohesion</td>
<td>-.052</td>
<td>.12</td>
</tr>
<tr>
<td>Satisfaction with Own Work Performance</td>
<td>-.318</td>
<td>.15</td>
</tr>
<tr>
<td>Wornout</td>
<td>-.084</td>
<td>.12</td>
</tr>
</tbody>
</table>

a This parameter is redundant. DV: Cortisol
OVERVIEW OF RESULTS AND DISCUSSION OF STRESS HORMONES: BOTH SITES

For ease of comparison, the results of the final multivariate analyses models for all three hormones at both sites are combined and presented in Table 14.11. These are discussed below in relation to each of the main domains, followed by a more general discussion and conclusions from these analyses.

Based on the research literature (see earlier discussions) it was postulated that, in response to the various workplace factors and wellbeing states, there would be related neuroendocrine activity and this would be echoed by changes in the urinary catecholamine and cortisol levels.

Generally, only very modest relationships were revealed between all the measured factors and stress hormone levels. Using MR, few factors reached significance, but more using the LMM approach. Based on the multiple regression results, the most variance was explained by the included factors for cortisol with 28.6% ($R^2$) or 17.8% (adjusted $R^2$). For adrenaline the included factors explained 22.3% ($R^2$) or 2.0% (adjusted $R^2$) of variance. For noradrenaline, the included factors explained 16.6% ($R^2$) or 3.2% (adjusted $R^2$).
Table 14.11. Factors predicting Adrenaline, Noradrenaline and Cortisol based (site one only three multivariate analyses) *

<table>
<thead>
<tr>
<th></th>
<th>Adrenaline</th>
<th>Noradrenaline</th>
<th>Cortisol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR (n = 60)</td>
<td>LMM (2 repetitions n = 57) Estimated regression coefficients</td>
<td>LMM (3 repetitions n = 44) Estimated regression coefficients</td>
</tr>
<tr>
<td>Intercepts</td>
<td>.304</td>
<td>-.075</td>
<td>-.090</td>
</tr>
<tr>
<td>Personal and Non-work variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.004</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General &amp; Temporal Job Demands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too Much To Do</td>
<td>-.689**</td>
<td>-.281*</td>
<td>-.212</td>
</tr>
<tr>
<td>Increasing Wld Pressure</td>
<td>-.028</td>
<td>.179</td>
<td>.321**</td>
</tr>
<tr>
<td>Unpleasant Wld Hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility</td>
<td>.047</td>
<td>-.136</td>
<td>-.230*</td>
</tr>
<tr>
<td>Specific Work Demands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Care Vigilance</td>
<td>-.148</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>.128</td>
<td>.120</td>
<td>.230*</td>
</tr>
<tr>
<td>Errors Important</td>
<td>.144</td>
<td>-.013</td>
<td>.008</td>
</tr>
<tr>
<td>Contextual Demands &amp; Impediments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environ/Inform Imped</td>
<td></td>
<td>-.417</td>
<td>-.151</td>
</tr>
<tr>
<td>Perform Uncertainty</td>
<td>.188</td>
<td>.249*</td>
<td>.294*</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>.266</td>
<td>.155</td>
<td>.347**</td>
</tr>
<tr>
<td>Conflict</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

all factors expressed as Z scores ** p<.05 ** p <.01  blue p >.05-1
Table 14.11. Factors predicting Stress Hormone Adrenaline, Noradrenaline and Cortisol (continued)

<table>
<thead>
<tr>
<th></th>
<th>Adrenaline</th>
<th>Noradrenaline</th>
<th>Cortisol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MR (n = 60)</strong></td>
<td>LMM 2</td>
<td>LMM 3</td>
<td>LMM 2</td>
</tr>
<tr>
<td><strong>β</strong></td>
<td>Estimated regression coefficient</td>
<td>Estimated regression coefficient</td>
<td>Estimated regression coefficient</td>
</tr>
<tr>
<td><strong>Intercept</strong></td>
<td>.304</td>
<td>-.075</td>
<td>-.090</td>
</tr>
<tr>
<td><strong>Job Control &amp; Variety</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision latitude</td>
<td>.263</td>
<td>.163</td>
<td>.214</td>
</tr>
<tr>
<td><strong>Supports</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coworker cohesion &amp; relationships</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reward Satisfaction</td>
<td>.277</td>
<td>.276*</td>
<td>.183</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction Own Performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Aspect of Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LBPD</td>
<td>-.211</td>
<td>-.106</td>
<td>-.200*</td>
</tr>
<tr>
<td>SACL Arousal</td>
<td>.024</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SACL Stress</td>
<td>.073</td>
<td>.116</td>
<td>.149*</td>
</tr>
<tr>
<td>Wornout</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>.223</td>
<td>.166</td>
<td>.286</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>.020</td>
<td>.032</td>
<td>.178</td>
</tr>
</tbody>
</table>

all factors expressed as Z scores ** p<.05  ** p <.01  blue p >.05-1
Additional Data from Job Description

Adrenaline and Job Type and Level

There were significant differences between the job types in the scores for estimated daily adrenaline nmol/24hrs, \((F[3, 159] = 1.834, \ p < .05)\). However, a post-hoc evaluation (using Tukey HSD) showed no significant differences in adrenaline levels between the Job Types (see Appendix 8, Table 8.124). However, post-hoc tests between job types failed to detect significant differences. A one-way ANOVA showed no significant difference between the scores for the different Job Levels.

Noradrenaline and Job Type and Level

There were significant differences between the job types in the scores for estimated daily noradrenaline nmol/24hrs, \((F[3, 156] = 3.076, \ p < .05)\) (see Appendix 8, Table 8.125). A post-hoc evaluation (using Tukey HSD) showed no significant differences in mean noradrenaline levels between the Job Types. A one-way ANOVA showed no significant difference between the scores for the different Job Levels.

Cortisol and Job Type and Level

There were no significant differences between either the job types or level in cortisol levels (see Appendix 8, Table 8.126).

REVIEW AND DISCUSSION OF RESULTS

Based on a body of literature indicating significant relationships between workplace demands, psychological wellbeing and stress, hormones could be expected (for example Biondi & Picardi, 1999; Frankenhaeuser et al., 1989,1991; Hiem, Ehlert & Hellhammer, 2000; Rissler, 1979, 1989; and Lundberg & Frankenhaeuser, 1980 and others) it was hypothesized that:

a. Adrenaline would increase when job demands and factors resulted in increased Arousal regardless of whether the associated affect experienced was positive or negative.

b. Noradrenaline would increase when job demands and factors resulted in increased Arousal, regardless of whether the associated affect experienced was positive or negative.

c. Cortisol would increase when job demands and factors contributed to a negative affective state or in response to an affective state.
Effects of Personal & Non-Work Variables

The impact of workplace factors and wellbeing states on the levels of stress hormone was the prime focus of the study, so attempts were taken to control or account for their impact by undertaking preliminary analyses (see Appendix 15). Where personal and non-work factors were significant, these were entered into the first regression block. Only three of the eight factors\(^{158}\) in the ‘personal and non-work’ domain met the inclusion criteria for any of the final model analyses. These were: age for adrenaline and noradrenaline; and gender and conflict between home and work demands for cortisol.

Only with cortisol were there any significant associations which indicated that levels of this hormone varied between the genders\(^{159}\). A one-way ANOVA also confirmed\(^{160}\) that there were differences in scores for women at the various job levels, with the lowest levels of cortisol reported by less-senior officers, who were therefore likely to have more job control. Interestingly, there were no significant differences between the men’s cortisol levels at the different job levels.

Overall, the F-change for the first block of the MR for both adrenaline and noradrenaline was less than 1%, whereas for cortisol it was 12.4%, suggesting these factors were more important.

Effects of the Work Demands

General and Temporal Job Demands

Of the six factors grouped in the ‘general demands’ domain, three were included in the final model for adrenaline\(^{161}\), one for noradrenaline\(^{162}\) and two for cortisol\(^{163}\). Overall, the F-change for the second block of the MR was, for adrenaline 12.2%, for noradrenaline 7.1% and for cortisol 6.1%. Factors in this domain contributed more than for any other for adrenaline and noradrenaline, and were the second most important group for cortisol.

Significant relationships were found between some work demands and adrenaline, and with cortisol, but to a lesser extent with noradrenaline. The smaller number of significant relationships for workplace factors for noradrenaline is not uncommon in field studies (e.g. Suilter et al., 2000). It was expected that high work demands would be associated with elevated catecholamines levels due to both associated mental and physical activity. The relationship of these factors with cortisol would be dependent upon people’s perception of their capacity to cope with these demands.

\(^{158}\) age, gender, stress at home, conflict between home and work demands, physical injury, cigarettes, caffeine, and exercise

\(^{159}\) (n=22 cf males n=40)

\(^{160}\) F(3, 54)= 3.412, p<.05

\(^{161}\) too much to do in the available time, increasing workload pressure, and responsibility

\(^{162}\) too much to do in the available time

\(^{163}\) unpleasant working hours, and responsibility
While working long hours was associated with marginally higher SACL Stress ratings (see discussion in Chapter 11), this did not translate to a comparable impact for any of the adrenocortical hormones. In contrast, the expected direction of effect (higher adrenaline levels) of the job demand increasing workload pressure, was confirmed and was significant for one of the three data analyses.

Too much to do in the available time accounted for more of the variance in both adrenaline and noradrenaline levels than most other factors. This reached significance for adrenaline using two of the three analysis methods. However, the relationship was negative, that is, when the demands were high, levels of both adrenaline and noradrenaline decreased. This direction of the effect was not hypothesised and was also observed between high responsibility and adrenaline. While time pressure did not meet the inclusion criteria (based on the bivariate correlations), a small negative effect of high demands and low catecholamines was also observed for this factor.

Frankenhauser (1991) suggested that catecholamine levels tended to reflect the intensity of mental demands. Perhaps these subjects perceived that significant effort to cope with these demands was not required. Further, the Job Description had indicated that most subjects’ tasks were usually undertaken while sitting, and so the lower catecholamine levels might be more reflective of lower physiological arousal levels due to prolonged sitting, rather than a sense of high temporal demand. This explanation may also apply to the negative relationship between high demands for care and vigilance and adrenaline scores.

Several significant effects were found for some general and temporal demands and cortisol levels. It was also found that when people had unpleasant working hours, they showed lower cortisol levels. An explanation for these results might be that, based on information derived from the Job Description, subjects with the highest unpleasant working hours were either more senior or those who were providing the technical and communication support crucial to the organisation’s operations. So while the working hours were relatively ‘unpleasant’, they also to some degree reflected the perceived ‘job significance’, and perhaps it was this which resulted in a positive affective state. Task significance, because it increases job meaningfulness and satisfaction, is sometimes viewed as a potential moderator of stress and strain (Cox and Griffiths 1995; Hackman & Lawler 1971; Hackman & Oldham, 1975).

Higher responsibility was found to be associated with higher cortisol levels. While responsibility is a demand, if it is within the person’s coping capacity it also makes the work more interesting and rewarding (Siegrist, 1996; Siegrist et al., 1997). Given the result, it appears that many subjects perceived the level of responsibility as stressful.
**Physical and Non-physical Task Demands**

Of the six factors grouped in the ‘specific demands’ domain, three variables were included in the final adrenaline model\(^{164}\), and none for either noradrenaline or cortisol. Overall, the F-change of the MR was very small (adrenaline 1.9%) and no factors in this domain were entered into the final regression sequence for either noradrenaline or cortisol.

It was expected that, mostly, demands would result in higher adrenaline and probably also noradrenaline levels, the exceptions being *static physical demands* and *demand for care and vigilance* where lower levels of both hormones were expected (Biondi & Picardi, 1999; Cummins & Gevirtz, 1993; Goldstein, 1995; Hiem, Ehlert & Hellhammer, 2000; Henry, 1992., Frankenhaeuser 1991; and Lunberg & Frankenhaeuser, 1980).

The expected relationship was confirmed with *emotional demands*. When these were higher, adrenaline were also higher. A less pronounced relationship was also observed for the variable *errors have importance consequences*. However, for the reasons previously discussed the factor *demand for care and vigilance* was associated with lower adrenaline levels.

While *cognitive demands* did not meet the inclusion criteria for the final cortisol analysis model, based on the bivariate correlations for data rounds one and three, cortisol levels were lower when these demands were high. In Chapter 11 it was noted that higher cognitive demands were associated with lower SACL Stress scores, perhaps because the work was viewed as stimulating. So perhaps if the demands were within the person’s coping capacity, they were perceived positively rather than negatively.

As the *dynamic physical demands* at this site were very low, the non-significant relationship for this factor with any of the stress hormones was not surprising.

**Contextual Demands and Impediments**

Of the seven factors in this domain, none was included in the final model for adrenaline, three were included for noradrenaline\(^{165}\), and one for cortisol\(^{166}\). Overall, the F-change of the MR was, for noradrenaline 5.5% and for cortisol 5.6%, but as there were no significant factors, it was not included for adrenaline. Factors in this domain were the second most important for noradrenaline, and third most important for cortisol.

In this study, factors which increased the impediments to performance or created uncertainty about the work or security, were likely to have negative impact on wellbeing (Arnetz *et al.*, 1991; Ferrie *et al.*, 2001; O’Connor & Peters, 1984). It was hypothesised that these demands

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\(^{164}\) demand for care and vigilance, emotional demands and errors have importance consequences

\(^{165}\) environmental and informational impediments, career uncertainty, uncertainty about own performance adequacy

\(^{166}\) conflict
would be associated with increased catecholamine levels and increased cortisol levels (Frankenhaeuser, 1991). This effect was confirmed for the factors uncertainty about own performance adequacy and career uncertainty which both were associated with increased noradrenaline levels.

Conflict is known to increase stress (O’Connor & Peters, 1984). It was therefore not surprising that higher levels of workplace conflict resulted in higher cortisol levels.

Interestingly, the factor environmental and informational impediments included in the final noradrenaline model was associated with lower levels noradrenaline. Examination of the preliminary analyses (see Appendix 15) shows this negative relationship was also apparent for adrenaline but was non-significant. Perhaps in contrast to the hypothesised relationship, for these subjects when there is insufficient information people give up, rather than choose to exert greater effort to overcome the lack of information.

**Job Control, Variety & Support**

Four factors were grouped under the ‘job control and variety’ domain, but only one was included in the final model for adrenaline\(^{167}\). Five factors were grouped in the ‘support’ domain, none were significant for either adrenaline or noradrenaline and one for cortisol\(^{168}\). Overall, the F-change of the MR was for adrenaline was 1%, and no factors met the inclusion criteria for noradrenaline or cortisol.

It was hypothesised [ based on JDC (Karasek, 1979, 1989) and JDC-S models (Baker, Israel, and Schuman, 1996), and the work of Frankenhauser et al (1991), Stansfeld, Fuhrer and Shipley (1998), and Lindfors and Lundberg (2002)] that because low job control and poor support would be viewed negatively, it would be associated with higher cortisol levels. The direction of the effect on catecholamines would depend on whether a decision to exert effort was taken by participants.

For subjects in this study site, decision latitude was associated with higher adrenaline levels, suggesting that control increased physiological arousal. The direction of this effect was also reported by both Härenstam and Theorell (1988), and Suilter et al. (2000b). Despite the above assumption, none of the job control and variety factors met the inclusion criteria for the final multivariate model analyses for cortisol.

A study by Suilter et al. (2000) of the effects of mental and physical work on cortisol levels found similar negligible effects, and that neither job control nor social demands significantly affected stress hormone levels.

\(^{167}\) decision latitude

\(^{168}\) coworker cohesion and relationships last six months
None of the support factors were included in the final catecholamine models. One support
factor, good *coworker cohesion and relationships* was associated with *lower* cortisol levels
and these were significant for two of the three multivariate analyses.

**Effects of ‘Satisfactions’ on Levels of Stress Hormones**

Of the four factors in this domain, a different one was included in the final models for
adrenaline\(^{169}\), noradrenaline\(^{170}\) and cortisol\(^{171}\). Overall, the F-change of the MR was 2.9% for
adrenaline, 1.4% for noradrenaline, and 2.8% for cortisol.

It had been hypothesized that satisfaction would occur when there was a good fit between the
job demands and the person’s coping capacity, and in turn this would be reflected by lower
cortisol levels. No particular direction effect was proposed for the catecholamines.

While *Job Satisfaction* was included in the final model for noradrenaline, the direction of the
effect was neither consistent or significant. Satisfaction with the *rewards* for effort was
associated with *higher* adrenaline levels which were significant for one of the three data
multivariate analyses. Perhaps when rewards were lower, people were *more* willing to spend
effort and so physiological arousal increased. As expected, *satisfaction with own performance
adequacy* was associated with *lower* cortisol levels.

Interestingly, *SPPCA* did not meet the inclusion criteria for the final model building for any
of the three hormones. This was noteworthy as it had proved one of the most significant
predictors for most other wellbeing indicators.

**Effects of ‘Other Aspects of Wellbeing’ on Levels of Stress Hormones**

Of the five factors in this domain, three were included in the final model for adrenaline\(^{172}\) two
for noradrenaline\(^{173}\) and one for cortisol.\(^{174}\) Overall, the F-change of the MR was for
adrenaline 4.3%, for noradrenaline 2.2% and virtually nothing for cortisol.

It had also been expected that catecholamines would be higher when people had higher
Arousal and Stress scores, but lower when they were *Wornout* (Aguilera, 1994; Bossert *et al.*, 1988; Christensen & Jensen, 1994; Frankenahueser, 1986, 1991; Henry, 1992; Pruessner *et al.*, 1997 and others ). The expected relationship were confirmed between higher Stress scores
and adrenaline (which were statistically significant for one of the three analyses) and with
noradrenaline levels.

\(^{169}\) reward satisfaction

\(^{170}\) Job Satisfaction

\(^{171}\) satisfied with own work performance

\(^{172}\) arousal, stress, and lower body part discomfort

\(^{173}\) stress, and lower body part discomfort

\(^{174}\) wornout
It had also been hypothesised that bodily discomfort would be associated with higher catecholamine and cortisol levels due to the stressful effects of pain (Chrousos & Gold 1992; Heim, Ehlert & Helhammer 2000; Neeck, Federlin, Graef, Rusch & Schmidt 1990). However, bodily discomfort to the low back, buttocks and legs (LBPD) was found to be associated with statistically significant lower adrenaline and noradrenaline levels. As observed in Chapter 9, people actually reported very little bodily discomfort, and it was therefore considered that this measure probably reflected levels of physical fatigue rather than pain. Alternatively, perhaps if people were experiencing physical discomfort, they might decrease their physical activity. In both circumstance this reduced activity, whether due to fatigue or pain, would result in lower Arousal and so lower catecholamine levels.

It had been expected that the cortisol levels would be higher when people had high bodily discomfort, Stress, and Wornout scores (Aguilera, 1994; Bossert et al., 1988; Christensen & Jensen, 1994; Frankenhaeuser, 1986, 1991; Henry, 1992; Pruessner et al., 1997 and others).

No clear or significant relationship was apparent between Wornout and cortisol. Further, despite the relatively clear conceptual links between cortisol and Stress and bodily discomfort, either meets the inclusion criteria for the final multivariate analyses. Also, the bivariate relationships were ambiguous.

Despite a substantial body of literature indicating that significant relationships between workplace demands, psychological wellbeing and some adrenocortical hormones (Hiem, Ehlert & Hellhammer, 2000; Biondi & Picardi, 1999; Goldstein, 1995; Cummins & Gevirtz, 1993; Henry, 1992: 78., Frankenhaeuser 1991; and Lunberg & Frankenhaeuser, 1980), non-significant relationships have also been reported, for example, by Kang et al. (2003), Lindfors and Lundberg (2002), Sluiter et al. (2000), and Härenstam and Theorell (1988). As has been already noted in previous chapters, the ratings for these aspects of wellbeing matched or were close to the Australian means. Perhaps the lack of a clear relationship indicates that, for these subjects, levels of distress as measured by these factors were not high enough to stimulate increased cortisol release. While, overall, fewer significant relationships were found with workplace factors and noradrenaline, as compared to adrenaline and cortisol, this is not uncommon (see Sluiter et al., 2000).

Given the modest results described above, further analysis was conducted based on the division of the subjects into ‘normal’ (2 SD around the mean) and ‘high responders’, those with elevated scores (more or less than 2.1 SD around the mean). Not surprisingly, these results were suggestive of stronger relationships between Stress score and stress hormone levels in the expected directions. However, numbers of cases in these subgroups were too small to justify systematic analysis.
MEASUREMENT ISSUES

Once data had been collected from site one, it became clear that despite the original plan to gather ratings during ‘high’, ‘medium’ and ‘low’ workload periods, there was little variation between the three samples. This effectively prevented the ‘medium’ workload data being used as the baseline from which to compare changes in stress hormones during the ‘high’ and ‘low’ periods. In order to make use of the urine samples, it was decided to examine round one data using stepwise sequential regression, and to treat data where subjects had completed full sets as ‘repetitions’, using LMM. Clearly, despite this strategy, the lack of baseline data was a serious limitation, and the small sample size did not permit inclusion of all the measured factors in one group during multivariate analysis.

Although the design focus of this study was on the workplace factors which influence stress hormones, in fact relatively little variance was explained by the measured constructs. A major criticism is that by inference some of the most important predictors of adrenocortical activity were not captured by this study design. However, in field studies there is always pressure to limit the number of questionnaire items, and it was judged that a longer questionnaire would not have been acceptable to subjects.

Finally, while the work factors and wellbeing measures selected were suitable for the general purposes of the study, they were not easily comparable with studies conducted by others. Future research might focus on repeating this study, but ensuring there is clearer baseline workload data and that more commonly used measures of work demands and wellbeing are used.

The sampling and assaying procedures and protocols for catecholamines (which were carried out within the university’s laboratories) were in accord with the recommendations of Bjørgaas et al. (1998), White et al. (1995), Rivero-Marcotegui, et al. (1995), Greenberg et al, (1985), Jenner et al. (1987), and Davidson & Fitzpatrick (1985). Cortisol samples were independently assayed using the Automated Chemiluminescence System by the Austin Repatriation Hospital for levels of unadjusted raw concentrations of cortisol (nmol/L) which were then converted by the researcher to nmol/min, as described in Appendices 5.4 and 5.5. Pooled average urinary hormone levels were used in this study to even out acute response, thereby accurately reflecting the effects over the whole measurement day. In hindsight, it may be that this approach was at the cost of some sample sensitivity.

Further, it is possible that the lack of significant effects of work factors on the stress hormones was due to unidentified problems in the assaying techniques. However, given an

175 High performance liquid chromatography (HPLC) with electrochemical detection was used to measure the catecholamine peak heights
independent laboratory undertook the assaying of urine samples for cortisol, and those results were also modest, this appears less likely.

