Psychosocial aspects of work and health in the North Sea oil and gas industry

A survey of FPSO installations
and comparison with platforms and drilling rigs

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A survey of FPSO installations and comparison with platforms and drilling rigs

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This report addresses three aspects of work and health among offshore personnel, drawing on data collected between 1995 and 2002.

- A detailed survey of North Sea personnel (N=470) working on *'Floating Production, Storage and Offloading'* (FPSO) installations in 2002 is reported. Significant differences were found across installations and across job types in a wide range of psychosocial measures. The effects of shiftwork and work/leave patterns were also examined.

- The FPSO data were compared with data (obtained in 1995) from personnel working on production platforms (N=1169) and drilling rigs (N=478). FPSO installations were similar to drilling rigs in psychosocial work characteristics but were closer to platforms in physical work environment.

- Changes in offshore work conditions and well-being over a five-year period (1995 to 2000) were examined in longitudinal data (N=288). Among those who remained in the same job, the measures analysed remained relatively stable. Job change (particularly to a management role) was the main factor influencing changes in work perceptions.

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SUMMARY

This report examines three aspects of "work and well-being" among offshore personnel in the North Sea oil and gas industry. First, a survey (carried out in 2002) of personnel working on "Floating Production, Storage, and Offloading" (FPSO) installations is described. Second, the FPSO data are compared with similar data collected in 1995-6 on production platforms and drilling rigs. Third, longitudinal data are analysed to evaluate the extent of change over time (1995 to 2000) in psychosocial factors and health among North Sea personnel.

In each study, the survey data included measures of the perceived work environment (physical stressors, workload, task variety/skill, autonomy, and job clarity), three aspects of overall work satisfaction (job satisfaction, job security, and satisfaction with safety), psychological well-being, physical health complaints, and health behaviours. Demographic factors (e.g. age, job type, employer) and work patterns (day/night shiftwork, work hours, and work/leave schedules) were also examined. The main findings are outlined below.

FPSO study. The data analysed related to 470 male personnel employed on seven installations (six FPSO's and one fixed platform); the overall response rate was 84%. Installations differed significantly on measures of the perceived physical and psychosocial environment, and on work satisfaction measures; similarly, there were significant differences across job groups. No single installation or job type was most favourable on all measures, but the results highlighted the relatively adverse work perceptions of catering personnel. Over and above the effects of installations and job types, work/leave patterns were significant in relation to work environment measures, but not in relation to work satisfaction. Age was related to job security in a non-linear manner but, in general, was only weakly associated with other measures.

Among FPSO personnel, scores on a standard measure of 'stress symptoms' were similar to those of other offshore groups, and more favourable than those of comparable onshore employees. However, catering personnel were significantly more likely than other job groups to report high levels of distress. Further analyses demonstrated the significant role of work environment variables (supervisor support, autonomy, task variety/skill, job clarity and workload) in mediating the effects of installations and job types on measures of well-being.

Comparison of production platforms, drilling rigs and FPSO's. Analyses of data from personnel (N=1861) on platforms, drilling rigs, and FPSO's showed significant differences across types of installations in the physical environment, in psychosocial work perceptions, and in work satisfaction measures. In general, FPSO's were more similar to drilling rigs than to platforms in psychosocial measures, although exposure to physical environment stressors on FPSO's was lower than rigs. Moreover, satisfaction with safety on FPSO's was significantly lower than on either platforms or rigs. As the data