More probably, the lack of significant results were due to the large within and between individual variations in hormone production, which was evident in this sample population, but also has been observed by others (see for example Andrew et al., 1998, Edwards & Rees, 1994; Cummins & Gevirtz, 1992; Pollard, Ungpakorn & Harrison, 1992; Young et al., 1992, Gerlo et al., 1991; Lundberg et al., 1990; Lehmann & Keul, 1986; Burch, 1984).

CONCLUSIONS

Based on the research literature, it was postulated that, in response to the various workplace factors and wellbeing states, there would be related neuroendocrine activity, and this would be echoed by changes in the urinary catecholamine and cortisol levels. Generally, only modest relationships were revealed between all the measured factors and stress hormone levels. Higher levels of catecholamines were associated with increasing workload pressure, emotional demands, errors have importance consequences, career uncertainty, uncertainty about own performance, Arousal and Stress; and higher cortisol levels with responsibility, workplace conflict and being Wornout.

However, as at this study site the job demands, both objectively and subjectively, were not extreme, perhaps if higher demands had been present and therefore likely to approach the limit of subjects’ coping capacity, more dramatic associations between the stress hormones and the work factors might have then become apparent.

It was surprising that there were very few significant relationships detected between the measured aspects of wellbeing and the three stress hormones. While there was a relationship between Arousal and adrenaline it was quite small. As discussed in Chapter 12, it is likely that the nature of the demands meant that the range in Arousal was insufficient to be able to detect significant variations in catecholamine activity. A more convincing relationship was demonstrated between Stress levels and catecholamine levels. Only modest relationships were found between the demands and cortisol, and most of the variance in stress hormones was explained by the ‘personal and non-work variables’. Cummins and Gevirtz (1992) also found few associations between workplace demands and cortisol, which they attributed to the large interindividual variations.

Clearly, as an objective measure of wellbeing, the adrenocortical response to workplace factors is of ongoing interest. However, this aspect of the JobLoad study revealed serious and practical limitations with the use of stress hormones as a field tool, and the ability to accurately relate levels of stress hormones with other data about work characteristics and their effects on employee wellbeing. As an approach, collecting and assaying urine samples to
determine levels of stress hormones was time consuming and expensive. Further, it was technically challenging to assay and interpret results due to the large interindividual variability and number of confounding factors. For most field ergonomists and OHS professionals, this would make the measurement of employee stress hormones impractical.

~æk~
This Chapter reports relationships between various dimensions of JobLoad and self-perceived performance capacity and adequacy (SPPCA), which is treated in this chapter as a dependent variable. The results of the final analyses for each site are reported separately and the summary results for both sites are then reviewed and discussed.

RESULTS: SITE ONE

As described in Chapter 6, the SPPCA score was created from the average of five factors related to people’s perception of their ‘overall work performance’, ability for ‘problem-solving and thinking creatively’, ‘decision-making’, ‘concentrating’, and ‘focusing thoughts and thinking clearly’.

The overall mean for SPPCA at site one was 5.1 (SD 1.0). The scores for each round were quite similar, indeed a one-way ANOVA showed no significant difference between the three survey rounds.

The distribution of scores for all three rounds combined are shown in Figures 15.1 where it can be seen these were slightly negatively skewed with mild kurtosis.
IDENTIFICATION OF FACTORS INFLUENCING SPPCA

Preliminary Analyses

Bivariate correlations between SPPCA and other measured constructs, grouped into the major domains identified by the JLM, are shown in Appendix 15, Table 15.1. The results of the preliminary multivariate analyses using MR and LMM as previously described are also reported in Appendix 15.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses are listed below:

- All of the six General and Temporal Demands: total hours worked, time pressure, too much to do, increasing workload pressure, unpleasant working hours and responsibility
- one of the seven Specific Work Demands: cognitive demands
- five of the seven Contextual Demands & Impediments: interruptions and disruptions, environmental and informational impediments, uncertain work requirements, career uncertainty, and conflict
- two of the four Job Control & Variety factors: skill utilization, influence
- three of the five Support factors: coworkers support this week, supervisor support this week, supervisor and management attitudes and communication
- three of the six Personal and Non-work factors: stress at home, conflict between home work demands, age.

MULTIVARIATE ANALYSES

Stepwise Sequential Multiple Regression Analysis (Round One Data)

The strategy adopted for multivariate analyses is described in Chapter 7. Results of the sequential multiple regression (MR) are summarised below and in Tables 15.1 and 15.2. Each model within the sequence was significant:

- Block one - Personal & Non-work Factors: \( R^2 = .108, (F[2, 117] = 7.097, p = .01) \). Two factors were entered: conflict between home and work demands and stress at home, accounting for 10.8% of the variance in SPPCA.
- Block two - General & Temporal Demands: \( R^2 = .150, (F[6, 113] = 3.332, p < .01) \). Four factors were entered: total hours worked (z score), increasing workload pressure (z score), unpleasant working hours (z score) and responsibility (z score). These explained approximately 4.2% of the variance.
- Block three - Specific Work Demands: \( R^2 = .164, [F[7, 112] = 3.147, p < .01] \). One factor was entered: cognitive demands (z score) and explained 1.4% of the variance.
- **Block four - Contextual Demands & Impediments:** $R^2 = .372$, ($F_{[11, 108]} = 45.815, p < .01$). Four factors were entered: *interruptions and disruptions* (z score), *environmental & informational impediments* (z score), *career uncertainty* (z score) and *conflict* (z score). These factors accounted for 20.8% of the variance.

- **Block five - Job Control & Variety** $R^2 = .426$, ($F_{[14,105]} = 5.560, p < .01$). Three factors were entered: *work variety* (z score), *decision latitude* (z score) and *influence* accounting for 5.4% of the variance.

- **Block six - Support:** $R^2 = .436$, ($F_{[15, 104]} = 5.351, p < .01$). One factor was entered: *coworker support* (z score). This was not significant and contributed little to variance explained.

Table 15.1 shows that the F-changes between blocks in the above sequence were significant at the first, fourth, and fifth blocks.

<table>
<thead>
<tr>
<th>Block one - personal &amp; non-work factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two- general &amp; temporal job demands</td>
<td>.108</td>
<td>.108</td>
<td>7.097</td>
<td>.001</td>
</tr>
<tr>
<td>Block three- specific work demands</td>
<td>.150</td>
<td>.042</td>
<td>1.400</td>
<td>.238</td>
</tr>
<tr>
<td>Block four- impediments &amp; uncertainty</td>
<td>.164</td>
<td>.014</td>
<td>1.883</td>
<td>.173</td>
</tr>
<tr>
<td>Block five - job control &amp; variety</td>
<td>.372</td>
<td>.208</td>
<td>8.925</td>
<td>.000</td>
</tr>
<tr>
<td>Block six- support</td>
<td>.426</td>
<td>.054</td>
<td>3.277</td>
<td>.024</td>
</tr>
<tr>
<td>Block six– support</td>
<td>.436</td>
<td>.010</td>
<td>1.820</td>
<td>.180</td>
</tr>
</tbody>
</table>

Table 15.2 shows unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients ($sr^2$), $R^2$, and adjusted $R^2$ value for this set of constructs.

With this combination of variables, seven factors: *conflict between home and work demands, increasing workload pressure, interruptions and disruptions, career uncertainty, conflict, influence, and work variety* (in red) were significant and their unique contribution to the $R^2$ was .310. The factor *environmental and informational impediments* approached significance. The IVs in combination contributed another .126 in shared variability. Thus a total of 43.6% (35.4% adjusted) of the variability in SPPCA scores was predicted by these IVs.
Table 15.2. Sequential Multiple Regression of SPPCA with Significant IVs (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>B</th>
<th>Sig.</th>
<th>sri2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict with home and work demands</td>
<td>-.578</td>
<td>.20</td>
<td>-.260</td>
<td>.006</td>
<td>-.209</td>
</tr>
<tr>
<td>Stress from family</td>
<td>.152</td>
<td>.20</td>
<td>.064</td>
<td>.450</td>
<td>.056</td>
</tr>
<tr>
<td>Total Hours Worked</td>
<td>-.002</td>
<td>.08</td>
<td>-.002</td>
<td>.978</td>
<td>-.002</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>.464</td>
<td>.11</td>
<td>.365</td>
<td>.000</td>
<td>.286</td>
</tr>
<tr>
<td>Unpleasant Working Hours</td>
<td>-.167</td>
<td>.10</td>
<td>-.132</td>
<td>.127</td>
<td>-.113</td>
</tr>
<tr>
<td>Responsibility</td>
<td>-.134</td>
<td>.12</td>
<td>-.101</td>
<td>.282</td>
<td>-.080</td>
</tr>
<tr>
<td>Cognitive Demand</td>
<td>.031</td>
<td>.10</td>
<td>.025</td>
<td>.771</td>
<td>.022</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>-.365</td>
<td>.12</td>
<td>-.243</td>
<td>.005</td>
<td>-.212</td>
</tr>
<tr>
<td>Environ/Informational Impediments</td>
<td>.316</td>
<td>.17</td>
<td>.182</td>
<td>.065</td>
<td>.137</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>-.514</td>
<td>.16</td>
<td>-.315</td>
<td>.002</td>
<td>-.230</td>
</tr>
<tr>
<td>Conflict This Week</td>
<td>-.305</td>
<td>.12</td>
<td>-.217</td>
<td>.015</td>
<td>-.182</td>
</tr>
<tr>
<td>Decision Latitude</td>
<td>.150</td>
<td>.11</td>
<td>.121</td>
<td>.193</td>
<td>.097</td>
</tr>
<tr>
<td>Influence</td>
<td>-.322</td>
<td>.15</td>
<td>-.221</td>
<td>.034</td>
<td>-.158</td>
</tr>
<tr>
<td>Work Variety</td>
<td>.362</td>
<td>.15</td>
<td>.224</td>
<td>.022</td>
<td>.171</td>
</tr>
<tr>
<td>Coworker Cohesion &amp; Relationships</td>
<td>-.146</td>
<td>.10</td>
<td>.115</td>
<td>.180</td>
<td>-.099</td>
</tr>
</tbody>
</table>

\[ F [15, 104] = 5.351, p < .01 \]

Intercept = 3.230 [SE .198] (46.1%)

R = .660  \quad \quad R^2 = .436  \quad \quad \text{Adjusted } R^2 = .354

Unique variability = .310  \quad \quad \text{Shared variability} = .126

Stepwise Sequential Multiple Regression Analysis with Aspects of Wellbeing

In order to explore the possible relationship between SPPCA and the aspects of wellbeing, the sequential regression was repeated this time including these factors. To meet the variable-to-cases ratio, single-item scores were created from the average of all items within that domain, both significant and non-significant. These were then used to represent the domain in the appropriate block. Results of the sequential multiple regression (MR) are summarised below and in Tables 15.3 and 15.4. A single score was created from the scores within each of the domains except blocks one and seven. Each model within the sequence was significant:

- Block one - Personal & Non-work Factors: \( R^2 = .100, (F [1, 118] = 13.142, p = .01) \).
  One factor was entered: conflict between home and work demands, accounting for 10% of the variance in the self-perceived performance capacity and adequacy.

- Block two - General & Temporal Demands: \( R^2 = .106, (F [2, 117] = 6.950, p < .01) \).
  A single construct score representing factors in this domain was entered to represent this domain, but explained little variance.

- Block three - Specific Work Demands: \( R^2 = .107, [3, 116] = 4.644, p < .01) \). This single construct was entered to represent this domain, but explained little variance.

- Block four - Contextual Demands & Impediments: \( R^2 = .247, (F [4, 115] = 9.432, p < .01) \). A single construct score was entered accounting for 14% of the variance in scores.
• Block five - Job Control & Variety $R^2 = .257$, ($F_{5, 114} = 7.905$, $p < .01$). A single construct score was entered accounting for 1% of the variance.

• Block six - Support: $R^2 = .274$, ($F_{6, 113} = 7.112$, $p < .01$). A single construct score was entered, accounting for 1.7% of the variance.

• Block seven – Other Aspects of Wellbeing: $R^2 = .575$, ($F_{11, 108} = 13.269$, $p < .01$). Four factors were entered: Upper Body Part Discomfort, Wornout, Stress, Arousal, and Job Satisfaction explained over 30.1% of the variance.

Table 15.3 shows that the F-changes between blocks in the above sequence were significant at the first, fourth, and seventh blocks.

Table 15.3. Models of IVs and SPPCA (site one, round one)

<table>
<thead>
<tr>
<th>Block one - personal &amp; non-work factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two - general &amp; temporal demands</td>
<td>.106</td>
<td>.006</td>
<td>.783</td>
<td>.378</td>
</tr>
<tr>
<td>Block three - specific demands</td>
<td>.107</td>
<td>.001</td>
<td>.134</td>
<td>.715</td>
</tr>
<tr>
<td>Block four - impediments &amp; uncertainty</td>
<td>.247</td>
<td>.140</td>
<td>21.351</td>
<td>.000</td>
</tr>
<tr>
<td>Block five – job control &amp; variety</td>
<td>.257</td>
<td>.010</td>
<td>1.602</td>
<td>.208</td>
</tr>
<tr>
<td>Block six – support</td>
<td>.274</td>
<td>.017</td>
<td>2.596</td>
<td>.110</td>
</tr>
<tr>
<td>Block seven – other aspects of wellbeing</td>
<td>.575</td>
<td>.301</td>
<td>15.268</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 15.4 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient ($\beta$), the semipartial correlation coefficients ($sr^2$), $R^2$, and adjusted $R^2$ value for this set of constructs.

With this combination of variables, specific work demands, impediments, Wornout, Arousal and Stress (in red) differed significantly from zero. A total of 57.5% (53.1% adjusted) of the variability in SPPCA scores were predicted by these IVs.

Table 15.4. Sequential Multiple Regression of SPPCA with Significant IVs (site one, round one)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>$\beta$</th>
<th>Sig.</th>
<th>$sr^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict with home and work demands</td>
<td>-1.148 (2.1)</td>
<td>.16</td>
<td>-0.067</td>
<td>.363</td>
<td>-0.057</td>
</tr>
<tr>
<td>General and Temporal Demands Score</td>
<td>.018 (0.2)</td>
<td>.08</td>
<td>.016</td>
<td>.837</td>
<td>.013</td>
</tr>
<tr>
<td>Specific Work Demands Score</td>
<td>-1.73 (2.4)</td>
<td>.07</td>
<td>-0.170</td>
<td>.021</td>
<td>-0.147</td>
</tr>
<tr>
<td>Impediments Score</td>
<td>-1.76 (2.5)</td>
<td>.07</td>
<td>-0.176</td>
<td>.027</td>
<td>-0.141</td>
</tr>
<tr>
<td>Job Control Score</td>
<td>.052 (0.7)</td>
<td>.08</td>
<td>.050</td>
<td>.535</td>
<td>.039</td>
</tr>
<tr>
<td>Support Score</td>
<td>.047 (0.6)</td>
<td>.07</td>
<td>.045</td>
<td>.543</td>
<td>.038</td>
</tr>
<tr>
<td>Upper Body Part Discomfort</td>
<td>-1.10 (1.4)</td>
<td>.07</td>
<td>-0.096</td>
<td>.161</td>
<td>-0.089</td>
</tr>
<tr>
<td>Wornout</td>
<td>-3.65 (5.2)</td>
<td>.08</td>
<td>-0.340</td>
<td>.000</td>
<td>-0.256</td>
</tr>
<tr>
<td>Stress</td>
<td>-2.16 (3.0)</td>
<td>.08</td>
<td>-0.187</td>
<td>.016</td>
<td>-0.153</td>
</tr>
<tr>
<td>Arousal</td>
<td>.215 (3.0)</td>
<td>.07</td>
<td>.213</td>
<td>.007</td>
<td>.173</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>.181 (2.5)</td>
<td>.11</td>
<td>.120</td>
<td>.133</td>
<td>.095</td>
</tr>
<tr>
<td>F_{11, 108} = 13.269, p &lt; .01</td>
<td>Intercept = 2.817 [SE .134] (40.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R = .758</td>
<td>$R^2 = .575$</td>
<td>Adjusted $R^2 = .531$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique variability = .160</td>
<td>Shared variability = .415</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

176 very small numbers of subjects experienced lower body part discomfort so this was omitted (see chapter 9)
Linear Mixed Model Analyses (Two & Three Repetitions)

LMM analysis was used to extend the investigation to encompass results from second and third repetitions of data within subjects at site one. Results are shown in Table 15.5.

SPPCA scores were higher (% per unit change) when:

- *career uncertainty* was higher (by 6.2% and 6.1%),
- *stress at home* was higher (by 4.2% and 4.4%),
- *influence* was higher (by 4.5% and 4.3%),
- *interruptions and disruptions* (by 4.4% and 3.7%),
- *unpleasant working hours* (by 2.9% and 2.2%),
- *conflict* was higher (by 4.0% and 2.9%),
- *responsibility* was higher (by 3.6% with three repetitions),
- *work variety* was high (by 5.4% and 5.0%).

SPPCA scores were lower (% per unit change) when:

- *coworker cohesion & relationships* was better (by 2.4% and 2.3%),
- there was *increasing workload pressure* (by 5.1% and 7.3%),
- when *total hours worked* were high (by 2.0%), and
- there were *environmental and informational impediments* (by 3.5%).
<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Two Repetitions (n = 103)</th>
<th>Three Repetitions (n = 71)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate (%)</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Intercept</td>
<td>2.67 (38.2)</td>
<td>.07</td>
</tr>
<tr>
<td>Conflict between home/work demands</td>
<td>-.138 (1.9)</td>
<td>.15</td>
</tr>
<tr>
<td>Stress at home</td>
<td>-.296 (4.2)</td>
<td>.14</td>
</tr>
<tr>
<td>Total Hours Worked</td>
<td>.145 (2.0)</td>
<td>.06</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>.362 (5.1)</td>
<td>.09</td>
</tr>
<tr>
<td>Unpleasant Working Hours</td>
<td>-.208 (2.9)</td>
<td>.08</td>
</tr>
<tr>
<td>Responsibility</td>
<td>-.116 (1.6)</td>
<td>.09</td>
</tr>
<tr>
<td>Cognitive Demand</td>
<td>.104 (1.4)</td>
<td>.07</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>-.310 (4.4)</td>
<td>.09</td>
</tr>
<tr>
<td>Environ &amp; Informational Impediments</td>
<td>.246 (3.5)</td>
<td>.12</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>-.437 (6.2)</td>
<td>.12</td>
</tr>
<tr>
<td>Conflict</td>
<td>-.283 (4.0)</td>
<td>.08</td>
</tr>
<tr>
<td>Decision Latitude</td>
<td>.057 (0.8)</td>
<td>.09</td>
</tr>
<tr>
<td>Influence</td>
<td>.317 (4.5)</td>
<td>.11</td>
</tr>
<tr>
<td>Work Variety</td>
<td>.381 (5.4)</td>
<td>.12</td>
</tr>
<tr>
<td>Coworker Cohesion &amp; Relationships</td>
<td>.174 (2.4)</td>
<td>.08</td>
</tr>
</tbody>
</table>
RESULTS: SITE TWO

The distribution of scores for all three rounds combined are shown in Figures 15.2 where it can be seen that the scores were negatively skewed with mild kurtosis. Most people in site two rated their SPPCA as good, with a mean of 5.0 and a mode of 6 (see Figure 15.2). A one-way ANOVA showed no statistically significant difference between the two rounds.

![Histogram showing distribution of SPPCA scores](image)

**Figure 15.2. Distribution of SPPCA scores (site two all rounds combined)**

IDENTIFICATION OF FACTORS INFLUENCING SPPCA

Bivariate correlations between SPPCA and other measured constructs, grouped into the major domains identified by the JLM, are shown in Table 15.1 of Appendix 15. The results of the preliminary multivariate analyses using MR and LMM, as previously described, are reported in Appendix 15.

Variables where the bivariate correlations were 0.3 or higher for at least one survey round, or that were statistically significant for at least two of the rounds, or which were found to be significant in the multivariate analyses were:

- three of the six General and Temporal Demands: *too much to do, increasing workload pressure, responsibility*, cf. site one: *total hours worked, time pressure, unpleasant working hours*
- three of the seven Specific Work Demands: *cognitive demands, errors have important consequences, emotional demands*, cf. site one: *cognitive demands*
- two of the seven Contextual Demands & Impediments: *interruptions and disruptions, career uncertainty*, cf. site one: *environmental and informational impediments, uncertain work requirements, conflict*
- none of the four Job Control & Variety, cf. site one: *skill utilization, and influence*
- one of the five Support factors: *coworker cohesion & relationships*, cf. site one: *coworkers support this week, supervisor support this week, supervisor and management attitudes and communication*
- one of the six Personal and Non-work Variables: *conflict between home work demands*, cf. site one: *stress at home.*

**MULTIVARIATE ANALYSES**

**Stepwise Sequential Multiple Regression Analysis (Round 1)**

Results of the sequential multiple regression (MR) are summarised below and in Tables 15.6 and 15.7:

- **Block one - Personal & Non-work factors:** $R^2 = .092$, ($F[1, 50] = 5.057, p < .05$). *Conflict between home and work demands* was entered accounting for 9.2% of the variance.
- **Block two - General & Temporal Demands:** $R^2 = .217$, ($F[3, 48] = 4.443, p < .01$). Factors entered were: *responsibility* (z score), *increasing workload pressure* (z scores) and *total hours worked* (z score) accounting for 12.5% of the variance.
- **Block three - Specific Work Demands:** $R^2 = .276$, ($F[5, 46] = 3.509, p < .01$). Factors entered were: *cognitive demands* (z score) and *emotional demands* (z score) and explained 5.9% of the variance.
- **Block four - Contextual Demands & Impediments:** $R^2 = .372$, ($F[7, 44] = 3.726, p < .01$). Two factors were entered: *interruptions and disruptions* (z score) and *career uncertainty* (z score), these accounted for 9% of the variance in scores.
- **Block five - Job Control & Variety** $R^2 = .380$, ($F[8, 43] = 3.297, p < .01$). One factor was entered *influence* (z score), accounting for little variance.
- **Block six - Support:** $R^2 = .395$, ($F[9, 42] = 3.045, p < .01$). The factors here were *coworker cohesion & relationships* (z score), but this contributed little to explained variance.
Table 15.6 shows that, for site one, the F-changes between blocks in the above sequence were significant at the first, second, and fourth blocks.

<table>
<thead>
<tr>
<th>Variables</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block One – personal &amp; non-work factors</td>
<td>.092</td>
<td>.092</td>
<td>5.057</td>
<td>.029</td>
</tr>
<tr>
<td>Block Two – general &amp; temporal demands</td>
<td>.217</td>
<td>.125</td>
<td>3.848</td>
<td>.028</td>
</tr>
<tr>
<td>Block Three – specific work demands</td>
<td>.276</td>
<td>.059</td>
<td>1.868</td>
<td>.166</td>
</tr>
<tr>
<td>Block Four – impediments &amp; uncertainty</td>
<td>.372</td>
<td>.096</td>
<td>3.365</td>
<td>.044</td>
</tr>
<tr>
<td>Block Five – job control &amp; variety</td>
<td>.380</td>
<td>.008</td>
<td>.554</td>
<td>.461</td>
</tr>
<tr>
<td>Block Six – support</td>
<td>.395</td>
<td>.015</td>
<td>1.020</td>
<td>.318</td>
</tr>
</tbody>
</table>

Table 15.7 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient (β), the semipartial correlation coefficients (sr_i^2), R^2, and adjusted R^2 value for this set of constructs.

The factors cognitive demands, and interruptions and disruptions, conflict between home and work demands approached significance. Together all the factors explained a total of 39.5% (26.5% adjusted) of variability in SPPCA.

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%)</th>
<th>SE</th>
<th>β</th>
<th>Sig.</th>
<th>sr_i^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict with home &amp; work demands</td>
<td>-.598 (8.5)</td>
<td>.32</td>
<td>.236</td>
<td>.076</td>
<td>-.219</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-.277 (3.9)</td>
<td>.17</td>
<td>.241</td>
<td>.126</td>
<td>-.187</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.219 (3.1)</td>
<td>.17</td>
<td>.194</td>
<td>.228</td>
<td>.147</td>
</tr>
<tr>
<td>Cognitive Demands</td>
<td>.345 (4.9)</td>
<td>.17</td>
<td>-.287</td>
<td>.059</td>
<td>.233</td>
</tr>
<tr>
<td>Emotional Demands</td>
<td>.058 (0.8)</td>
<td>.19</td>
<td>.051</td>
<td>.770</td>
<td>.035</td>
</tr>
<tr>
<td>Interruptions &amp; Disruptions</td>
<td>-.347 (4.9)</td>
<td>.18</td>
<td>.304</td>
<td>.065</td>
<td>-.227</td>
</tr>
<tr>
<td>Career Uncertainty</td>
<td>-.224 (3.1)</td>
<td>.19</td>
<td>.195</td>
<td>.261</td>
<td>-.137</td>
</tr>
<tr>
<td>Influence</td>
<td>.178 (2.5)</td>
<td>.20</td>
<td>.156</td>
<td>.392</td>
<td>.104</td>
</tr>
<tr>
<td>Coworker Cohesion &amp; Relationships</td>
<td>.183 (2.6)</td>
<td>.18</td>
<td>.163</td>
<td>.318</td>
<td>.121</td>
</tr>
<tr>
<td>F [10, 40] = 1.681, p = .119</td>
<td>Intercept = 2.796 [SE 1.62] (39.9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R = .628</td>
<td>R^2 = .395</td>
<td>Adjusted R^2 = .265</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique variability = .105</td>
<td>Shared variability = .290</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Stepwise Sequential Multiple Regression Analysis with Aspects of Wellbeing (Round 1)

Sequential regression analysis was repeated with the inclusion of wellbeing variables. As with site one a single item score was used to represent the workplace factors.

Results of the sequential multiple regression (MR) are summarised below and in Tables 15.8 and 15.9. Except blocks one and seven, each model within the sequence was non-significant:

- **Block one - Personal & Non-work Factors:** $R^2 = .084$, ($F [1, 46] = 4.211, p = .01$). One factor was entered: *conflict between home and work demands*, accounting for 8.4% of the variance in the scores.
- **Block two - General & Temporal Demands:** $R^2 = .088$, ($F [2, 45] = 2.167, p < .01$). A single construct score was entered, but explained little variance.
- **Block three - Specific Work Demands:** $R^2 = .095$, ($F [3, 44] = 1.543, p = 217$). A single construct score was entered, but explained little variance.
- **Block four - Contextual Demands & Impediments:** $R^2 = .125$, ($F [4, 43] = 1.473, p = .208$). A single construct score was entered, accounting for 3% of variance.
- **Block five - Job Control & Variety:** $R^2 = .144$, ($F [5, 42] = 1.337, p = .241$). A single construct score was entered, accounting for 1.8% of variance in scores.
- **Block six - Support:** $R^2 = .164$, ($F [6, 41] = 1.337, p = .263$). A single construct support score was entered, contributing 2% of variance in scores.
- **Block seven – Other Aspects of Wellbeing:** $R^2 = .599$, ($F [11, 36] = 4.881, p < .01$). Five factors were entered *Upper Body Part Discomfort, Burnout, Stress, Arousal, and Job Satisfaction*. These explained 43.5% of variance in SPPCA scores.

Table 15.8 shows that the F-changes between blocks in the above sequence were significant at the first, and seventh blocks.

*Table 15.8. Models of IVs and SPPCA (site two, round one)*

<table>
<thead>
<tr>
<th>Block one - personal &amp; non-work factors</th>
<th>R Square</th>
<th>R Square Change</th>
<th>F-change</th>
<th>Sig. F-change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block two - general &amp; temporal demands</td>
<td>.084</td>
<td>.084</td>
<td>4.211</td>
<td>.046</td>
</tr>
<tr>
<td>Block three - specific demands</td>
<td>.088</td>
<td>.004</td>
<td>.197</td>
<td>.659</td>
</tr>
<tr>
<td>Block four - impediments &amp; uncertainty</td>
<td>.095</td>
<td>.007</td>
<td>.355</td>
<td>.554</td>
</tr>
<tr>
<td>Block five - job control &amp; variety</td>
<td>.125</td>
<td>.030</td>
<td>1.473</td>
<td>.232</td>
</tr>
<tr>
<td>Block six - support</td>
<td>.144</td>
<td>.018</td>
<td>.902</td>
<td>.348</td>
</tr>
<tr>
<td>Block seven - other aspects of wellbeing</td>
<td>.164</td>
<td>.020</td>
<td>.986</td>
<td>.327</td>
</tr>
<tr>
<td>Block seven - other aspects of wellbeing</td>
<td>.599</td>
<td>.435</td>
<td>7.802</td>
<td>.000</td>
</tr>
</tbody>
</table>
Table 15.9 shows the unstandardized regression coefficients (B) and intercept, the standardized regression coefficient (β), the semipartial correlation coefficients (sr^2), R^2, and adjusted R^2 value for this set of constructs. *Job Satisfaction* was significant. A total of 59.9% (47.6% adjusted) of the variability in SPPCA scores was explained by these IVs.

**Table 15.9. Sequential Multiple Regression of SPPCA with Significant IVs (site two, round one)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>B (%) (SE)</th>
<th>SE</th>
<th>β</th>
<th>Sig.</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict between home-work demands</td>
<td>-.348 (.9)</td>
<td>.30</td>
<td>-.140</td>
<td>.263</td>
<td>-.120</td>
</tr>
<tr>
<td>General Temporal Demands Score</td>
<td>-.161 (2.2)</td>
<td>.15</td>
<td>-.153</td>
<td>.319</td>
<td>-.107</td>
</tr>
<tr>
<td>Specific Demands Score</td>
<td>.093 (1.3)</td>
<td>.16</td>
<td>.079</td>
<td>.579</td>
<td>.059</td>
</tr>
<tr>
<td>Impediments Score</td>
<td>.011 (0.1)</td>
<td>.16</td>
<td>.011</td>
<td>.945</td>
<td>.007</td>
</tr>
<tr>
<td>Job Control Score</td>
<td>.259 (3.6)</td>
<td>.16</td>
<td>.280</td>
<td>.125</td>
<td>.166</td>
</tr>
<tr>
<td>Supports Score</td>
<td>.168 (2.3)</td>
<td>.18</td>
<td>.157</td>
<td>.358</td>
<td>.098</td>
</tr>
<tr>
<td>Upper Body Discomfort Score</td>
<td>-.064 (0.9)</td>
<td>.15</td>
<td>-.054</td>
<td>.686</td>
<td>-.043</td>
</tr>
<tr>
<td>Wornout Score</td>
<td>-.312 (4.4)</td>
<td>.19</td>
<td>-.244</td>
<td>.121</td>
<td>-.168</td>
</tr>
<tr>
<td>SACL Stress Score</td>
<td>-.246 (3.5)</td>
<td>.18</td>
<td>-.210</td>
<td>.201</td>
<td>-.138</td>
</tr>
<tr>
<td>SACL Arousal Score</td>
<td>.169 (2.4)</td>
<td>.15</td>
<td>.134</td>
<td>.288</td>
<td>.114</td>
</tr>
<tr>
<td><strong>Job Satisfaction Score</strong></td>
<td><strong>.726 (10.3)</strong></td>
<td><strong>.24</strong></td>
<td><strong>.614</strong></td>
<td><strong>.315</strong></td>
<td></td>
</tr>
</tbody>
</table>

**F [11, 108] = 13.269, p < .01**  
**Intercept = 2.652 [SE .176] (37.8)**

**R = .774**  
**R^2 = .599**  
**Adjusted R^2 = .476**

**Unique variability = .099**  
**Shared variability = .500**

**Linear Mixed Model Analyses (Two Repetitions)**

LMM analysis was used to extend the investigation to encompass results from subjects who participated twice. To facilitate interpretation of the results (given that factors are entered in one block using this method), only the main variables (as identified above) from the most centrally important domains were included: task and job demands, control, support and job type and level. Results are shown in Table 15.10.

Self-perceived performance capacity and adequacy scores were poorer (% per unit change in SPPCA) when:

- *increasing workload pressure* was higher (by 4.3%),
- *interruptions and disruptions* were higher (by 4.1%), and
- *cognitive demands* were higher (by 4.1%).
Table 15.10. Estimates of Fixed Effects SPPCA & significant IVs (site two, two repetitions)

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Estimated Effects (%)</th>
<th>Std. Error</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.25 (46.4)</td>
<td>.25</td>
<td>52.957</td>
<td>.000</td>
</tr>
<tr>
<td>Conflict between home-work demands</td>
<td>.421 (6.0)</td>
<td>.29</td>
<td>54.050</td>
<td>.163</td>
</tr>
<tr>
<td>No conflict between home-work demands</td>
<td>0(a)</td>
<td>0</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>Increasing Workload Pressure</td>
<td>-.305 (4.3)</td>
<td>.14</td>
<td>54.945</td>
<td>.042</td>
</tr>
<tr>
<td>Cognitive Demands</td>
<td>.289 (4.1)</td>
<td>.14</td>
<td>51.141</td>
<td>.050</td>
</tr>
<tr>
<td>Interruptions and Disruptions</td>
<td>-.287 (4.1)</td>
<td>.14</td>
<td>57.912</td>
<td>.049</td>
</tr>
<tr>
<td>Career uncertainty</td>
<td>-.207 (2.9)</td>
<td>.15</td>
<td>56.946</td>
<td>.175</td>
</tr>
<tr>
<td>Influence</td>
<td>.119 (1.7)</td>
<td>.15</td>
<td>57.978</td>
<td>.440</td>
</tr>
<tr>
<td>Coworker Cohesion and Relationships</td>
<td>-.143 (2.0)</td>
<td>.13</td>
<td>54.521</td>
<td>.288</td>
</tr>
</tbody>
</table>

Overview of Results: Both Sites

For ease of comparison, the results of the multivariate analyses for both sites are combined and presented in Table 15.11. This shows all the work characteristics and personal and non-work factors which were included in the final multivariate analyses. At site one, these factors explained approximately 43.6% (R²) or 35.4% (adjusted R²) and, at site two, 39.5% (R²) or 26.5% (adjusted R²) of the variance in SPPCA.
Table 15.11. Multivariate Analyses Final Models SPPCA – (both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th>Site Two</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR (n = 120)</td>
<td>LMM (2 repetitions n = 103)</td>
</tr>
<tr>
<td>intercept</td>
<td>21.28 (46.1)</td>
<td>2.67 (38.2)</td>
</tr>
<tr>
<td><strong>Personal &amp; Non-work variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>conflict between home/work</td>
<td>-.578 (8.2)**</td>
<td>-.260</td>
</tr>
<tr>
<td>stress from family</td>
<td>.152 (2.1)</td>
<td>.064</td>
</tr>
<tr>
<td><strong>General &amp; Temporal Work Demands</strong></td>
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<td></td>
</tr>
<tr>
<td>total hours worked</td>
<td>.002 (0.03)</td>
<td>-.002</td>
</tr>
<tr>
<td>increasing workload pressure</td>
<td><strong>.464 (6.6)</strong>*</td>
<td>.365</td>
</tr>
<tr>
<td>unpleasant working hours</td>
<td>-.167 (2.3)</td>
<td>-.132</td>
</tr>
<tr>
<td>responsibility</td>
<td>-.134 (1.9)</td>
<td>-.101</td>
</tr>
<tr>
<td><strong>Specific Work Demands</strong></td>
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<td></td>
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<tr>
<td>cognitive demand</td>
<td>.031 (0.4)</td>
<td>.025</td>
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<td>emotional demands</td>
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<td></td>
</tr>
<tr>
<td><strong>Contextual Demands &amp; Impediments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>interruptions &amp; disruptions</td>
<td><strong>-.365 (5.2)</strong>*</td>
<td><strong>-.243</strong></td>
</tr>
<tr>
<td>environmental &amp; informational impediments</td>
<td><strong>.316 (4.5)</strong>*</td>
<td><strong>.182</strong></td>
</tr>
<tr>
<td>career uncertainty</td>
<td><strong>-.514 (7.3)</strong>*</td>
<td><strong>-.315</strong></td>
</tr>
<tr>
<td>conflict</td>
<td><strong>-.305 (4.3)</strong>*</td>
<td><strong>-.217</strong></td>
</tr>
</tbody>
</table>

DV: SPPCA  * p < .05  ** p < .01  Blue p between .05-.1

Table 15.11 continued on next page
Table 15.11. Multivariate Analyses Final Models SPPCA – (both sites all multivariate analysis methods)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site One</th>
<th></th>
<th></th>
<th>Site Two</th>
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<tr>
<td></td>
<td>MR</td>
<td>LMM (2 repetitions n = 103)</td>
<td>LMM (3 repetitions n = 71)</td>
<td>MR</td>
<td>LMM (2 repetitions n = 36)</td>
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</tr>
<tr>
<td>Intercept</td>
<td>B (%)</td>
<td>(\beta)</td>
<td>Estimated effects (%)</td>
<td>B (%)</td>
<td>(\beta)</td>
<td>Estimated effects (%)</td>
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<td>2.68 (38.4)</td>
<td>2.79 (39.9)</td>
<td>3.25 (46.4)</td>
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<tr>
<td><strong>Job Control &amp; Variety</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision Latitude</td>
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<td>.121</td>
<td>.057 (0.8)</td>
<td>-.039 (0.5)</td>
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<tr>
<td><strong>Influence</strong></td>
<td>.322 (4.5)*</td>
<td>.221</td>
<td>.317 (4.5)**</td>
<td>.307 (4.3)**</td>
<td>.178 (2.5)</td>
<td>.156</td>
</tr>
<tr>
<td>Work Variety</td>
<td>.362 (5.1)*</td>
<td>.224</td>
<td>.381 (5.4)**</td>
<td>.355 (5.0)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supports</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coworker Cohesion &amp;</td>
<td>.146 (2.0)</td>
<td>.115</td>
<td>.174 (2.4)*</td>
<td>.165 (2.3)*</td>
<td>.183 (2.6)</td>
<td>.163</td>
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<td>Relationships</td>
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<tr>
<td>(R^2)</td>
<td>.436</td>
<td></td>
<td></td>
<td>.395</td>
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<tr>
<td>Adjusted (R^2)</td>
<td>.354</td>
<td></td>
<td></td>
<td>.265</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DV: SPPCA  * p <.05  ** p <.01  Blue p between .05-.1
Additional Data from Job Description

Job Type and Level

The data on job type and level were analysed separately because of the correlations and conceptual overlaps with JLM variables (see Appendix 8, Tables 7.121-123.). While the SPPCA scores were not significantly different between the four job types, there were differences between SPPCA amongst the job levels in site one (but not for site two). Overall, the poorer scores were reported by the most junior employees.

Given the performance might vary with level of education and years of experience, the bivariate correlations with SPPCA were checked but were found not to be significant.

The results from the Job Description process highlighted that, even within the same organisation, ratings of work demands and factors did sometimes vary between the job types and levels. The next section contains discussion of the IVs that were subsequently identified as significant predictors of SPPCA.

Participants’ open comments on Performance-related Issues (Site Two Only)

At the request of the employees’ union and Chief Executive Officer, subjects at site two were asked some additional questions relating to organisational performance, and things or actions, which in their opinion would help to improve staff productivity. The most consistent themes that emerged were suggestions regarding the need to provide clear and explicit task directions, positive feedback, reduce impediments and unnecessary work processes, increase responsibility, control and accountability for work but with concurrent support, and further improve pay, general conditions, training and opportunities for advancement

REVIEW AND DISCUSSION OF RESULTS

In order to have secure employment, most employees need to ensure that they meet performance goals. The maintenance of effort needed to meet these goals will have a personal cost, but success in work activities will also have benefits for overall wellbeing. In the JLM, good performance is viewed as a desirable outcome both for the employer and for the individual.
In the JobLoad Model adequate performance is viewed as inextricably interrelated with work-related wellbeing. It is viewed as the outcome of a manageable workload and a ‘good fit’ between the work demands, factors, and the individual’s coping capacity. As has been shown in the preceding chapters, SPPCA can also be viewed as an intervening variable between work factors and aspects of employee wellbeing (see Chapters 9 to 13 and 16), and in turn, coping capacity will be influenced by the individual’s wellbeing.

Factors expected to predict SPPCA, and which were measured and discussed in this section of the study, are indicated in red in Figure 15.3. Most people rated their SPPCA as very good\textsuperscript{177}. Whether this was an accurate reflection of their objective work performance is open to conjecture. The low variability in SPPCA scores found in this study is consistent with findings reported by Jex (1998). There is a question of whether this is artifactual or true range restriction. An artifactual restriction might have occurred if the scale design implicitly encouraged ratings within a limited range, but this is unlikely as the scale design followed the guidelines suggested

\footnotesize{\textsuperscript{177} Mode at both site 6, and at site one and two respectively, 20% and 21% of subjects rated their SPPCA as ‘extremely poor’ to ‘below average’, 25% and 29% as ‘average’, 36% and 39% as ‘very good’, and 18% and 10% as ‘extremely good’.}
by Meister (1989b). Alternatively, artifactual restriction might arise because people tend to view themselves favourably.

A more likely scenario was that the sample range was truly restricted because, not unfairly, proportionally more subjects were really likely to have average to very good performance. This is because either ‘poor performers’ were less likely to be encouraged to stay in the organisations, or they were not appointed in the first place. Alternatively low situational restraints and a good organisational climate might mean that narrow but good performance ranges were quite possible (Peters & O’Connor, 1988). Nevertheless, from the ergonomists’ perspective SPPCA was a valid estimation of the effect of the JobLoad (and both measured and unmeasured factors) on peoples’ perception of their own performance capacity and adequacy. The results of the multivariate analysis allows an inference about what factors these subjects found related most to their performance capacity and adequacy.

**Effects of Personal & Non-Work Variables**

While factors in this domain were not the focus of this research, accounting for their impact was important as they are expected to indirectly impact on performance capacity (Duxbury & Higgins, 2001; Lee, 1997). Of the six personal and non-work factors that were measured, only two met the criteria for inclusion in the final models as covariates. As noted in the previous section, overall, the personal and non-work and the work-related factors predicted only a moderate proportion of the overall variance in SPPCA.

At both sites SPPCA scores were poorer when conflict between home and work demands was higher. At site one SPPCA were also poorer when people reported higher Stress at home. With just these factors, the F-change in the sequential regression was 10.8% at site one and 9.2% at site two.

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178 While this may have been the case in site one which is usually regarded by other as a high performing organisation, this was not necessarily true at site two.

179 conflict between home and work demands, and stress at home
Effects of Work and Job Demands

General & Temporal Job Demands

Of the six factors in this domain, four factors\textsuperscript{180} were included in the final model for site one, and two\textsuperscript{181} for site two. It had been expected that when demands were perceived as high they were more likely to exceed coping capacity, and so SPPCA scores might then be poorer. The relative impact of factors in this domain varied between the two sites. While the F-change at site one was small and non significant (4.2%), it was large and significant at site two (12.5%). The reasons for this difference are discussed later.

The strongest relationships were found between SPPCA and \textit{increasing workload pressure}, however while both reached significance, the two sites responded differently\textsuperscript{182}, with the mean scores higher at site one than site two\textsuperscript{183}. To investigate this difference the scores were grouped into ‘low’, ‘moderate’ and ‘high’ \textit{increasing workload pressure} groups at both sites. A one-way ANOVA confirmed that SPPCA scores were different between these three groups at site one\textsuperscript{184} but not at site two. That is, people rated their SPPCA as better at site one where there was ‘moderate’ and ‘high’ \textit{increasing workload pressure}, but poorer at site two when these scores were ‘high’. Given that the Job Description had shown differences between the job types (see Chapter 7) it is conjectured that the differences may reflect the relative demands of the clerical versus other types of jobs. However examination of the Figure 15.4 box-plots of job type, SPPCA and \textit{increasing workload pressure} scores shows a trend for good SPPCA when pressure was high for the site one clerical, IT and technical officers, but not for the communications and help-desk officers or the clerical officers at site two. Clearly, the clerical officers at the two sites are responding differently to this kind of pressure.

One explanation for the differences is that these officers (that is the technicians, IT and site one clerical) may interpret \textit{increasing workload pressure} as reflecting the significance of their work. Alternatively, people in these job types (who can deal with workload pressure and still perform), have the prospect of being rotated to prestigious overseas posts or short-term missions. In

\textsuperscript{180} \textit{total hours worked, increasing workload pressure, unpleasant working hours, and responsibility}

\textsuperscript{181} \textit{increasing workload pressure, and responsibility}

\textsuperscript{182} However, this scale had very low scale reliability coefficients at both sites (.28 at site one and <.2 at site two) reducing the confidence in these findings.

\textsuperscript{183} \(\mu=4.4[SD 1.2]\) cf \(\mu=3.6[SD 1.6]\)

\textsuperscript{184} \(F[2, 291] = 8.599, p < .01\)
contrast, neither the communications and help desk officers nor site two clerical officers, had similar ‘rewards’ for working well under this pressure. A further question was raised by this result that requires further research. To what extent might the result mean that people in site one were successfully ‘adapting’ to this kind of pressure, but in site two their response was negative, because they were reaching or had exceeded a point where they perceived they able to cope?

Unpleasant working hours were associated with poorer SPPCA scores at both sites, although the associations were modest and it was only included in the final model at site one. Interestingly, SPPCA was rated as higher in site one when the total hours worked was higher. Figure 15.5 shows a modest upward trend between SPPCA and total hours worked which was significant at site one\(^{185}\) but not at site two.

\[^{185}\] F[4,289] = 2.554, p < .05
Jex (1998) noted that, while the negative health effects of long working hours is now clear, there is relatively little focus in this literature on their impact on performance. Where this has occurred, for example Spector et al. (1988) self-reported workload was not particularly strongly correlated with performance. Spurgeon, Harrington and Cooper (1997) reported performance decrements with longer working hours, which they attribute to fatigue associated with sleep deprivation. Where work is highly physically demanding, especially if there is also prolonged working hours, physical capacity will progressively decline and performance can then only be maintained by increasing effort or by using alternative approaches (Cooper and Branwell, 1992; Rodhal, 1989).

However, for most subjects at these study sites, the working hours were neither extreme, nor was the work especially physically demanding. Where work tasks are motivating, as was the case for many subjects at site one (based on the Job Description), it may be this also helps to protect performance capacity by increasing Arousal levels. Finally, as was alluded to in an earlier discussion, people may choose to work longer hours (as opposed to it being an involuntary requirement) in order to decrease overall work intensity. The longer working hours may give people time to work at a more comfortable pace and meet or exceed the required performance standards, thereby reducing stress. But in the long-term, this strategy is only sustainable if it does not create conflict between the home and work demands.

In site one, significant positive bivariate correlations existed between SPPCA and the variables *too much to do in the available time* and *time pressure and deadlines*, but this pattern was not
evident at site two. While these factors did not meet the inclusion criteria for the final multivariate analysis, Figure 15.6 illustrates that subjects at each site responded differently to time pressure.

![Figure 15.6. Box Plot of SPPCA Scores & Time Pressure](image)

One explanation might be that site one subjects expect to experience and cope with high temporal demands. Indeed, as emerged during interview with senior managers, their employer apparently deliberately selected for high performance capacity, certain personality types and overall stress resilience. Subjects knew that, within the context of the Australian public service, they were extremely highly regarded and their work was both prestigious and objectively important. In contrast, subjects at site two had more typical work demands and personnel profile. If this was the explanation for the different response, it illustrates the importance of considering the organizational context, and how this might influence employee attitudes to time pressure. Given the different patterns of effects at the two study sites for working hours and for the temporal demands, this area needs further investigation.
Specific Work Demands

Of the six factors in this domain only one\textsuperscript{186} met the criteria for inclusion in the final model, but even then the F-change, was neither large nor significant. Overall, this factor explained virtually none of the variance in SPPCA scores in site one, but it reached significance (using LMM) and explained proportionally more of the variance at site two.

That is, at site two when the work was more cognitively demanding people rated their SPPCA as marginally better. Perhaps cognitively demanding work was arousing and satisfying, and so increased people’s performance capacity, and willingness to spend effort.

It had been expected that SPPCA would be poorer when the cognitive, emotional, static and dynamic physical demands and the need for care and vigilance exceeded a person’s coping capacity. However, (except for cognitive demands), overall, most people did not rate these demands as very high.

Contextual Demands & Impediments

Of the seven factors in this domain two\textsuperscript{187} were included in the final model at both sites as well as two others\textsuperscript{188} at site one. The F-change in the regression sequence was significant at both sites (20.8\% and 9.6\%). Overall, a significant proportion of the variance in SPPCA were explained by these factors. Those factors with the greatest effect on SPPCA were interruptions and disruptions, career uncertainty and conflict.

Blumberg and Pringle’s (1982) view of job performance was that it was a function of the interactions of people’s psychological and emotional characteristics (capacity), which influences their willingness to spend effort (motivation), their cognitive and physiological capacity (ability), and of the environmental opportunities and impediments (opportunities) which affect performance effectiveness. As was seen in Chapter 11, impediments as well as directly interfering with performance because they are powerful stressors, can also indirectly impede effectiveness (Peters & O’Connor, 1980; Steel & Mento, 1986).

However, SPPCA was higher when there were environmental and informational impediments (e.g. insufficient information or equipment, red tape, not enough staff). There are several possible explanations. Perhaps where people overcame these impediments (by exerting extra effort or

\textsuperscript{186} cognitive demands
\textsuperscript{187} career uncertainty and conflict
\textsuperscript{188} interruptions and disruptions, environmental and informational impediments
using alternative approaches to still meet the work outputs), they felt this reflected ‘good’ performance by them. An example arose during the Job Description process, where technicians working overseas sometimes worked in cramped underfloor spaces joining communications cables (limiting their ability to perform) and where the right parts or tools (opportunities) might not be available. Overcoming these impediments required considerable ingenuity and extra effort. Objectively the measure of good performance, the installation of a communications network which worked, was the same with or without these impediments but, not unreasonably, people judging their own performance may have the view that in the circumstance they had done very well.

Workplace conflict can impede performance directly by limiting access to information and help from others, and indirectly through its action as a stressor (Chen & Spector, 1992). In this study employees reported relatively low levels of conflict and it was only weakly related to SPPCA. It could be that stronger association may have emerged if conflict was higher.

In both sites SPPCA scores were poorer when career uncertainty was high, although the impact was greater in site one (where organizational restructuring and downsizing was ongoing). Parker, Axtell & Turner (2001) and Sevrke & Hellgren (2001) both reported that job insecurity can impair performance. However Sverke et al. (2002) in a meta-analytical review, noted that the way insecurity relates to performance will be influenced by the organizational context. Where people perceive that their performance is not a primary criterion, their motivation to exert additional effort to increase their performance may be low. For example, whether they are laid off from work (or not) rather than, for example, global economic pressures.

At both sites, interruptions and disruptions were powerful predictors of SPPCA. The degree to which interruptions impede performance (and are a stressor) will depend on, amongst other things, the complexity of the current task (and opportunities for time-sharing), nature of the interruptions (how often, how much) and people’s strategies and opportunities for control (Eyrolle & Cellier 2000:542; Gillie & Broadbent, 1989).
Job Control & Variety

Of the four factors in this domain three\textsuperscript{189} were included in the final model for site one, and one for site two. Although the F-change (5.4\%) was significant at site one, it was smaller and non-significant at site two.

In site one SPPCA was higher when people felt that their influence was higher. A similar pattern was evident at site two. Several authors have found that participation (which is conceptually similar to influence) was more strongly related to self-rated performance, than to performance which was rated by others (Wagner & Gooding, 1987; Fisher, 1995 in Jex, 1998). That is, while observers did not rate it as important, the person did.

SPPCA was found to be higher when people experienced opportunities to use and develop their skills, reaching significance at both sites. Work variety was also positively associated with higher SPPCA scores, reaching significance in the final model. Both these factors provide opportunities for people to develop skills and expand their experience and helps to prevent boredom.

Importantly, work variety where is uses different body parts and capacities, allows opportunities for rest and recovery, protecting against performance decrements associated with fatigue.

Although not significant in the final multivariate model, decision latitude was associated with higher SPPCA scores.

Care must be taken when assuming causal inferences between control and performance. While poor job control tends to increase stress, which in turn may reduce performance, there may be reasons for subjects having little control other than poor job design. Supervisors may be reluctant to give control to those in whom they have little confidence, and who have a history of poorer performance (Jex, 1998).

The link between job characteristics and stress has been well established (see Karasek, 1989; Marmot et al., 1997 and others). While is it intuitively appealing to think that the same association will also apply with task performance, two meta-analyses undertaken of studies which looked at the relationship between perceived ‘job control’ (autonomy and participation in decision making or ‘influence’) and performance found only weak correlations, but much stronger relationships between Job Satisfaction and autonomy. From, these studies is could be concluded that while employees like having job control it does not necessarily improve task performance (Fried & Ferris, 1987; Spector, 1986.). Nevertheless, the importance of the control

\textsuperscript{189} decision latitude, skill utilization, influence, and work variety
should not be dismissed. Control may allow people to adopt strategies to overcome impediments, but it also contributes to Job Satisfaction, so improving motivation, attitudes and related work behaviours (Cropanzano et al., 1997).

**Support**

Of the five factors in this domain only *coworker cohesion & relationships* met the inclusion criteria in the final model at both sites. While significant in site one, overall it explained very little variance. Evidence from other studies are consistent with the inference that ‘support’ helps to moderate overall demands and buffer people from effects of stress (Cohen & Wills, 1985; Daniels & Guppy, 1995; House, 1981; and others). In the present study support from coworkers and supervisor (but not senior managers) were rated as good. It may be that if support had been lower, the effect on SPPCA would have become more obvious.

**Effects of Wellbeing**

To investigate the effects of aspects of wellbeing on SPPCA, a stepwise sequential regression was undertaken with these variables added in the last block. Of note was that a ‘healthy worker’ bias was likely to be operating, as those employees with physical or psychological problems which severely impeded performance were less likely to be at work and so participating in this study. However, the wellbeing factor’s contribution was substantial, evidenced by the F-change of 30.1% at site one and 43.5% at site two (Tables 15.3 and 15.7).

**Bodily Discomfort**

It was assumed that physical discomfort would directly influence SPPCA by reducing the muscle contractile forces, and indirectly by reducing people’s willingness to exert physical effort. At both sites, *UBPD* was associated with poorer SPPCA scores, despite the relatively small numbers of people reporting this kind of discomfort.

**Wornout**

The literature review discussed the theorised relationship between *severe* fatigue and performance decrements. Fatigue will both reduce information processing capacity and a person’s willingness to spend effort. It was therefore expected that SPPCA scores would be poorer when people were *Wornout*. It emerged that being *Wornout*, at both sites, was one of the most powerful predictors of poor SPPCA.
Stress

Within the ergonomics and cognitive psychology arena, factors which directly (for example poor text clarity on computer screens or low light conditions) or indirectly (such as stress) interfere with information processing capacity are of special interest. Many authors have reported that severe stress indirectly reduces information processing capacity by using attentional resources and by disrupting cognitive functioning (e.g. Hendy et al., 2001; Kantowitz, 1987; Proctor & Van Zandt, 1994; Wickens et al., 1998; Weaver, et al., 2001). The expectation that stress would therefore be associated with poorer SPPCA scores was confirmed at both sites. In site one, it was one of the most powerful single factors predicting poor performance.

Conversely, the impact of fatigue and stress on performance is not necessarily straightforward, as people are capable of adaptive and resourceful approaches to manage their performance and their stress and fatigue.

In the face of decreasing capacity, eventually people will choose protect either performance or themselves. However, in reality there are often significant incentives to maintain effort to delay performance breakdown, even when the human cost is high.

Hockey (1998) advises that it is useful to distinguish between the performance coping strategies used when people are stressed versus tired. It is suggested that anxiety will occur when people appraise that they can not longer meet the performance requirements (Lazarus & Folkman, 1983), whereas fatigue signals the cumulative cost of coping and the need for a shift to a low-effort mode of response (Hockey, 1998). To maintain performance, when people are stressed, they need to reduce their level of anxiety, whereas combating performance deteriorations associated with fatigued requires an ‘active mode of coping’ (resisting sleep or sustaining an effortful processing mode) (Hockey, 1998).

In practical terms, people may choose to reduce fatigue or stress by taking a short rest break to increase energy levels and calm down, undertake more rewarding tasks, or if possible switch to easier tasks or reduce work quality (Hancock and Desmond, 2001; Jex, 1998; Matthews, 2000).

However, in the compensatory control model (Broadbent, 1971; Kahneman, 1973; Hockey, 1997) when under stress people will be bias towards maintaining high-priority tasks at the expense of low- priority tasks. This required an increased commitment to the use of controlled processing, which is both phenomenologically effortful and attracts a wellbeing cost. While this is a good short-term strategy, the risks of this strategy failing is likely to increase as low priority
tasks queue up. It assumes also that people’s judgement about what tasks are high priority and those that have a low risk are the same as their manager’s. The technicians commented that, as the workload troughs had disappeared, they had fewer opportunities to get around to completing low priority tasks.

While people’s management strategies were not measured in this study, anecdotally and from the Job Description, subjects reported that they attempted to maintain performance in high workload periods by working hard, working longer and only doing tasks with the highest priorities, hoping that “the less important jobs might just go away”. Officers noted that if they did not consistently maintain a high performance standard they were passed over for promotion, leading to further work-related stress and dissatisfaction. Nevertheless, getting the balance right is not always easy. The human costs of high workloads was illustrated by a comment from a senior manager when asked what the consequences were of a performance strategy of working longer hours. He replied, somewhat ironically “my three marriages”.

**Arousal**

Easterbrook (1959) proposed a hypothesis to explain the relationship between arousal and performance which was discussed in Chapter 3. According to this hypothesis, when in low arousal states, performance is poor because people attend to both relevant and irrelevant task stimuli. As arousal increases, focus narrows so that relevant material is noted but irrelevant stimuli are ignored. In an over aroused state, the attentional focus becomes so narrow that some task-relevant stimuli are missed (Matthews, 2000; Easterbrook, 1959). While the absolute level of arousal is important, it is also its appropriateness given the nature of the task (e.g. complex or boring), and the strategies which people use to maintain their alertness.

At both sites the multivariate analyses demonstrated that overall SPPCA was poorer when Arousal scores were low. While the relationship between SPPCA and Arousal was not absolutely curvilinear (see Figure 15.7), as has been proposed by others (for example Broadbent, 1971 and Kahneman, 1973), SPPCA was better with low and moderate Arousal scores and worse with high Arousal scores.

Given that only 16% of people had SACL Arousal scores in the bottom quadrant, and 23%, it the upper quadrant of Arousal scores (where the relationship with performance was more likely to be evident), confidence in the reliability of this relationship is limited.
It may be that this measure was not sensitive enough to detect extremes of especially low Arousal where performance might be assumed to maximally deteriorate. Alternatively, it may be that for these subjects with these kinds of work demands, few people were under-aroused to the point where they felt their performance was seriously impeded. That, overall, the Arousal level were appropriate for adequate performance was inferred by the good SPPCA rating.

Information on the strategies that people used to maintain their alertness was not explicitly collected, apart from anecdotally. For example, people in site one working evening and night shifts tried to get up and walk around more, and/or consumed caffeine (this information was collected as part on the stress hormone investigation in a subset of subjects). Interestingly, the communications and help-desk officers, whose work did not entail much freedom to take breaks and who all regularly undertook shift work (when Arousal levels might reasonably be expected to be low), had the lowest Arousal scores and one of the poorest SPPCA ratings.

**Job Satisfaction**

Many authors have reported that Job Satisfaction may influence performance by increasing willingness to spend effort, or engagement in productive behaviours such as mentoring, increased loyalty and organisational citizenship (Cropanzano et al., 1997; Schott, 1992; Sauter, Murphy
&Hurrell, 1992; Tetrick, 1992 and others). A recent meta-analysis demonstrated the modest but significant link between overall Job Satisfaction and job performance (Judge et al., 2001). At both sites, *Job Satisfaction* was associated with higher SPPCA with a proportionally higher effect for subjects in site two.

However, while few people would argue that Job Satisfaction has no impact on performance, it is likely that its effect is more pronounced when work behaviour is not constrained or controlled (McCormick and Illgen, 1985). For example, Communications Officers were expected to process a specified number of documents within a predetermined time, so their opportunity to vary their performance as an expression of their dissatisfaction was limited or at least not without consequences.

As noted in the last chapter, the empirical research of causality of the relationships between performance and satisfaction is still not clear. It may be that happy workers are more productive and efficient, but this happiness might be equally due to good work conditions as to people’s disposition, or that good performance leads to satisfaction (Warr, 1999). However intuitively for most of us, it is probably both factors at work. A related concept to Job Satisfaction is that of self-efficacy (Bandura, 1997), which is both a personality trait and a result of performance success. Although not measured in this study it would be expected that there would be a strong correlation between ratings of SPPCA and self-efficacy.

It is notoriously difficult to assume a causal relationship between aspects of wellbeing and performance because this would require a level of control of factors not normally possible in field studies. While unpicking the direction of causality is important, is was beyond the scope of the study. Nevertheless, from a practitioner’s perspective, addressing the issues which cause dissatisfaction and poor performance will in all likelihood result is some benefit to the other.

**MEASUREMENT ISSUES**

This study viewed workload and performance within an ergonomic and human factors context. Within these disciplines a number of workload measures have been developed (such as the Cooper Harper and the NASA TLX) as a tools for the study of mental workload, usually applied to specific tasks. They asked subjects to rate their demands, performance and related stress and frustration during or shortly after tasks are completed. In this study subjects were asked to rate their performance capacity and adequacy as it related to their *whole* job and over the *last week*, rather than a momentary assessment of task load.
The SPPCA scale was developed for the purposes of this study, where the work was largely cognitive in nature. While the small subject numbers at both sites restricted both the confidence in and the ability to extrapolate findings, the scale’s reliability and consistency over the repeated rounds was noted to be high. As with other outcome measures, most IV’s limited range meant that it is was not possible to adequately assess the scale’s sensitivity.

In future research, it is suggested that additional items be added if the work has inherently high emotional demands, or where the tasks are primarily physical in nature. In line with the research by Johnson (2001), further consideration should be given to include appropriate ratings on ‘team performance’, ‘citizenship’ or ‘discretionary performance’. The latter two categories reflect activities which, while not formally part of a job, help to support overall organizational productivity and create a positive work climate (Coleman & Borman, 2000).

Nevertheless, while it clearly requires further testing and refinement, the SPPCA scale showed promise as another field tool for the ergonomist interested in people’s perception of their own performance capacity and adequacy where the work was largely cognitive in nature.

CONCLUSIONS

In the JLM, it was proposed that SPPCA would be higher when there is a good person-demand match, and in turn good SPPCA would improve wellbeing. Strong associations between SPPCA and the specific, contextual demands and impediments were found. This is an important finding because, while it is very common to collect information about ‘psychological demands’, job control, support, and organisational climate, it is rare in workplace studies for comprehensive information and ratings to be collected about specific demands, such as the nature and level of cognitive or perceptual work or performance impediments. From this study, it is evident that had this not been done, these factors’ important role in facilitating or impeding SPPCA would have been missed. However it should not be interpreted that, because SPPCA scores were not strongly associated with long working hours, temporal, perceptual, physical and emotional demands, and job control and support, that these factors were therefore not important predictors. Rather, these need to be seen in the context of their relative importance against other workplace factors. For these subjects, the demands and factors appeared to match their performance coping capacity. Further, good levels of job control and support were viewed as normal, so their relative impact

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190 Site one $\alpha=0.89$ and site two $\alpha=0.93$ with high scale consistency over the repeated rounds $\alpha$ for round 1=0.92, round 2=0.93, round 3=0.94, and a Guttman Split-half =0.89 and $\alpha$ part 1 =0.87 and part 2 =0.88 see chapter 6 for expansion.
was probably weaker. In contrast, it is possible that the contextual demands and impediments emerged as significant predictors because they were viewed as both unsatisfactory and largely preventable\(^{191}\). In sites where job control or support is poor it may be that their relative impact on SPPCA would then have been more profound.

Finally, it is essential not to automatically dismiss the importance of the work factors because only small effects on SPCCA were detected. Where tasks are very important to the organization’s efficiency, or where there are safety critical situations, quite small performance gains may still be very important. For example, anything that helped the Communications Officers to more effectively scan security sensitive material, or the Technicians to safely and efficiently install electrical components, would be valuable.

A strong association between SPPCA and the different aspects of wellbeing was confirmed. This illustrated the importance of considering performance within a dynamic interactive model. Modification of work demands and job factors to improve their match with the coping capacity of the normative operator are likely to improve performance capacity. However, it is also desirable to concurrently address the work-related causes of fatigue, stress, discomfort, job dissatisfaction and low arousal to not only improve employee wellbeing but to reap performance benefits. Studies like this one, which demonstrates the link between work factors, performance, and wellbeing, can help convince employers that there is benefit in addressing both the causes of poor performance and also of distress. While it is not possible to assume causal relationships between aspects of wellbeing and performance, from a practitioner’s perspective addressing the workplace factors which are associated with fatigue, discomfort, stress and promoting those which lead to Arousal and satisfaction will, in all likelihood, result in performance improvements for both the organisation and the individual.

Given the SPPCA scale’s apparent utility both as an outcome measure, and as a measure of and important and powerful predictor of aspects of wellbeing, establishing its reliability in other sites and where performance is known to be poor would be desirable. Additional research is also recommended to explore it efficacy as a measure of performance capacity and adequacy by supervisors and coworkers.

\(^{191}\) see earlier chapters for further discussion
Chapter 16

RELATIONSHIPS BETWEEN ASPECTS OF WELLBEING

The dimensions of work-related wellbeing that were formally measured in the present study were
arousal, wornout, discomfort, stress, and satisfaction. In previous chapters the predictors of each
of these wellbeing variables and of SPPCA have been reported. In this chapter the focus is on
relationships between these dimensions of wellbeing, and between each of these and SPPCA. It
is one of the unique features of this study that not only are the predictors of SPPCA examined but
also, interrelationships between SPPCA and various aspects of wellbeing. Their relationships
with adrenaline, noradrenaline and cortisol, and with ratings on single-item constructs assessing
general health, stress, and fatigue, are also reported. Single-item ratings were not included in
most of the multivariate analyses reported in previous chapters due to their high conceptual
overlap with the other, more reliable measures of wellbeing.

Although conceptually distinct from each other, it was expected that the different dimensions of
wellbeing would be correlated. For example, it is now well accepted that stress tends to increase
background muscle tension, and thereby increases the risk of bodily discomfort (see Schleifer et
al., 2002; Wærsted et al., 1996; Lundberg, 2002). In similar fashion, job satisfaction might
change how discomfort is viewed and tolerated, and protracted periods of feeling highly stressed
or wornout are likely to be dissatisfying.

Correlations for each of the two sites are displayed in Tables 16.1 to 16.3 for data collection
rounds one to three respectively. Values for single-scale ratings of Stress and Fatigue are
included here simply to confirm their relationships with more complex measures of the same
constructs, but are not considered further.

It can be seen that the strongest correlations are between SPPCA and Wornout, which is not
surprising given their conceptual overlap. Weighting the means from each round equally, data in
these tables show that the three strongest correlates for each of the key dimensions of wellbeing
plus SPPCA are:

- **Discomfort:** Wornout, SPPCA (low), Stress
- **Stress:** Wornout, SPPCA (low), Arousal (low)
- **Arousal:** SPPCA, Wornout (low), Satisfaction
Wornout: SPPCA (low), Stress, Satisfaction (low)

Satisfaction: SPPCA, Wornout (low), Arousal

SPPCA: Wornout (low), Arousal, Satisfaction.
Table 16.1. Correlations between aspects of wellbeing measure at round one (Pearson correlation coefficients for sites one and two separately)

| Aspects of Wellbeing | UBPD site one $r$ | UBPD site two $r$ | LBPD site one $r$ | LBPD site two $r$ | Stress site one $r$ | Stress site two $r$ | General Stress site one $r$ | General Stress site two $r$ | Arousal site one $r$ | Arousal site two $r$ | Wornout site one $r$ | Wornout site two $r$ | General Fatigue site one $r$ | General Fatigue site two $r$ | Poor Health site one $r$ | Poor Health site two $r$ | Job Satisfaction site one $r$ | Job Satisfaction site two $r$ | Adrenalin site one $r$ | Noradrenaline site one $r$ | Cortisol site one $r$ | Site One Mean | Site Two Mean |
|----------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Values for same site |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| UBPD                 |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| LBPD                 |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Str                 |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| GStr                |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Ar                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| WO                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Fatigue             |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Health              |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| JSat                |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| A                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| NA                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Cort                |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |

** Correlation is significant at the 0.01 level (2-tailed) and * Correlations is significant at the 0.05 level (2-tailed)

blue approached significance a= site one n=120; b= site two n=55 (9,10 & 11 n=61)
Table 16.2. Correlations between aspects of wellbeing measure at round two (Pearson correlation coefficients for sites one and two separately)

<table>
<thead>
<tr>
<th>Aspects of Wellbeing</th>
<th>UBPD Site One</th>
<th>LBPD Site One</th>
<th>Str Site One</th>
<th>GStr Site One</th>
<th>Ar Site One</th>
<th>WO Site One</th>
<th>Fatigue Site One</th>
<th>Health Site One</th>
<th>JSat Site One</th>
<th>A Site One</th>
<th>NA Site One</th>
<th>Cort Site One</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBPD site one</td>
<td>r</td>
<td></td>
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<td></td>
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<tr>
<td>UBPD site two</td>
<td>r</td>
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</tr>
<tr>
<td>LBPD site one</td>
<td>r .636**</td>
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</tr>
<tr>
<td>LBPD site two</td>
<td>r .607**</td>
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</tr>
<tr>
<td>Stress site one</td>
<td>r .491**</td>
<td>.362**</td>
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<td></td>
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</tr>
<tr>
<td>Stress site two</td>
<td>r .220</td>
<td>.131</td>
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</tr>
<tr>
<td>General Stress site one</td>
<td>r .275**</td>
<td>.210*</td>
<td>.460**</td>
<td></td>
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<tr>
<td>General Stress site two</td>
<td>r .241</td>
<td>- .010</td>
<td>.683**</td>
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</tr>
<tr>
<td>Arousal site one</td>
<td>r -.240*</td>
<td>-.184</td>
<td>-.393**</td>
<td>-.113</td>
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<td></td>
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</tr>
<tr>
<td>Arousal site two</td>
<td>r -.421*</td>
<td>-.168</td>
<td>-.250</td>
<td>-.296</td>
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</tr>
<tr>
<td>Wornout site one</td>
<td>r .398**</td>
<td>.357**</td>
<td>.592**</td>
<td>.276**</td>
<td>-.540**</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Wornout site two</td>
<td>r .463**</td>
<td>.408*</td>
<td>.416*</td>
<td>.518**</td>
<td>-.369*</td>
<td></td>
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<tr>
<td>General Fatigue site one</td>
<td>r .402**</td>
<td>.308**</td>
<td>.395**</td>
<td>.411**</td>
<td>-.396**</td>
<td>.430**</td>
<td></td>
<td></td>
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<tr>
<td>General Fatigue site two</td>
<td>r .468**</td>
<td>.237</td>
<td>.366*</td>
<td>.540**</td>
<td>-.576**</td>
<td>.587**</td>
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<tr>
<td>Poor Health site one</td>
<td>r .383**</td>
<td>.200*</td>
<td>.327**</td>
<td>.143</td>
<td>-.240*</td>
<td>.325**</td>
<td>.287**</td>
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</tr>
<tr>
<td>Poor Health site two</td>
<td>r .263</td>
<td>.079</td>
<td>.261</td>
<td>.037</td>
<td>-.553**</td>
<td>.207</td>
<td>.392*</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Job Satisfaction site one</td>
<td>r -.172</td>
<td>.202*</td>
<td>-.312**</td>
<td>.119</td>
<td>.385**</td>
<td>-.400**</td>
<td>-.048</td>
<td>-.213*</td>
<td></td>
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<tr>
<td>Job Satisfaction site two</td>
<td>r -.140</td>
<td>.362**</td>
<td>-.158</td>
<td>-.007</td>
<td>-.080</td>
<td>-.411*</td>
<td>-.181</td>
<td>-.239</td>
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<tr>
<td>Adrenaline site one</td>
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<td>-.063</td>
<td>.111</td>
<td>.140</td>
<td>-.010</td>
<td>.052</td>
<td>.062</td>
<td>-.076</td>
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<td>Noradrenaline site one</td>
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<td>.011</td>
<td>.055</td>
<td>.048</td>
<td>.007</td>
<td>-.102</td>
<td>-.018</td>
<td>.432**</td>
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<tr>
<td>Cortisol site one</td>
<td>r .005</td>
<td>.193</td>
<td>.068</td>
<td>.205</td>
<td>.036</td>
<td>-.096</td>
<td>.087</td>
<td>-.025</td>
<td>-.320**</td>
<td>.508**</td>
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<tr>
<td>Site One Mean</td>
<td>1.6</td>
<td>1.4</td>
<td>38.9</td>
<td>4.3</td>
<td>31.0</td>
<td>16.7</td>
<td>4.4</td>
<td>3.0</td>
<td>4.6</td>
<td>-2.061</td>
<td>-2.49</td>
<td>-0.78</td>
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<tr>
<td>SD</td>
<td>1.2</td>
<td>1.2</td>
<td>1.09</td>
<td>1.4</td>
<td>8.9</td>
<td>8.4</td>
<td>1.5</td>
<td>1.4</td>
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<td>.5962</td>
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<td>Site Two Mean</td>
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<td>17.3</td>
<td>4.2</td>
<td>3.0</td>
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<tr>
<td>SD</td>
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<td>1.3</td>
<td>13.3</td>
<td>1.5</td>
<td>8.4</td>
<td>7.6</td>
<td>1.7</td>
<td>1.5</td>
<td>1.3</td>
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** Correlation is significant at the 0.01 level (2-tailed) and * Correlations is significant at the 0.05 level (2-tailed)
blue approached significance a site one n=103; b site two n=36 (9,10 & 11 n=57)
Table 16.3. Correlations between aspects of wellbeing measure at round three (Pearson correlation coefficients for sites one)

<table>
<thead>
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<th>Aspects of Wellbeing</th>
<th>UBPD</th>
<th>LBPD</th>
<th>Str</th>
<th>GStr</th>
<th>Ar</th>
<th>WO</th>
<th>Fatigue</th>
<th>Health</th>
<th>JSat</th>
<th>A</th>
<th>NA</th>
<th>Cort</th>
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<tr>
<td>SACL Stress</td>
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<tr>
<td>General Stress</td>
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<td>-.291*</td>
<td>.355**</td>
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<td>SACL Arousal</td>
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<td>.459**</td>
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<td>.541**</td>
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<td>General Fatigue</td>
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<td>.401**</td>
<td>.277*</td>
<td>.423**</td>
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<td>.299*</td>
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<tr>
<td>General Health</td>
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<tr>
<td>Job Satisfaction</td>
<td>.386**</td>
<td>-.382**</td>
<td>-.053</td>
<td>-.527**</td>
<td>-.448**</td>
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<td>-.214</td>
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<tr>
<td>Adrenaline Z</td>
<td>.122</td>
<td>.070</td>
<td>.034</td>
<td>-.132</td>
<td>.132</td>
<td>.079</td>
<td>-.353**</td>
<td>.524**</td>
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<tr>
<td>Noradrenaline Z</td>
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<td>.058</td>
<td>.001</td>
<td>-.139</td>
<td>.104</td>
<td>.010</td>
<td>-.342*</td>
<td>-.076</td>
<td>.056</td>
<td>.932**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cortisol Z</td>
<td>.121</td>
<td>.142</td>
<td>.081</td>
<td>-.092</td>
<td>.341*</td>
<td>-.327*</td>
<td>-.293</td>
<td>.020</td>
<td>-.239</td>
<td>.028</td>
<td>.170</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>1.6</td>
<td>1.3</td>
<td>42.3</td>
<td>4.1</td>
<td>32.3</td>
<td>18.1</td>
<td>4.2</td>
<td>3.2</td>
<td>4.6</td>
<td>-.0302</td>
<td>.1082</td>
<td>.0247</td>
</tr>
<tr>
<td>SD</td>
<td>1.28</td>
<td>1.14</td>
<td>13.2</td>
<td>1.4</td>
<td>7.4</td>
<td>6.8</td>
<td>1.6</td>
<td>1.5</td>
<td>0.9</td>
<td>1.063</td>
<td>1.226</td>
<td>.9766</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed) and * Correlations is significant at the 0.05 level (2-tailed)
blue approached significance site one n=72 (9,10 & 11 n=44)
Although some correlations between separate dimensions are quite high and many are statistically significant, the overall pattern is confirmation of the multidimensional nature of wellbeing. Three of the five wellbeing dimensions are more strongly correlated with SPPCA than with any other variable, and for the other two (Discomfort and Stress), SPPCA was their second strongest correlate. These results support the role of SPPCA as an important precursor of wellbeing, as depicted in the JobLoad Model (see Figure 2.2).

The correlations also demonstrate that, excluding SPPCA, Wornout was the strongest correlate of all other wellbeing dimensions – that is: Stress, Satisfaction (low), Arousal (low) and Discomfort (in order of correlation strength) were all most strongly correlated with Wornout.

In the following sections, each of the five main dimensions of wellbeing is briefly reviewed in terms of its correlations with other dimensions of wellbeing and with SPPCA.

**Discomfort**

The strongest correlates of UBPD were Wornout, SPPCA (low) and Stress. These relationships are consistent with the nature of most of the participants’ jobs, which were largely computer-based and sedentary. Such work typically entails static physical demands, which are known to be associated with local muscle fatigue in the affected body regions; sedentary work is also associated with lower levels of physiological arousal, which – if performance must be maintained so that it is not possible to relax – can be experienced subjectively as tiredness.

UBPD scores were significantly and positively correlated with Wornout at both sites, consistent with them both being dimensions of fatigue (see chapter 3). Cox, Davis and Cook 1990 (in an unpublished paper reported in Cox, Kuk & Leiter, 1993) stated that “the effects of routine computer-based work on the report of muscular aches and pains are conditioned by the subjects’ feelings of being wornout...”.

For most data rounds, UBPD was significantly positively correlated with stress (both the SACL score and the single scale rating of General Stress). These results confirmed to the expectations that stress, because it is tends to increase levels of muscle tension, will result in higher fatigue and discomfort (Bongers et al., 2002; Carayon et al., 1999; Chaffin, 1991; Hagen et al., 1998; Kumar, 2001; Keyserling, 2000; Linton, 2001 and others). Conversely, being physically tired and uncomfortable is potentially stressful if it reduces coping capacity. This is especially so if discomfort escalates into pain, which is an extremely potent stressor (Bongers et al., 2002, Bültmann et al., 2002; Forde, Punnett and Wegman, 2002).
Wornout

The GWBQ was developed to tap “subjects’ sub-optimal health” using self-reported symptoms, subdivided into ‘being wornout’ and ‘up tight and tense’ (Cox & Griffiths, 1995). The Wornout scale was designed to map “fatigue, emotional fragility and confusion” (Gotts & Cox, 1988). The overall mean score for Wornout at both sites in the present study were above the mean values reported by Cox and Griffith (1995). The strongest correlates of Wornout were SPPCA (low), Stress and Satisfaction (low). Wornout was also positively correlated with discomfort, as reported above, and negatively correlated with Arousal for all rounds at both sites.

Stress

The strongest correlates of Stress were Wornout, SPPCA (low) and Arousal (low). Operationally, psychological stress and fatigue (UBPD, Wornout) are often caused by similar events, but whereas fatigue is conceptualised as resulting from a depletion of energy reserves, stress results from an appraisal that there is a threat to coping capacity (Lazarus 1966; 1999; Tepas and Price, 2001). Thus, being fatigued may not in itself be stressful. If tiredness results from activity that is perceived as ‘successful’ and which is shortly due to stop, the sensations may be interpreted as ‘pleasant tiredness’. Further, if people perceive that despite their fatigue they will be able to continue to meet performance goals (by exerting extra effort, or using alternative strategies), their level of stress may not increase. However, at the point where the individual believes that fatigue threatens their performance capacity, a stress response is likely to occur (Jex, 1998).

Looked at from another viewpoint, the experience of being ‘stressed’ entails the expenditure of ‘emotional energy’ which is likely to increase arousal, which in turn may tend to degrade performance, further increasing the effort required to meet the performance goals. Therefore, it was expected that when Stress was high, both UBPD and Wornout scores would be higher. For both sites, this assumption was confirmed – particularly in the case of Wornout.

There is a great deal of research showing significant associations between stress and poorer mental and physical health (e.g. Bosma, Peter, Goldstein, 1995; Schnall et al., 1994; Siegrist & Marmot, 1998; and Goldstein, 1995; Stansfeld, Fuhrer, Shipley, & Marmot, 1999). Consistent with this, poor General Health (which may represent the effects of exposure to chronic stress) was expected to reduce coping capacity, with a resultant increase in the probability of stress increasing. There were strong and significant bivariate correlations between Stress and General

192 Site one μ=17.0, SD 7.6, site two μ=18.1, SD 6.8 Cox and Griffith (1995)μ= 16.7, SD 8.3
Health for all data rounds and at both sites. Figure 16.1 shows the clear trend for poorer self-rated health with higher Stress scores.

Figure 16.1. Box Plot of Stress related to General Health (both sites)

When people are dissatisfied with their job, they may be more tired, stressed, less emotionally robust and therefore not able to deal as easily with challenges they face in the course of their work (Cropanzano et al., 1997; Schott, 1992), and can lead to disengagement, higher turnover rates, and non-legitimate absenteeism (Baker et al., 1996; Tetrick, 1992; Sauter, Murphy & Hurrell, 1992). However, the relationship between Stress and Satisfaction was not one of the strongest in this study: significant negative correlations between Stress and Job Satisfaction were evident at all three rounds at site one, and at one of the two rounds at site two.

Arousal

Arousal is conceptualised as an affectively neutral state that influences coping capacity. Very low levels are undesirable at work, because they are not conducive to effective work performance. Depending upon the nature of the activity, moderate to high (but not extreme) levels of arousal are desirable (Jex, 1998). It was expected that Arousal would be most directly influenced by the level of effort and activity entailed in work performance, and indirectly by other factors that might alter willingness to expend effort and thus increase coping capacity.
(except at very high arousal levels). In fact, Arousal scores at both sites were very close to the mean value reported by Gotts & Cox (1988) for an Australian sample of heterogeneous workers. As expected, Arousal was lower when fatigue (Wornout, UBPD) was higher, although the relationships were among the weaker ones. Health was rated as higher when Arousal was higher, which is consistent with people being less active when they feel less well. It was expected that Arousal and Job Satisfaction would be positively correlated, since Job Satisfaction is likely to be associated with higher energy and activity levels, and monotonous or boring work is likely to be both de-arousing and unsatisfying. Results were consistent with this, with Satisfaction being one of the strongest correlates of Arousal (after SPPCA and Wornout).

**Job Satisfaction**

Satisfaction was conceptualised as an affective state resulting from a cognitive judgment of the satisfactoriness of the match between the individual’s work demands and coping capacity, in light of the perceived rewards for effort. In fact, the strongest correlates of Satisfaction were SPPCA, Wornout (low) and Arousal, which is consistent with this view. At both sites Satisfaction was also higher when people rated their health as higher, and when stress was lower. Relationships between Satisfaction and UBPD were in the expected direction, but usually did not reach significance.

**Stress Hormones**

Very modest associations were found between the stress hormones and other measures of wellbeing. These relationships are discussed in Chapter 15.

**RELATIONSHIPS BETWEEN WELLBEING MEASURES IN TERMS OF THE WARR / DANIELS FIVE-AXIS MODEL**

Figure 16.2 presents mean correlations (means of round means for each site) between the five wellbeing dimensions measured in this study, in relation to Daniels’ (2000) five axes of affective wellbeing (see Figure 3.2 of Chapter 3); correlations with SPPCA and with the single-item rating of general health are also shown. This figure is based on that of Daniels (2000, p.280), developed from earlier work of Warr.

States of vigour and enthusiasm are represented here by high Arousal in combination with low Wornout, high Satisfaction and low Discomfort (in order of their correlation coefficients). Conversely, a state of tiredness was represented by high Wornout, in combination with low Arousal and high Discomfort (in order of their coefficients). States of anger and anxiety are
represented here by high Arousal and high Stress. It is interesting that, for both of the two populations sampled in this study there were negative correlations between Arousal and Stress, suggesting that, in terms of Daniels’ model, people generally felt more placid than angry.

As expected, high Stress was correlated with low Satisfaction. Good General Health was most strongly correlated with low Stress, low Wornout, and high Arousal; correlations with low Discomfort and high Satisfaction were considerably lower.

Arousal is positively correlated with SPPCA and Satisfaction, but negatively correlated with General Health. This may indicate that poor (self-reported) health is a limiting factor that restricts activity resulting in lower Arousal, rather than any effect of Arousal on health.
Figure 16.2. Five affective dimensions of wellbeing as conceptualized by Warr (2003) and Daniels (2000), showing relationships to the aspects of wellbeing measured in this study (in red -- all rounds combined for sites one and two). Numbers in brackets are means of correlations for sites 1 and 2. Correlations are between underlined variables and the variables below.
COMPARISON AND REVIEW OF WORK-RELATED PREDICTORS OF WELLBEING

Having reviewed correlations between wellbeing dimensions, the final section in this chapter briefly compares these dimensions in terms of their main work-related predictors, as identified and discussed in previous chapters, and summarised in Table 16.4. The predictor variables in this figure are listed in order of the strength of their relationship with each dimension, as determined by a review of results from the analyses reported in Tables 9.8, 10.8, 11.11, 12.8, 13.8, and 15.11. In comparing the different dimensions, reference is also made to the $R^2$ change values for blocks of predictor variables, which are summarised in Table 17.2.

Discomfort

There was a considerable difference between sites one and two in the pattern of predictors for UBPD, with the only factors in common being low SPPCA (the strongest in each case) and awkward arm and body postures (third strongest for site one, and second for site two). At site one, specific task demands (emotional demands, demand for care and vigilance) played a larger role than at site two. Overall, the general picture is that discomfort is more affected by performance-related factors (Specific Work Demands) than the other dimensions, with more general, job-related factors playing a lesser role. In view of the physically localised nature of this discomfort, this finding is unsurprising – although it should be noted that cognitive and emotional task demands, as well as physical demands, played significant roles.

It might have been expected that longer working hours would have played a larger role than it did (see for example IJzelenberg, Molenaar, & Burdorf, 2004; Lipscomb et al., 2002; Sparks et al., 1997), but the results here were equivocal. UBPD scores were marginally lower when total hours worked were higher in the final multivariate models. This weak but unexpected result was also found with some other wellbeing dimensions. It might perhaps be due to some people opting to work longer hours as an effective stress management strategy, if they would experience more stress by working more intensively for a shorter period. Further research is required to investigate the processes linking working hours to different aspects of employee wellbeing.
Table 16.4. Summary of the strongest predictors for each wellbeing dimension, listed in order of the strength of their relationship with each as determined by a review of results from the analyses reported in Tables 9.8, 10.8, 11.11, 12.8, 13.8 and 15.11.

<table>
<thead>
<tr>
<th>SPPCA</th>
<th>Site 1</th>
<th>Site 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increasing workload pressure↓</td>
<td>Conflict between home &amp; work demands↓</td>
</tr>
<tr>
<td></td>
<td>Career uncertainty↓</td>
<td>Increasing workload pressure</td>
</tr>
<tr>
<td></td>
<td>Work variety↑</td>
<td>Cognitive demands↑</td>
</tr>
<tr>
<td></td>
<td>Interruptions &amp; disruptions ↓</td>
<td>Interruptions &amp; disruptions↓</td>
</tr>
<tr>
<td></td>
<td>Influence↑</td>
<td>Influence↑</td>
</tr>
<tr>
<td></td>
<td>Conflict↓</td>
<td>Conflict↓</td>
</tr>
<tr>
<td></td>
<td>Conflict between home &amp; work demands↓</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Upper Body Part Discomfort</th>
<th>Wornout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>Site 2</td>
</tr>
<tr>
<td>Emotional demands↑</td>
<td>Awkward arm &amp; body postures↑</td>
</tr>
<tr>
<td>Awkward arm &amp; body posture↑</td>
<td>Low support↑</td>
</tr>
<tr>
<td>General temporal demands, hours worked↑</td>
<td>Environmental &amp; Informational Impediments↑</td>
</tr>
<tr>
<td>Demand for care &amp; vigilance↑</td>
<td>Supervisor Support↓</td>
</tr>
<tr>
<td>Conflict↑</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stress</th>
<th>Site 1</th>
<th>Site 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men↓</td>
<td>Time pressures/ deadlines↑</td>
</tr>
<tr>
<td></td>
<td>Conflict between home &amp; work↑</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demand for care &amp; vigilance↑</td>
<td>Total hours worked↑</td>
</tr>
<tr>
<td></td>
<td>Skill utilization↓</td>
<td>Supervisor Support↓</td>
</tr>
<tr>
<td></td>
<td>Career Uncertainty↑</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supervisor Support↓</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Satisfaction</th>
<th>Arousal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>Site 2</td>
</tr>
<tr>
<td>Skill utilization↑</td>
<td>Skill utilization↑</td>
</tr>
<tr>
<td>Career uncertainty↓</td>
<td>Work variety↑</td>
</tr>
<tr>
<td>Coworker cohesion↑</td>
<td>Supervisor support↑</td>
</tr>
<tr>
<td>Influence↑</td>
<td>SPPCA↑</td>
</tr>
<tr>
<td>SPPCA↑</td>
<td>Career uncertainty↓</td>
</tr>
</tbody>
</table>
The association between bodily discomfort and both job control and support, as conceptualised within the JCD-S model has been widely cited (for example De Jonge et al., 2000; Hagen et al., 1998; MacDonald et al., 2001; Toomingas et al., 1997). At both these sites, the effects of control and support on UBPD were quite small. Perhaps where job control and support is good, they act as ‘hygiene’ factors (Herzberg, 1968). That is their presence is highly desirable and adds to positive work attitudes, but it is only their absence or inadequacy that leads to fatigue.

In the JobLoad Model and elsewhere (see chapter 3), stress is viewed as a variable that intervenes between work-/job-related factors and UBPD. However, when both Stress and Job Satisfaction were added into the regression sequence (after all other factors) to test this association, the $R^2$ change at both sites was small (1.2% and 3.7% respectively) and the F-changes did not approach significance. This suggests that the effects of these personal states are largely mediated by work-related variables that were already included in the regression model for discomfort.

**Wornout**

As can be seen in Table 16.4 there was greater similarity between the two sites in predictors of Wornout than was the case for UBPD. SPPCA was the strongest predictor, and Contextual Demands and Impediments (*interruptions and disruptions, environmental and informational impediments*) also played an important role at both sites. At site one, the second strongest predictor variable was a factor in the Specific Work Demand domain – *demand for care and vigilance*. No single factors from this domain stood out at site two, and therefore none are shown in Table 16.4. However, reference to sequential regression results (summarised in Table 17.2.) shows that for both sites, the change in $R^2$ accounted for by the block of Specific Work Demand factors is significant, and almost as large at site two as at site one.

General and Temporal Demands (*increasing workload pressure, too much to do*) were identified as significant at site two only. Inspection of the change in $R^2$ accounted for by this block of General and Temporal Demand factors shows that the overall effect, while larger at site two than at site one, was less important than that of Contextual Demands and Impediments.

Overall, the impression created is that feeling Wornout is a function of having to ‘do battle’ against contextual demands and impediments, without great success (poor SPPCA), and that this can be significantly exacerbated when the demands of either specific work tasks or the overall job are high. As in the case of UBPD, there was little evidence of a major effect of long working hours on Wornout.
Finally, it should be noted that a state of diminished energy resources due to having been working hard (as opposed to experiencing physical discomfort or feeling wornout) does not inherently affect wellbeing. It is not necessarily experienced as a negative affective state, and in some circumstances it might be cognitively evaluated as perfectly appropriate and even satisfying, as in the experience of being 'pleasantly tired' at the end of a hard day's work with the immediate prospect of a long rest. It is when people are required to continue performing work, despite increasing fatigue having reduced their performance capacities to a degree that threatens their performance adequacy, that they are then likely to experience their fatigue as negative, constituting a ‘cost’ to their wellbeing.

**Stress**

As with Discomfort and Wornout, the main predictor of Stress was SPPCA, at both sites. The only other predictor variable in common between the two sites was low supervisor support, but this was not one of the strongest predictors and the variance accounted for by the block of Support factors was quite small (although this was the last block to be entered into the sequential regression model). Stress was the wellbeing dimension most strongly affected by personal factors, and after SPPCA, the next largest group of factors predicting Stress was Personal and Non-work Factors (entered first into the regression – see Table 17.2). At site two, no single personal factor stood out, but at site one both gender and conflict between home and work were significant. This difference between sites might be related to women being a much smaller proportion of the sample at site one, relative to site two where they were a clear majority.

At site one, the next strongest factor was demand for care and vigilance, which was also a predictor there of fatigue (both UBPD and Wornout scores). The other major predictors at that site related to Contextual Demands and Impediments; the strongest factor within that block was career uncertainty, and the factors in that block together accounted for a substantial amount of variance in Stress scores.

At site two, two factors from the General and Temporal Demands domain were significant predictors of Stress (time pressures/deadlines, total hours worked), and factors in this domain together accounted for a substantial amount of variance (see Table 17.2). This reflects the pattern described above for Wornout, where General and Temporal Demand factors exerted a stronger influence than at site one. Since there was no significant difference between the two sites in absolute levels of Stress or Wornout, and also no difference in rated levels of these different types of demand, including total hours worked, the reason for the stronger influence of General and Temporal Demands at site two is not immediately obvious. It might possibly be related to the
much higher proportion of inexperienced people (in terms of time in the job) at site two, compared with site one, such that their capacities to cope with work demands were generally lower. Consistent with this (i.e., consistent with a lower level of competence between site two participants), cognitive demand was a major correlate of SPPCA at site two, but at site one was not significant.

It is interesting that factors in the Job Control and Variety domain had relatively little influence. At site one, low skill utilization was a significant factor, but the amount of variance accounted for by all factors in this domain, when entered as a block following personal factors and the various categories of demand factors, was very modest (see Table 17.2).

**Arousal**

Again, SPPCA was the strongest predictor of Arousal at both sites, and in this case, there were few other major factors: low static physical demands and supervisor support at site one, and errors have important consequences and time pressures or deadlines at site two. At site one, General and Temporal Demand factors together accounted for the greatest amount of variance, whereas at site two it was the Specific Work Demand factors that together accounted for most variance.

Relatively few studies have reported the efforts of work-related factors on Arousal (as conceptualised by Gotts and Cox, 1988). Kahneman’s (1973) model of ‘attention and effort’ explicitly identified physiological arousal level as an important influence on level of attentional resources and hence on coping capacity and performance – a view supported by numerous studies since then (e.g. Brisswalter et al. 2002). Thayer (1989, p.95) observed that the “basic biopsychological system of energetic arousal is undoubtedly associated with physical health”, and “Healthy people are more likely than unhealthy ones to experience energy, vigour and vitality as opposed to unusual levels of fatigue and tiredness”. The significant correlations between arousal and self-reported health in the present study are consistent with this view of Arousal.

**Job Satisfaction**

The predictors of Satisfaction show a somewhat different pattern from those of the other wellbeing dimensions. First, this is the only dimension for which SPPCA is not the dominant variable, although it is still plays a significant role – particularly at site two. Second, factors related to Job Control and Variety, and to a lesser degree, Support, had more influence on Satisfaction than on other wellbeing dimensions. Within Job Control and Variety, skill utilisation
was the strongest single factor at both sites. Other factors in this domain were influence at site one, and work variety at site two, and such factors together accounted for a substantial proportion of variance in Satisfaction, particularly at site two. Within Support, the strongest factor at site one was coworker cohesion, and at site two it was supervisor support.

However, the domain Contextual Demands and Impediments accounted for the greatest variance at both sites, as can be seen in Table 17.2. This included career uncertainty at both sites, as shown in Table 16.4. Clearly, high levels of these factors detrimentally affect job satisfaction at both sites.

Finally, since SPPCA was the predominant influence on all dimensions of wellbeing except Satisfaction, of which it was still a significant determinant, it is interesting to review the predictors of SPPCA. Table 16.4 identifies key factors at both sites as: increasing workload pressure, interruptions and disruptions, and conflict between home and work demands. At site two, cognitive demands were also a significant factor, as noted above. At site one, where a greater amount of variance in SPPCA was explained by the regression model, additional factors were career uncertainty, work variety, influence, and conflict.

CONCLUSIONS

The often substantial and highly significant correlations between measures of different dimensions of wellbeing support the conception of ‘wellbeing’ as a coherent but multidimensional construct. The direction and extent of most relationships, with the exception of some of those involving the stress hormones, were in accord with expectations. It was also noteworthy that factors such as career uncertainty, skill utilisation, interruptions and disruptions, environmental and informational impediments, and supervisor support were commonly important for most aspects of wellbeing.

Particularly noteworthy is the role of SPPCA, which is conceptualised here as a variable intervening between wellbeing and factors in the main domains of the JobLoad Model. SPPCA was the strongest correlate of Wornout (negative), Arousal (positive) and Satisfaction (positive), and the second strongest correlate (after Wornout) of Stress (negative) and UBPD (negative). These close relationships demonstrate the potential of SPPCA to influence both negative and positive aspects of wellbeing. It seems likely that workload management strategies would be more effective in promoting both effective performance and employee wellbeing if they took specific account of these relationships.
SUMMARY, DISCUSSION AND CONCLUSIONS

This study originated from a strong interest in the OHS implications of the increasing workloads of Australian workers in terms both of hours worked and of work ‘intensification’. As has been discussed, many organisations, including the two studied here, have been experiencing changing work conditions that were informally reported to have resulted in high workloads. If not well managed, very high workloads have the potential to harm employee wellbeing, and do not necessarily achieve the desired gains in organisational efficiency (Bennett, 1991; Gandolfi & Neck, 2003).

The present thesis is based on the premise that safe and effective management of workload will be facilitated by a more comprehensive understanding of the relationships between ‘workload’, performance and wellbeing. To this end, the first aim of this project was to formulate a JobLoad Model to provide a more comprehensive and detailed account of factors contributing to a job’s workload, and the second aim was to identify or develop measurement instruments for each of its work-related constructs. In fulfilment of the second of these aims, the JobLoad Index (JLI) was formulated and used in empirical investigations of relationships between workload, wellbeing and self-reported performance among employees in two different workplaces.

In this final chapter, the content of the JLI is reviewed in relation to that of some other questionnaires with comparable content, including one that was developed concurrently with this thesis. These questionnaires are compared in terms of the comprehensiveness of their coverage of work demands and other job factors that are likely to affect people’s experience of, and capacity to cope with, their workload, along with other variables that more directly reflect individual coping abilities and performance. The adequacy of the JLI is also reviewed in terms of the amount of variance that it accounted for in the measured aspects of wellbeing, relative to similar indices used in comparable studies.

Using the JLI, the third aim of this project was to determine relationships between a range of task, job and environmental factors as identified by the JobLoad Model, and each of the measured indicators of employee wellbeing. Details of these relationships have been reported in previous chapters. In this chapter, each of the main task, job and environmental factors comprising the JobLoad Model is reviewed in terms of the strength of its relationships with...
different components of wellbeing. Finally, strengths and limitations of the current study are identified, along with some issues highlighted by this project that require further research.

**CONTENT OF THE JOBLOAD INDEX**

As discussed in chapter 2, ‘workload’ assessment within the domain of cognitive ergonomics tends to focus narrowly on task-specific variables, but a variety of different methods have been developed for measurement of the workload related to performance of specific tasks. Of these, the most useful tool for the present purpose was the NASA Task Load Index (TLX) (Hart and Staveland, 1988); the general rationale underlying this method is similar to that of the JobLoad Model.

Within the domain of occupational health, ‘workload’ is typically represented by only one construct of quite variable content, and there is wide variation between different measurement instruments in the constructs assessed, and even in the content of constructs with similar names. The tools selected from this domain as most potentially useful for measuring the constructs of the JobLoad Model were the Job Content Questionnaire (Karasek, 1985); the Generic Job Stress Questionnaire (Hurrell & McLaney, 1988); the Work Environment Scale (Moos, 1981); the Occupational Stress Inventory (Osipow & Spokane, 1987), and the Pressure Management Indicator (Williams & Copper, 1998). In addition, useful items were found in the following, more specific tools: the Interpersonal Conflict at Work Scale (Keenan & Newton, 1985); the Organisational Constraints Scale (Peters & O’Connor, 1980); and the Role Conflict and Role Ambiguity scale (Rizzo, House & Lirtzman, 1970).

Reviewing the content of these instruments in relation to the JobLoad Model, it was evident that they provided inadequate coverage of general and temporal aspects of job demands, the specific demands of particular tasks, and impediments to work performance. The JLI was developed to measure the key constructs within the JobLoad Model, drawing on the above sources and creating additional items as necessary, with the aim of providing effective coverage of all areas within the Model.

Existing measurement instruments also vary considerably in the extent of their coverage, if any, of aspects of wellbeing. Although the nature and measurement of wellbeing was not central to this thesis, its measurement was necessary in order to assess the effectiveness of measures of JobLoad. Accordingly, a set of measures of different aspects of wellbeing were selected from among existing tools. Coping capacity and performance are a central focus of the JobLoad Model, reflecting the own performance scale within the NASA-TLX (Hart and Staveland, 1988),
but existing measures relating to occupational demands and wellbeing provided little coverage of this construct. An additional set of items to assess the individual’s own perceived performance and underlying prerequisite capacities were therefore incorporated within the JLI.

Table 17.1 displays the JLI constructs in relation to those of the main measurement methods listed above (using the most recent versions, where applicable). The purpose of this table is to support a review of the JLI’s coverage (comprehensiveness, level of detail) of key constructs, in accord with the first aim of this thesis. In this table, two of the questionnaires that were used in developing the content of the JLI are replaced by more recent versions: the Pressure Management Indicator (Williams & Cooper, 1998) replaces the earlier Occupational Stress Indicator, and a revised version of the JCQ (Karasek et al, 1998) replaces the earlier version. In addition, the Copenhagen Psychosocial Questionnaire (COPSOQ) (Kristensen, 2002), which was developed concurrently with the JLI, is included.

General and Temporal Demands are covered to some degree by all of the tools reviewed in Table 17.1 with the revised JCQ being apparently weakest in this regard. This is an interesting observation, given the central importance of ‘Demand’ within the Demand-Control (-Support) model that underpins the JCQ. It supports the conclusion of Johnson et al (1996) regarding this that “Clearly, one practical conclusion of this study is that the basic measurement of the demand construct should be improved”. Within this domain, the JLI is the only one to include any record of working hours in absolute terms; this information can be important for various purposes, particularly if levels of exposure to some types of workplace hazard are to be monitored.

The COPSOQ, which was developed concurrently with the JLI, is the only one to rival it in coverage of Specific Task Demands, despite additions to the original JCQ to supplement its coverage in this domain. Unlike the JLI, the COPSOQ does not address any aspects of either static or dynamic physical task demands; the JCQ provides cursory coverage of these.
Table 17.1 Comparison of JLI and other common Job Strain and Work Environments Measures.
The numbers in brackets after each JLI construct name show the number of questionnaire items relating to that construct. For the other measurement instruments, numbers of items related to the part of the content of the relevant JLI construct are specified; some but not all of these are represent whole constructs within these other instruments. For example, within the JLI General and Temporal Demands domain, the OSI “Role overload (10)” is a whole construct within the OSI, but the JCQ “concentration (1)” within the JLI Specific Demands domain is just one item from within a broader JCQ construct.

<table>
<thead>
<tr>
<th>JobLoad Index (JLI)</th>
<th>JLI Scale Cronbach’s alpha (α) values for sites 1 and 2, respectively</th>
<th>JCQ ‘full recommended version’(^193) *=new items</th>
<th>Pressure Management Indicator (^194)</th>
<th>COPSOQ(^195)</th>
<th>WES (^196)</th>
<th>NIOSH(^197)</th>
<th>OSI (^198)</th>
</tr>
</thead>
</table>

\(^{193}\) Job Content Questionnaire (Karaske, 1986) full recommended version, new questions are indicated by * (Karasek, Brisson et al, 1998)
\(^{194}\) Pressure Management Indicator (Williams & Copper, 1998)
\(^{195}\) Copenhagen Psychosocial Questionnaire (Kristernsen, 2001)
\(^{196}\) Work Environment Scale (Moos, 1994)
\(^{197}\) Generic Job Stress Questionnaire (Hurrell & McLanney, 1988)
\(^{198}\) Occupational Stress Inventory (Cooper, Sloan & Williams, 1988)
| General and Temporal Demands | Total working hours | Too much to do (9) | Time pressures (6) | Unpleasant hours (2) | Increasing workload pressure (2) | Responsibility (6) | General psych demands (5) | Workload (8) | Managerial responsibility (4) | Personal responsibility (4) | Quantitative demands (7) | Work pressure (9) (Part of Personal Growth) | Wld, role demands task demands control and conflict (13) | Quantitative workload (4) | Quantitative workload (7) | Responsibility for people (3) | Skill underutilisation (3) | Work hazard (5) | Role demands, responsibility physical environ’ (6) | Role overload (10) | Role insufficiency (10) | Respon (9) |
|-----------------------------|---------------------|-------------------|-------------------|---------------------|-----------------------------|-----------------|--------------------------|----------------|-----------------------------|-----------------------------|----------------|-----------------------------|------------------------------------------------|----------------|----------------|---------------------------------|----------------|----------------|-----------------------------|
| NA | .73, .80 | .43, .23 | .25, .60 | .44, .24 | NA | Concentration (1 *Part Psych Demands and Wild) Physical Demands: General physical loading (1*) Isometric load (2*) | Cognitive demands (8) Emotional demands (3) Emotion concealment (2) Sensorial demands (5) | Physical comfort (9) (part of System Maintenance and Change) | Mental demands (5) Physical environment evaluation (10) | Physical environme... |
| Support                                                                 | Coworkers support (5) | Coworker cohesive & relationships (5) | Supervisor support (5) (includes feedback) | General supervisor support (5) | Senior management communications attitudes (3) | Part of Social Support: Coworkers socioemotional support (2) | Coworker instrumental support (2) | Supervisor socioemotional support (2) | Supervisor instrumental support (2) | Social support (3) | Social support (4) | Social support (4) | Social support (9) | Social support from co-workers (4) | Social support from family(4) | Social support from supervisor (4) | Social support (10) |
|------------------------------------------------------------------------|------------------------|----------------------------------------|---------------------------------------------|-------------------------------|-----------------------------------------------|-------------------------------------------------|-----------------------------|--------------------------------|--------------------------------|----------------|----------------|----------------|----------------|-----------------------------|----------------|--------------------------------|----------------|----------------|
|                                                                        | 0.81, 0.81             |                                        | 0.73, 0.86                                 | 0.69, 0.90                    | 0.70, 0.69                                   | 0.81, 0.81                                      | 0.79, 0.70                   | 0.69, 0.70                      | 0.70, 0.69                      | 0.73, 0.86 | 0.70, 0.86 | 0.70, 0.86 | 0.70, 0.86 | 0.70, 0.86               | 0.70, 0.86 | 0.70, 0.86                          | 0.70, 0.86 | 0.70, 0.86 |

<table>
<thead>
<tr>
<th>Aspects of Wellbeing</th>
<th>Satisfaction with rewards (4)</th>
<th>Satisfaction org change (2)</th>
<th>Satisfaction own performance (3)</th>
<th>Org satisfact (6) Organizational security(5) Recognitio n (4)</th>
<th>Cognitive Stress (4)</th>
</tr>
</thead>
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<tr>
<td>UBPD (4,5)</td>
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<td>.81, .81</td>
<td>.58, .68 NA</td>
<td></td>
<td></td>
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<tr>
<td>LBPD (2)</td>
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<td>NA</td>
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<td>NA</td>
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<tr>
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<td>.50, .93 NA</td>
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<tr>
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<td>.50, .93 NA</td>
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<tr>
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199 Cox and Gotts, 1988
200 Cox et al., 1983, 1984, Cox, 1988
201 Cox et al., 1983, 1984, Cox, 1988

Psychological strain (10)
Interpersonal strain (10)
Vocational strain (9)
Physical strain (10)
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<tr>
<th>Non-Work Variables</th>
<th>Home-work conflict (1)</th>
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<td></td>
<td>Stress at home (1)</td>
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<td>Physical injuries (1)</td>
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<td>Daily hassles (4)</td>
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<th>Type A drive (5)</th>
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<tbody>
<tr>
<td></td>
<td>Patience-impatience (5)</td>
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<td>personal influence and control</td>
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<td>Sense of coherence (9)</td>
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<td>Cognt stress (4)</td>
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<td>Selective coping (2)</td>
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<td>Resigning coping (2)</td>
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<tr>
<th>Personality &amp; Coping Strategies</th>
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<td>Self-Esteem (10)</td>
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<td>Life-work balance (4)</td>
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<th>Home-work balance (6)</th>
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<th>Non-Work Variables</th>
<th>Non-work activities (7)</th>
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<tr>
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<td>Other health information (32)</td>
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<td>Problems at work (6)</td>
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<tr>
<th>Non-Work Variables</th>
<th>Recreation (10)</th>
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<td>Self-care (10)</td>
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Contextual Demands and Impediments are now covered reasonably well by the JCQ, although less comprehensively than by the JLI. Within this domain the old NIOSH scales and the OSI (Inventory, not Indicator) have substantial numbers of items, but they focus mainly on ambiguities and uncertainties, making their coverage of this broader domain, as defined by the JobLoad Model, relatively narrow.

Control is most comprehensively covered by COPSOQ and the JCQ, followed by the JLI. The OSI provided no coverage at this entire domain. All of the questionnaires appear to provide acceptable coverage of Support, with a common major focus on interpersonal sources. Only COPSOQ and the JLI specifically include performance feedback.

Finally, the recently developed COPSOQ is the only tool other than the JLI that directly assesses self-perceived performance and related coping capacity (although different terminology is used). The construct closest to the present SPPCA within this questionnaire is termed cognitive stress, but its component items entail self-estimates of cognitive performance capacities over the past four weeks. In contrast, the construct within COPSOQ that assesses problem-focused coping behaviour is about general behavioural style, rather than work performance or associated capacities. However, the distinction is not totally clear.

Overall, it can be seen that the questionnaire most similar to the JLI is the COPSOQ. Since the latter is newly developed (particularly the English language version), as yet there are relatively few published studies reporting its use, and none that are comparable to the present one.

Reliability of the scales used in the JLI was mostly acceptable, as shown by values of Cronbach’s alpha (second column in Table 17.1). However, alpha values for six of the JLI scales at either one or both of the sites were low (Increasing Workload Pressure, Static Physical Demands, Dynamic Physical Demands, Demand for Care and Vigilance, Performance Uncertainty; and Satisfaction with Own Performance) as discussed in chapter 6. This was attributed primarily to the intrinsically multidimensional nature of most, if not all, of these scales: for example, in the construct demand for care and vigilance, the items repetitive work and monotonous and boring are typically but not necessarily highly correlated, and in fact they were highly correlated at site one \( (r = 0.583) \), but not at site two \( (r = -0.050) \). Further research will be needed to refine these scales to increase their reliability.

**EXPLANATORY POWER OF THE JLI**

In addition to the above review of JLI content in relation to that of comparable measurement instruments, it would be interesting to evaluate its value as a predictor of employee wellbeing,
relative to that of those instruments. However, a review of published literature has highlighted the multiple difficulties confronting such a comparison, with different occupational groups, different aspects of wellbeing assessed using a wide variety of measures, and widely varying sample sizes and data analysis methods. No completely comparable studies could be found. Nevertheless, following is an overview of some roughly comparable studies, using a very wide variety of measurement instruments, which reported $R^2$ values for dependent variables of fatigue, job satisfaction, stress, and/or physical discomfort.

Macdonald (2003) reported results that were of particular interest because they entailed use of the NASA-TLX measure of workload (modified for workplace), along with the same measures of stress and arousal as in the present study; a single-scale measure of fatigue was also obtained. For a sample of workers in manufacturing industry performing highly repetitive work tasks, the following variables accounted for 32% of variance (adjusted $R^2$) in stress scores: high workload (TLX score), low motivating potential score (from the Job Diagnostic Survey – representing autonomy, feedback, variety, opportunities to have a sense of ‘ownership’, and pride in work performed), very short task cycle times, and having a high level of external pacing (work paced by work processes or machine line speed); a similar set of predictor variables explained 36% (adjusted $R^2$) of variance in Arousal.

Cooper and Bramwell (1992) reported that measures of factors intrinsic to the job, undervalue and monotony, physical environment, career and achievement, home/work interface, working hours and equipment breakdowns accounted for 26% (unadjusted $R^2$) of variance in mental health, although this increased to 40% when just the ‘manager’ subgroup were considered. Ganster and Bates (2003) investigated the effects on stress and job satisfaction of a large number of individual factors (9 in all), as well as working hours, various “job quality” factors (autonomy, job pressure and learning opportunity), and interactions between job factors and work hours, These variables accounted for 24% of variance in stress, with the job factors having the greatest explanatory power, and 29% of variance in job satisfaction, with most of the variance here explained by working hours.

Leino and colleagues (1995) found that between 22% and 36% of variance in musculoskeletal symptoms in both blue and white collar employees was accounted for by individual factors (age, gender, occupational class) and work factors (work content, overstrain and physical load). Klitzman and Stellman (1989), studying office workers, found that measures of individual variables, occupation type, job future, supervisor support, support, decision latitude, air quality, ergonomic stressors, lighting and noise accounted for 42% of variance in job satisfaction, 20% in
fatigue, and 20% in ‘generalised distress’. (It should be noted that most authors seem to have reported unadjusted $R^2$ values, rather than the typically lower, adjusted values).

Van Veldhoven and colleagues (2002) specifically reviewed the amount of variance in wellbeing measures that is typically accounted for by “psychosocial job conditions”. They concluded that “In research on work stress an upper limit of explained variance of 10 to 15% in individual stress symptom measures” seems to be due to these types of variables, with stressor-strain correlations typically no higher than 0.30. They collected data using the Dutch Questionnaire on the Experience and Evaluation of Work (van Beldhoven & Broerson, 1999), encompassing work speed and quantity, emotional demands, skill variety, learning possibilities, autonomy, participation, and relationships with colleagues and supervisor. They then used multilevel analysis methods to determine the amount of variance explained in two aspects of wellbeing: “work-related strain” (fatigue, worrying) and “work-related well-being” (pleasure, organisational commitment). They found that regression models explained about 35% of variance in both ‘strain’ and ‘well-being’ (a little more in the latter – consistent with present results), and concluded that their results – in terms of amount of explained variance – did not differ significantly from comparable studies that did not use multi-level analysis.

Evaluating results from the present study (see Table 17.2) in the above context, it is concluded that the JLI performed well in terms of the amount of variance it explained.
Table 17.2. Relationships between Job Factor and the Measures of Wellbeing (both sites)

<table>
<thead>
<tr>
<th>Variables</th>
<th>UBPD</th>
<th>WO</th>
<th>Str</th>
<th>Ar</th>
<th>JS</th>
<th>A</th>
<th>NA</th>
<th>C</th>
<th>SPPCA</th>
<th>UBPD</th>
<th>WO</th>
<th>Str</th>
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<tr>
<td><strong>Personal &amp; Non Work Factors</strong></td>
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<td>Age</td>
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<td>Poor general health</td>
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<tr>
<td>Conflict between home work</td>
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<td>Stress at home</td>
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<tr>
<td>$R^2$</td>
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<td>.127</td>
<td>.007</td>
<td>.013</td>
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<td>.005</td>
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<td>.127</td>
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Table 17.2 continued on next page

202 Score created by the average of all IVs in that domain both significant and non-significant
Table 17.2. Relationships between Job Factor and the Measures of Wellbeing (both sites) continued

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Table 17.2. Relationships between Job Factor and the Measures of Wellbeing (both sites) continued

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<sup>203</sup> Score created by the average of all IVs in that domain both significant and non-significant
RELATIONSHIPS BETWEEN JLI COMPONENTS, SPPCA, AND WELLBEING

Using the JLI, the second aim of this project was to determine relationships between a range of task, job and environmental factors as identified by the JobLoad Model, and each of the measured indicators of employee wellbeing. Details of these relationships have been reported in previous chapters. In this final chapter, each of main components of the model, as measured by the JLI, is reviewed in terms of the strength of its relationships with different components of wellbeing.

Work Demands

According to the JobLoad Model, Work Demands is a broad domain within which are the following sub-domains: General and Temporal Demands, Specific Work Demands (with Physical Work Demands broken down further for analyses of UBPD), and Contextual Demands & Impediments. As defined here, all work demands are factors that people must cope with in performing their work; this coping process demands the expenditure of effort, which tends to be fatiguing.

General and Temporal Demands

In absolute terms, demand levels were somewhat higher for more senior staff at both sites, and for the Technical and IT Officers at site one. Otherwise, differences in absolute levels of these factors between sites, and between job types at site one, were minimal. The constructs within this domain were total hours worked, time pressure, too much to do, unpleasant working hours, increasing workload pressure, and responsibility.

Total Hours Worked

At both sites, most participants worked for longer than ‘standard’ hours, and hours worked at site one were longer than at site two. At site one, 75.2% of participants and at site two, 81.8% of participants worked more than 37-40 hours per week. However, very few people commonly worked extremely long hours, and at both sites the mean working hours were lower than 50-55 hours per week, which is the duration usually cited as that at which harmful effects of long working hours become a significant risk (Liu et al., 2002; Sparks, Cooper, Fried, & Shirom, 1997).

Overall, the results demonstrate that within the range of hours worked by participants in this study, working longer hours is not always associated with poorer wellbeing – particularly at site one, where longer hours were significantly associated with lower UBPD and higher levels of job

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204 At site one, 75.2% of participants and at site two, 81.8% of participants worked more than 37-40 hours per week.
satisfaction, arousal and SPPCA. At site two, however, working longer hours was associated with higher stress.

There are a number of possible differences between the two sites that might explain these differences. There was also some evidence (see chapter 9) that subjects at site two, were less satisfied and committed to their organization than those at site one. At site one, however, the highest working hours were undertaken by Technical Officers on short-term overseas missions, and by IT Officers engaged in new program rollouts. Both these groups had high job satisfaction (see chapters 9 and 14) social status, objectively important jobs, and received high financial remuneration for their effort.

Working long working hours when this is appropriately recognised, rewarded and importantly – when it results in perceived success – can also alter how this demand is perceived. For example, there is evidence that people might choose to work quite extreme hours, even at some cost to their own wellbeing, if they believe it produces a social good (Deary et al., 1996), or where it is appropriately rewarded (de Jong et al., 2000), or contributes to a higher sense of self-worth (Pugliesi, 1995). Some of the negative effects of long hours can be moderated by support from others (Bültmann, 2002; Cohen & Wills, 1985. Daniels & Guppy, 1995).

In the present study there was some evidence from site one that working longer resulted in higher SPPCA, with associated higher Job Satisfaction and Arousal, whereas as site two there was a non-significant but tending-to-be-negative association between hours worked and SPPCA, and no evidence of a relationship with Job Satisfaction. However, longer hours were also associated, at both sites, with higher levels of Stress, and at site one also with higher UBPD. So, while longer hours have some positive outcomes at site one, some negative costs were still evident.

At site one, some people may have chosen to work longer hours as a means of controlling stress, and/or to enable them to achieve performance goals and associated satisfaction. In the longer term, however, such a strategy may be sustainable only if it does have excessive costs for other aspects of wellbeing, including conflict with domestic demands (Weston et al., 2003). It should be noted that there was a much higher proportion of women among site two participants, and that both gender and conflict between home and work were significant predictors of stress at site one.

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50% of people at site one answered that if offered a position at the same level in another organisation they would accept.

For example, doctors’ higher clinical workloads were related to higher feelings of personal achievement but also to higher stress.
**Unpleasant Working Hours**

It was expected that the impact on wellbeing of working longer hours could be affected by whether or not the actual times of day or week were undesirable or unpleasant for particular individuals. Higher levels of *unpleasant working hours* were associated with lower SPPCA at both sites. Also, at site two they were associated with higher UBPD and Stress levels.

**Responsibility**

Responsibility can be a satisfying source of status and prestige, and if it is associated with enhanced control it can provide opportunities for job enrichment and learning (Driscoll *et al.*, 1998; Kalimo *et al.*, 1997). However, responsibility is inherently demanding, and if, for example, it entails making decisions that can have major negative effects on other people’s lives (such as is the case for many manager), responsibility can also be a potent source of stress (Cox *et al.*, 1993; French & Caplan, 1970; Maslach, 1993).

In the present study, higher levels of *responsibility* were associated at both sites with higher Stress and Arousal scores at both sites. At site one it was also related to lower adrenaline and SPPCA and higher cortisol, and at site two with higher UBPD and higher Job Satisfaction. Overall, it seems that higher responsibility at site one was associated with poorer wellbeing, whereas at site two, given that Job Satisfaction was slightly but significantly higher, the relationship with wellbeing was more equivocal. Job Description information about site two (see Appendix 13.) shows that many people felt that they had insufficient responsibility, which is consistent with greater satisfaction with their higher levels of Job Satisfaction when responsibility was higher.

**Time pressure and deadlines**

Time pressures are one of the most commonly cited causes of stress, fatigue and dissatisfaction (Alluisi & Morgan, 1982; Hart & Staveland, 1988; Reid & Nygren, 1988; Landy *et al.*, 1991; Maule, Hockey, & Bdzola, 2000). It was therefore somewhat surprising that this factor did not reach significance at either site in any of the final multivariate models. Examination of the bivariate correlations showed that it was significantly associated with higher Arousal scores at both sites. At site one it was also associated with higher Wornout scores and lower *job satisfaction*, and at site two, with higher UBPD and Stress. So, while the effect sizes were small, it might be concluded that higher levels of *time pressure and deadlines* were generally associated with poorer wellbeing.
However, the increase in Arousal at both sites with higher time pressure is not in itself a negative influence, and at site one higher time pressure was also associated with higher SPPCA scores (although tending towards a negative association at site two). These results might be best interpreted within the context of an inverted-U relationship between arousal and performance, and the associated Yerkes-Dodson law (see Jex, 1998), whereby performance is optimal at moderate levels of arousal, with the optimal point being lower for tasks that people are experiencing as more complex or difficult. There is some evidence that site two participants were experiencing their work as more difficult or complex (see Cognitive Demands section below), in which case the Yerkes-Dodson law predicts that their performance would tend to deteriorate at lower arousal levels than for site two participants.

**Too Much to do in the Available Time**

As discussed in chapters 2 and 3, having too much to do (i.e. high quantitative demand) has been widely reported as a source of poorer wellbeing, represented by higher levels of stress, fatigue and dissatisfaction. Consistent with this, higher levels of this variable at site two were associated with higher scores on Wornout, Stress and UBPD. At site one, none of the associations reached significance in the final multivariate models and the pattern was somewhat different: the affected wellbeing dimensions were Wornout, Arousal, and Job Satisfaction, which were all higher, and adrenaline levels were lower. The latter result was unexpected, since lower adrenaline levels are usually associated with lower activity; however, given the static nature of the work of most participants, it is likely that people with larger amounts of work to do were ‘chained to their desks’ for longer periods, resulting in the lower catecholamine levels. This explanation is consistent with the negative relationship observed between high demands for care and vigilance and levels of adrenaline.

**Increasing Workload Pressure**

At both sites, increasing workload pressure was associated with lower Wornout scores, which reached significance in the final multivariate models. At site one it was also associated with higher Arousal, SPPCA and adrenaline levels, which suggests that increasing workload pressure was experienced as an enjoyable challenge by people at site one, with the concomitant higher arousal levels helping resulting in people feeling energised rather than wornout, consistent with Kahneman’s activation model (Kahneman, 1973). At site two, however, SPPCA scores were lower, despite the lower Wornout scores.
Overall Influence of General & Temporal Demands on Wellbeing

It can be seen from the R² changes following entry of General and Temporal Demand variables in Table 17.2 that the largest effects of these were on Arousal and adrenaline at site one, and on SPPCA and Stress at site two. Taking account also of the effects of each of the specific constructs within this domain as discussed above, it can be seen that site one participants responded positively to the stimulation of higher job demands as represented by these factors, whereas those at site two responded much more negatively – despite working somewhat shorter hours, on average, and levels of these demands being no higher.

Thus, these results reflect the variety of findings in the literature, where high job demands or workload have often been associated with poorer wellbeing (e.g. Ganster & Bates, 2003; Sparks, Cooper, Fried & Shirom, 1997), but have also been associated with higher perceived performance and work energy (Beehr, Jex, Stacy, & Murray, 1997; Spector, Dwyer, & Jex, 1988).

Specific Work Demands

Factors in this domain reflect the kind of work being performed. The specific constructs were static physical demands, dynamic physical demands, demand for care and vigilance, cognitive demands, emotional demands, and errors having important consequences. Absolute levels of scores on these factors were very similar across the two sites, except for dynamic physical demands at site one, where levels were a little higher, consistent with the Job Descriptions documented in chapter 8.

Static Physical Demands

Consistent with data reported in chapter 8, JLI data showed these demands to be highest at site one for Communications Officers (whose work was entirely computer based, with minimal opportunities for unscheduled breaks), and lowest for Technical Officers (who were required to assume a wide range of work postures and positions). Across all job types, static demands were higher for more junior staff.

At site one, higher levels of static physical demands were significantly associated with lower Arousal, as noted above, and with higher Wornout and Stress scores, and although the latter did not reach significance in the final multivariate model. At site two there were some similar trends apparent, but none reached significance. Physical Task Demands were further investigated in relationship to UBPD, because of their close conceptual relationship, via additional analyses in which the separate constructs comprising static physical demands and dynamic physical demands
were ‘unpacked’ into their constituent variables. These additional analyses showed that, at both sites, UBPD was significantly higher when awkward arm and body positions scores were higher, reaching significance in the multivariate models. At site one, UBPD was also significantly correlated with long periods of sitting or standing, and at site two, with work very hard.

**Dynamic Physical Demands**

This kind of physical demand (e.g. forceful movements, walking fast) entails physical activity of a kind that typically entails increased arousal level and variation in the types of muscle actions and groups used, which can help to moderate negative effects of high static physical demands.

As documented in the Job Description (chapter 9) the work of participants in this study did not impose significant levels of dynamic physical demands, except occasionally for Technical Officers at site one. Dynamic physical demands at site one were associated with higher Stress and Arousal, and lower Job Satisfaction. At site two, such demands were extremely low, and were associated with lower Stress scores and slightly but significantly higher Wornout scores. As discussed in chapter 11, it seems that this difference is probably because the work of some participants at site one, particularly Technical Officers, involved occasional periods of heavy physical work with some associated injury risk, which could reasonably be experienced as stressful. In contrast, the small amount of dynamic physical activity experienced by site two participants carried no injury risk and would instead have constituted a pleasant opportunity for postural variation, despite the concurrent higher levels of Wornout.

**Overall effect of specific Physical Work Demands (UBPD only)**

When the block of all specific Physical Work Demand variables (both static and dynamic) were entered into the sequential regressions for UBPD at sites one and two, following the General and Temporal Demands block, the amount of variance accounted for was substantial, as can be seen by the $R^2$ changes of 0.13 and 0.12, respectively. These results are consistent with prior evidence that intensive use of a computer mouse and to a lesser extent a keyboard (as with these people) is likely to increase discomfort and MSD risk (Buckle & Devereux, 2002; Buckle et al., 1999; Kryger et al., 2003).

**Demand for Care and Vigilance**

The final multivariate models showed that higher levels of demand for care and vigilance were strongly associated with higher UBPD, Wornout and Stress scores. At site two, bivariate
correlations with these wellbeing dimensions were all trending in the same direction as those at site one, suggesting that with a larger sample (as in site one) they too might have reached significance. At both sites, demand for care and vigilance was associated with significantly lower Job Satisfaction.

Job Description information (chapter 8) indicated that this kind of demand was likely to be highest for participants whose work appeared to be rather monotonous, such as for Communications and Help Desk Officers whose work entailed prolonged visual screening of text messages to identify the occurrence of key words, or more generally, by many junior clerical officers at both sites. Such concentrated, monotonous work is likely to be both stressful and unsatisfying (French, Caplan & Harrison, 1982; Hart & Staveland, 1988; Hurrell & McLaney, 1988; Kalimo, Lindström & Smith, 1997; Rissler, 1979; Young & Stanton, 2002), as was found here.

**Cognitive Demands**

The work of all participants was primarily cognitive in nature, and consistent with this, cognitive demand ratings were the highest of any variable within the Specific Work Demand domain. While there were no significant differences in mean cognitive demands score between the sites, or between job types within site one, the level was significantly higher for more senior staff (see chapter 8).

Cognitive demands were associated with higher SPPCA in site two (significant in the final multivariate analysis. These were significant bivariate collections between cognitive demands and Job Satisfaction (both sites, and Arousal (site one), and Stress (site two).

Since participants at site two were, on average, quite inexperienced in their jobs relative to those at site one, it seems likely that the individual coping capacities of some site one participants were still less than optimal – particularly since if is known from Job Description information that many had been recruited from backgrounds unrelated to their present jobs. Site two participants, in contrast, were known to have been thoroughly trained and inducted into their jobs, as well as being considerably more experienced. As a result, it is likely that site one participants’ coping capacities encompassed a wider range. If this were so, it would be consistent with the stronger association between cognitive demands and SPPCA at site one. Overall, it seems that when

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207 At site one, mean time in current job was 3.3 years, compared with 1.9 years at site two
cognitive demands exceed the person’s coping capacity they will be perceived as stressful, but for those who perceive that they are performing well, coping with higher demands is arousing (site one) and a source of job satisfaction (both sites).

**Emotional Demands**

While most work requires some interactions with people and therefore has some degree of ‘emotional’ demand, such demands are highest for those working with clients, patients or customers, and they have also been shown to be quite significant for many managers (Kristensen, Hannerz, Christensen & Borg, 2002).

At site one, higher emotional demands were significantly related to higher UBPD, Wornout, and Arousal scores, higher adrenaline levels, and lower Job Satisfaction. At site two, when these demands were high, the Wornout and Stress scores were higher. Clearly, the impact of emotional demands was greater at site one, which is probably due to greater variation between the different job types there in this aspect of job demand.

**Errors have important consequences**

The perceived importance of consequences of errors will influence the level of care that must be taken during performance, and might also enhance job satisfaction if it is associated with a higher level of perceived task significance (Hackman & Oldham, 1976, 1980). In general, this is expected to be higher for more senior staff, and this was found to be the case (see chapter 8). In line with the findings of the site one Job Description, errors have important consequences was rated as highest by the Communications and Help Desk Officers and lowest by the Clerical Officers. At both sites, the highest ratings were from the most senior staff.

Although this variable is only a single item, it emerged as a strong predictor of UBPD at site one, and Wornout scores were also significantly related to it. These results suggest that concern about the consequences of errors was particularly fatiguing for some site one participants – probably the Communications and Help Desk Officers, for whom it was known that performance errors had an objectively high risk of incurring major negative consequences. At site two, higher levels of this variable were related to lower levels of Arousal, for which there is no obvious explanation; this result seems unlikely to be a reliable one.

**Overall Influence of Specific Work Demands on Wellbeing**
In Table 17.2 it can be seen from the $R^2$ changes following entry of the main group of these variables at site one that their largest impact was on Wornout (higher), with substantial effects also on UBPD (higher), Job Satisfaction and Arousal (directions of effect varied). At site two, the variables in this domain appeared to affect Arousal most strongly, despite the domain being represented by only two factors (cognitive demands and errors have important consequences), of which only the latter reached significance; this may be an unreliable result. After Arousal, the next most strongly affected by Specific Work Demands at site two were Wornout (higher), Job Satisfaction and Stress (higher). In addition, higher levels of awkward postures was shown to have a substantial impact on UBPD.

Overall, it seems that the demands specific to the performance of particular work tasks are usually associated with higher fatigue, as expected, which can reduce job satisfaction. However, the experience of coping successfully with higher levels of cognitive demands can enhance job satisfaction, and in the context of jobs such as these, which are primarily cognitive, higher levels of dynamic physical demands can increase arousal level, which can be experienced as positive.

**Contextual Demands and Impediments**

The constructs within this domain were interruptions and disruptions, environmental and informational impediments, uncertainty about work requirements, performance uncertainty, workload variance, career uncertainty, and conflict. Few differences between job types were evident for these variables, but levels tended to be higher for more junior staff, except in the case of conflict. This was higher for more senior staff, who were more likely to have to deal with conflicts concerning the disquiet of more junior staff about ongoing organisational changes, and to experience confrontations with senior managers regarding these issues.

**Interruptions and Disruptions**

The content of items within this construct related to events and situations that are likely to have negative effects on work performance, and to be difficult or impossible for junior employees to control: for example, having to leave one task incomplete in order to work on another; not having enough time to plan or coordinate work properly, to do tasks thoroughly, or to ‘think creatively’ about how best to do things. Higher levels were experienced by the more junior officers (see chapter 9).
Table 17.2 shows that at both sites, higher levels of *interruptions and disruptions* were related to higher Wornout (in final models) and Stress scores, and to lower SPPCA (also in final models). At site two only, *interruptions and disruptions* were also associated with lower *job satisfaction*.

**Environmental and Information Impediments**

Whereas the *interruptions and disruptions* construct has a strong temporal focus, the *environmental and information impediments* items are more related to physical and informational performance barriers, again of the type that most employees are ordinarily unable to change easily, such as having inadequate information, equipment or tools; dealing with ‘red tape’, inefficient procedures, inadequate staffing levels, and so on. Levels were fairly similar between job types and levels, but tended to be experienced as higher by more senior staff, in contrast to the situation with *interruptions and disruptions*.

The pattern of causal factors for *environmental and informational impediments* was very similar to that for *interruptions and disruptions*. An important exception to this similarity concerns their opposite relationships with SPPCA, which was lower with *increasing interruptions and disruptions*, but *higher* with increasing *impediments*. The latter relationship did not reach significance at site two, but it approached it for both rounds. Higher *impediments* were also related to reduced Job Satisfaction at site one.

There is prior evidence that factors related both to environmental impediments and to interruptions /disruptions can act as stressors (e.g. Peters & O’Connor, 1980; Eyrolle & Cellier, 2000; Steel & Mento, 1986). The present evidence confirm this, and also demonstrates that they are fatiguing and can be dissatisfying.

However, the division here between performance barriers related to temporal factors (interruptions/disruptions) and those related to environmental/informational factors has revealed some interesting differences in their effects on wellbeing. Effects of the former construct were entirely negative, with particular impact on junior staff. Effects of the latter construct were greater for more senior staff, and it seems that having to overcome this type of performance barrier can have the *positive* outcome of enhancing SPPCA, despite higher levels of fatigue and stress, and reduced overall job satisfaction. The difference in effects on SPPCA may relate to how people perceive these different kinds of barriers. For example, site one Technical Officers installing communication equipment in economically under-developed countries probably see impediments such as power failures as a normal part of the job, with which their managers cannot
reasonably be expected to help. This viewpoint is likely to ‘contextualise’ such impediments as interesting challenges which, if successfully overcome, may enhance SPPCA. On the other hand, the negative impact on performance of constant interruptions or other such disruptions leaves little scope for ‘work around’ strategies, and hence no scope for any enhancement of SPPCA.

**Uncertainty about Work Requirements (i.e. role clarity)**

At site one, the highest levels of uncertainty about work requirements were reported by the Technical Officers, who often worked in unpredictable environments (including internationally) with little supervision. There were differences between job levels only at site two, where the more junior staff experienced higher uncertainty about work requirements, consistent with above discussions of site two staff as more inexperienced in their jobs.

Higher levels of uncertainty about work requirements were associated with higher Wornout and Stress scores at both sites. At site one, higher uncertainty was also associated with lower SPPCA, and at site two, with lower Job Satisfaction. Thus, the impact of this variable on wellbeing was entirely negative.

**Performance uncertainty**

The items in this construct related to the degree of uncertainty about the adequacy of the respondent’s own performance due to inadequate feedback or other relevant information (as opposed to the level of self-perceived performance capacities and adequacy, as in SPPCA). Degree of such uncertainty was similar across sites, job types and levels, with more junior staff experienced it to a greater extent.

At site one, this factor was associated with lower Job Satisfaction, higher Noradrenaline and lower SPPCA. However, overall this was one of the weakest factors and it had poor reliability coefficients, so little confidence can be placed in this result.

**Workload Variance**

Items within this construct concerned the extent to which there is variation over time in workload, the difficulty and complexity of work, required concentration level, and work rates. Such variations can reflect the cyclical nature of work demands as well as a range of other factors. While some level of variation adds desirable variety and interest, it may be experienced as a demand if perceived as excessive, unpredictable and/or uncontrollable (Hurrell & McLanney, 1988).
Levels were similar across the sites, job types and levels. At site one, the range of values of this variable was greater for people in more junior jobs. At both sites, high levels of workload variance was associated with lower Job Satisfaction, and at site two only, with higher Wornout scores.

**Career Uncertainty**

This construct is related to job insecurity, but is somewhat broader in coverage. Items are related to uncertainty about career prospects, the feasibility of finding new employment if necessary, future value of job skills and future job responsibilities. The highest career uncertainty was reported by the Communications and Help Desk Officers, whose section was undergoing ‘downsizing’ and restructuring, and by the more junior staff in site one.

At both sites, higher career uncertainty was significantly associated with lower Job Satisfaction and SPPCA. In addition, at site one it was associated with higher Stress, noradrenaline, UBPD and Wornout, and lower Arousal. The effect on SPPCA is consistent with findings of Parker, Axtell and Turner (2001) and Sevrke and Hellgren (2001), that job-related insecurity impaired job performance. The apparently greater impact at site one might, perhaps, be related to evidence from the Job Descriptions that staff there placed greater value on their current employment, because of its high status and financial rewards, than was the case for those at site two (see Appendix 8).

**Conflict**

Overall, interpersonal conflict levels were very low, but at site one there were differences between job types, with the highest levels among the Communications and Help Desk Officers. This was consistent with information that this group had recently undergone restructuring of their duties and conditions – a process that at times had been quite acrimonious (see Appendix 8). There were also significant differences between job levels with the most senior staff experiencing more conflict – again, for reasons consistent with Job Description information.

At both sites, higher levels of conflict were significantly associated with higher Wornout, and Stress scores, and lower Job Satisfaction. In addition, at site one only, higher conflict was associated with higher UBPD and SPPCA scores, and higher cortisol levels.

Based on a meta-analysis, de Dreu and Weingart (2003) reported strong, negative correlations between relationship conflict and team performance, and team member satisfaction. Where work
was inherently more complex and cognitively challenging (similar to that of participants in the current study) conflict was found likely to have a more powerful negative effect on both individual and team performance. Such effects might be mediated both by the increased impediments to effective performance that are presented by interpersonal conflicts, such as greater difficulty in accessing required information, and by reductions in individuals’ cognitive and emotional resources due to the additional effort they have to expend in dealing with conflicts. The observed relationships between conflict, wellbeing dimensions and SPPCA are consistent with such an interpretation.

**Overall Influence of Contextual Demands and Impediments on Wellbeing**

In Table 17.2 it can be seen from the $R^2$ changes following entry of the above group of Contextual Demands and Impediments constructs that easily their greatest impact is on Job Satisfaction (lower), with substantial effects also on SPPCA (mixed directions of effect), Burnout (lower) and Stress (lower).

Importantly, these contextual demands, impediments and constraints are often not under the immediate control of the individual, and if employee performance assessments do not take these factors into account, frustration and dissatisfaction may be particularly acute. On the other hand, where people have sufficient authority or control to manage these factors, they may then be viewed merely as nuisances (O’Connor et al., 1984).

**Job Control and Variety**

The important role of job control as a moderator of workplace stress is well established (e.g. Baker, Israel, & Schuman, 1996; Carayon & Zijlstra, 1999; De Croon et al., 2002; Karasek, 1979, 1989). According to the JobLoad Model, the constructs within this domain are likely to influence both the level of work demands, and people’s capacity and/or motivation to cope with demands, as discussed in chapter 2 and depicted in Figure 2.2. The domain is represented here by the following constructs: skill utilisation, work variety, decision latitude, and influence.

**Skill Utilization**

Levels of *skill utilization* were similar at both sites, although there were significant differences at site one between job levels, with higher levels among more senior staff.
Higher skill utilisation was associated with higher Job Satisfaction, higher SPPCA and lower Wornout scores at both sites. In addition, at site one it was related to lower Stress, and higher Arousal. Clearly, its effects at both sites were entirely positive.

**Work Variety**

The items in this construct related simply to variety in work tasks, and how much repetitive work there is. Levels of work variety were similar across the two sites, with higher levels among more senior staff at site one.

However, the reported levels of work variety resulted in improved employee wellbeing. At both sites, higher variety was associated with higher Job Satisfaction and SPPCA. In addition, Arousal was higher with greater work variety at site one, and Wornout was lower at site two.

**Decision Latitude**

The items in this construct related to freedom to decide the order in which work tasks are done, when to take breaks, starting and finishing work times each day, and more generally, freedom to ‘make decisions on own’. There were significant differences between the sites, job types and levels in the amount of decision latitude. The highest latitude was reported by the Technical Officers and the more senior staff.

This factor either did not meet the inclusion criteria for the final multivariate models or, where included, its effects were not statistically significant. However the bivariate correlations with Job Satisfaction and SPPCA were positive and significant at both sites. Decision latitudes was negatively and significantly correlated with both Stress and Wornout at site two, and while not reaching significance the pattern was the same at site one.

**Influence**

The items here related to how much ‘say’ people have, and whether or not people’s opinions are ‘taken seriously’. There were significant differences between the job types and levels in the amount of influence subjects felt they had. Technical Officers at site one, and more senior staff at both sites, reported the highest levels.

With higher influence, levels of Wornout and Stress scores were lower, and Arousal, Job Satisfaction and SPPCA scores were higher, at both sites. In addition at site one, UBPD was lower. Clearly, the effects of higher influence were uniformly positive at both sites.

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208 At site one, μ=4.2, SD 0.9; at site two μ=4.3, SD 0.9
Overall Influence of Job Control and Variety on Wellbeing

In Table 17.2 it can be seen from the $R^2$ changes following entry of the above group of Job Control and Variety constructs that, as in the case of Contextual Demands and Impediments, their greatest impact is on Job Satisfaction, where the additional variance explained was 13% at site one and 19.5% at site two.

Effects of increased Job Control and Variety on other factors were very much less. Perhaps this indicates that the great majority of participants in this study had sufficient control to facilitate their effective work performance, so that variation above that level affected Job Satisfaction but had little effect on levels of Arousal, Stress, Wornout or UBPD.

Coping Capacity

This major construct within the JobLoad Model represents those factors that affect the individual’s capacity to cope (their coping abilities), and/or their motivation to exert effort – both of which may affect actual performance. Within it are three sub-domains. First, a range of personal characteristics affect each individual’s coping capacity. These were not the focus of the present research, but a small number of potentially important and easily documented variables were recorded, and entered first into all sequential regression analyses.

Second, in some environments people’s coping capacities can be significantly affected by exposure to adverse physical factors such as excessive heat, noise, cold, noxious fumes, and so on, and their willingness to exert effort might also be affected by such factors, depending on how they perceive them. The initial job descriptions for participants in the present study determined that such factors were not relevant, so these were not measured here.

Third, the workplace social and organisational environment can provide varying forms of social support that may enhance coping capacity in various ways.

Personal and Non-work Factors

The variables documented were: age, gender, experience in the job, self-rated general health, whether or not there was any current specific injury, stress at home, and conflict between home and work demands. Most participants at site one rated their general health as good although it
was poorer at site two. Few reported injuries or mental or physical ill health problems which impeded their coping capacity.

It can be seen in Table 17.2 that older age was associated with higher levels of UBPD at both sites, and with lower Wornout scores at site one, and poorer general health was also related to higher UBPD at both sites. Those reporting a current physical injury that affected their coping capacity had higher Arousal levels at both sites, and at site two they also had higher Wornout scores and lower adrenaline levels. The only significant effect of gender was on Stress levels at site one, which were lower for men. Experience in the job had surprisingly little correlation with anything, so was not included in further analyses. Higher stress at home was not associated with any site two measures, but at site one it was related to higher Wornout scores, lower Arousal and lower SPPCA.

The variable in this domain that was most strongly and consistently associated with work-related wellbeing was conflict between home and work demands. Higher levels of this were associated with higher Stress and lower SPPCA at both sites; at site one, there were also associations with higher Wornout scores and higher cortisol levels. This general pattern is consistent with the findings of others (Barnett et al., 1992; Brisson, 1999; Duxbury & Higgins, 2001; Hammer et al., 2004; Hall, 1992; Kinman & Jones, 2001).

Looking at the total amount of variance accounted for by the variables in this domain when they were entered first into a sequential regression analysis (Table 17.2), it can be seen that the dimensions of wellbeing most affected were Stress, cortisol, Wornout and UBPD (in that order) at site one; and at site two, UBPD, Stress and SPPCA.

Social and Management Support

The variables within this sub-domain were coworker support this week, coworker cohesion, supervisor support this week, general level of supervisor support (last 6 months), and senior management support and communications.

Coworker Support (last week)

Coworker support were quite high at both sites, and between all job types and levels. Higher levels at both sites were significantly related to lower Stress and Wornout and higher Job

\[209\text{At site one, } \mu = 5, \text{ SD } 1.5, \text{ with a mode of 6, and at site two, } \mu = 3.2, \text{ SD } 1.5 \text{ with a mode of 2}

\[210\text{At site one, } 13\% \text{ of participants, and at site two } 12.7\% \text{ of participants reported that they were ill or injured} \]
Satisfaction and SPPCA scores at both sites. In addition at site one, UBPD was lower and Arousal was higher.

**Coworker Cohesion and Relationships (last six months)**

Levels of *coworker cohesion and relationships* varied significantly between the job types and job levels at site one. The poorest support was reported by the Communications and Help Desk Officers, and by the most senior officers. At both sites, higher levels of *coworker cohesion and relationships* were associated with higher Job Satisfaction scores, and at site one, this was the only significant relationship. At site two, it was also associated with lower Stress and Wornout and higher SPPCA scores.

**Supervisor Support (last week)**

Levels of this variable were similar at both sites, for all job types and levels. At both sites, higher *supervisor support* was associated with lower Wornout and Stress, and higher Arousal and Job Satisfaction scores. At site one, it was also associated with lower UBPD and higher SPPCA.

**General Level of Supervisor Support (last six months)**

Levels of this factor were similar for all job types at both sites, except for the Communications and Help Desk Officers who experienced lower levels. At site one (but not at site two) there were significant differences between job levels, with the highest support being experienced by contractors, and by the most junior of junior employees.

**Senior Management Attitudes and Communications**

Levels of perceived *senior management attitudes and communications* varied significantly between job types, and between job levels at site two. The lowest levels were experienced by the Communications and Help Desk Officers at site one, and by the most senior officers at site two. Relationships with wellbeing were relatively weak for this variable. Higher levels were associated with higher Job Satisfaction at both sites. At site one, it was also associated with higher Arousal and SPPCA, and lower Wornout scores.

**Overall Influence of Social and Management Support**

In Table 17.2 it can be seen from the $R^2$ changes following entry of these constructs that they accounted for little additional variance in any of the wellbeing variables or in SPPCA, with the highest effects being on Job Satisfaction and Arousal scores. It should be noted, however, that this block of factors was entered following the block of Contextual Demands and Impediments.
variables, and there were substantial correlations between variables within that prior block and several of the support variables (see Appendix 6, Tables 6.2a. and 6.2b.): in particular, correlations between general level of supervisor support and senior management attitudes and communications with influence were quite substantial (0.42 and 0.38, respectively). Such correlations would, of course, reduce the variance attributed to support.

**ROLE OF SPPCA AS A PREDICTOR OF WELLBEING**

The JobLoad Model has been partially derived from the cognitive ergonomics notion of workload, where a central tenet is the ‘spare attentional capacity’ available to an individual when performing a task. Based on this view of workload, the NASA-Task Load Index (TLX) workload measurement method includes among its six scales one representing the respondent’s perception of how well they have performed a task – the own performance scale. Within the JLI, which has been developed for use in measuring the workload associated with performing whole jobs rather than a specific task, the component corresponding to this own performance scale is SPPCA – the Self-perceived Performance Capacity and Adequacy. This encompasses items addressing the perceived quality or adequacy of both actual performance and the performance capacities underlying performance.

Achievement of a satisfactory level of work performance is the most centrally important requirement for any job incumbent. If this can only be achieved by the expenditure of a high degree of effort, such that there is little ‘spare capacity’ available for a large proportion of the working day, then excessive fatigue may threaten wellbeing. And if work demands are such that workers perceive their abilities to cope as possibly inadequate, threatening their achievement of adequate performance, they are likely to experience stress. On the other hand – drawing on literature from occupational health and organisational psychology – if people perceive that they are coping adequately with high levels of demand, or that they are performing particularly well, they can be expected to experience positive affect and a high level of job satisfaction. In other words, SPPCA can both threaten and enhance aspects of work-related wellbeing.

Within the JobLoad Model, SPPCA is both an outcome of the match between the work demands and the individual’s coping capacity, and an intervening variable between work demands and employee wellbeing. Work- and job-related factors predicting SPPCA were described in chapter 15, and chapter 16 included a review of relationships between SPPCA and dimensions of wellbeing.
For site one, a regression model including two personal and thirteen work factors accounted for 43.6% (R²) or 35.4% (adjusted R²) of variance in SPPCA; at site two, a regression model including one personal and eight work factors accounted for 39.5% (R²) or 26.5% (adjusted R²) of the variance.

At site one, major predictors of higher SPPCA were increasing workload pressure, conflict between home and work (negative), interruptions and disruptions (negative), career uncertainty (negative), work variety, influence, and conflict (negative), as well as stress at home (negative), total hours worked, unpleasant working hours (negative), responsibility (negative), and environmental and informational impediments.

At site two, the major predictors of higher SPPCA were increasing workload pressure (negative – opposite from site one), conflict between home and work demands (negative), cognitive demands, and interruptions and disruptions (negative).

To investigate the role of SPPCA as a determinant of each wellbeing dimension, it was added last to each of the sequential regression models, following entry of personal, work and job factors. It can be seen in Table 17.2 that it accounted for little additional variance in UBPD and Job Satisfaction. However, in Wornout scores it explained an additional 18% of variance at site one, and 21% at site two; and in Stress scores it explained an additional 15% at site one, and 12% at site two.

With Arousal, the effects of SPPCA differed between sites; at site one, it explained an additional 18% of variance, whereas at site two it explained only an additional 6%. It is not possible to tease out the precise reasons for this, but it seems likely to be related to the previously discussed difference between sites in people’s responses to increasing workload pressures. While Wornout scores increased at both sites, there was also a positive element in the response of people at site one, in terms of higher levels of Arousal, adrenaline, Job Satisfaction (a pattern not present at site two), as well as increasing levels of SPPCA. The reason for this difference is not evident from the data obtained in the present study. Hypotheses based on the Effort-Reward model of Siegrist (1996; Siegrist et al, 2004) could be advanced. This general issue might also be explored within an ‘organisational health’ framework such as that described by Hart and Cooper (2001).
CONCLUSIONS

The first aim of this project was to formulate a JobLoad Model to provide a more comprehensive and detailed account of factors contributing to a job’s workload, and the second was to construct a questionnaire (the ‘JobLoad Index’ or JLI) to support measurement of constructs within the Model. This new model, which encompasses a much broader set of factors than have previously been included within the context of ‘workload measurement’, has the potential to support more effective management of workload at the level of whole jobs in real workplaces – rather than simply to measure the workload associated with performance of specific tasks without any consideration of the ‘real world’ context, as in previous models. A review of the construct and content validity of the JLI in relation to that of comparable measuring instruments, including some developed concurrently with the present study, demonstrated that the aim of providing more comprehensive and detailed coverage of workload-related factors had been well achieved. Further, the JLI’s power to account for variance in wellbeing was shown to compare well with that of comparable instruments.

The third aim of the project was to investigate relationships between workload, wellbeing and self-reported performance among employees in two different workplaces, using the JLI. The reliability and future applicability of results from these investigations was enhanced by the collection of data from two separate work organisations, with employee participation rates of 63% and 73% respectively, and by the use of both objective and subjective data about job demands. Measurement of ‘stress hormone’ levels for a subgroup of participants provided an additional source of information about wellbeing. The relationships thus documented provided interesting, and potentially very useful, insights into the relative influences of a wide range of work- and job-related variables on people’s perceived abilities to cope with their job demands, and on various related aspects of their wellbeing. The importance of identifying different aspects of wellbeing, and differentiating their separate sets of work-related determinants, was also well demonstrated. Finally, and perhaps most significantly, these analyses identified the powerful role that self-perceived performance can play as an intervening variable between job demands and people’s work-related wellbeing.

Results from this research, and from further research based on it, as discussed in the following section, should facilitate more effective workplace management of people’s ‘jobloads’. In particular, it has the potential to support the identification of staffing levels and work rates that
can be safely and productively sustained, with resultant benefits for both performance quality, and individual wellbeing in both its positive and negative aspects.

**FURTHER RESEARCH**

*Possible developments of the JLI*

**Refine present scales**

Any measurement instrument intended for workplace use must be as brief as possible, and the present JLI is probably unduly long. Further, the reliability of a small number of the present scales is too low. There is a need for further development of the scales to enhance or maintain their reliability while reducing the length of some of the longer ones.

**Review scales used to measure wellbeing dimensions**

Since the commencement of this project, some additional ‘wellbeing’ measured have been reported, including ones to measure fatigue (e.g. the Swedish Occupational Fatigue Inventory, Åhsberg, Gamberale & Kjellberg, 1998), and ‘vigour’, which is a dimension of wellbeing closely related to arousal (e.g. Dickman, 2002). The potential value of such scales within the JLI, or in conjunction with a modified form of it, should be reviewed.

**Develop modified scales as required for use with different types of work and jobs**

While it was possible to gather rating from subjects who belonged to four distinct job types and with different levels of seniority, the work of all participants was still predominantly cognitive in nature. It would be desirable to conduct further investigations with participants whose job is more physically demanding, and/or more repetitive and monotonous, and/or in which levels of emotional demands are higher, such as in the human services sector (Ganster & Bates, 2003). It is highly likely that modified forms of at least some of the scales would be required for some purposes, since the relative importance of different types of work and job demands is likely to vary significantly for people in different types of job.

**Consider inclusion of additional organisational and/or personal variables**

Some determinants of individual wellbeing might be better investigated in terms of the Effort-Reward model of Siegrist (1996; Siegrist et al, 2004), or utilising an ‘organisational health’ framework (Hart and Cooper, 2001). The value of incorporating measurement scales to address these issues should be reviewed. The Copenhagen Psychosocial Questionnaire, which was
developed concurrently with the JLI, also has potentially useful content related to these variables, particularly its commitment to the workplace and meaning of work constructs. It seems likely that the addition of some such constructs would be helpful in increasing the capacity of the JLI to identify more clearly the workplace and organisational factors that are associated with individuals responding more positively to job demands, as was found at site one compared to site two in the present study.

**Applications of the JLI**

**Multilevel analysis**

More extensive interpretations of the results from the present study would have been facilitated by use of multilevel analysis methods to identify differences between the influence of different variables at the levels of the individual, the job and the organisation. This was not possible here, but should be considered in future studies, where practicable.

**Longitudinal data collections**

Design of the present study entailed collection of data from the same individuals at different points in time, but the original aim of selecting data collection points to coincide with substantially different workload levels proved to be impracticable in this instance. It would be useful to pursue this aim further.

**Identify impact of SPPCA on objective performance indicators such as safety-related behaviours, and trade-offs between performance quantity and quality**

There are sound theoretical grounds for expecting that in many situations, levels of both safety and performance quality will deteriorate with decreasing SPPCA. It would be useful to empirically investigate such hypotheses, since there are potentially very important implications for workplace management practices, occupational health, and safety performance and associated financial costs, and broader productivity issues.

**Identify role of personal variables in relation to SPPCA and objective performance indicators**

The JLI in its current form is designed to address major work demands and related job factors, but provides only cursory coverage of personal and non-work factors that may influence SPPCA and/or actual work performance. Nevertheless, it is evident from others’ research that individual variables such as preferred coping strategies are likely to interact with work- and job-related
variables, as measured by the JLI, and thus to influence SPPCA. Variables such as the individual’s sense of coherence, or locus of control, are also likely to be influential in some situations. It would be useful to explore the possible roles of such personal variables in relation to levels of SPPCA and actual performance, to provide the basis for future development of human resource management and training strategies that will more effectively promote both high quality performance and individual wellbeing.

Other individual characteristics that are highly likely to interact with work- and job-related factors in influencing SPPCA and wellbeing are employee age, and the extent of pre-existing injuries. Research to determine the nature and extent of the effects of these factors would be of value in supporting more effective management both of ageing workers, and of workers in rehabilitation programs. In view of the ageing workforces in most economically developed countries, such issues are of increasing economic significance.

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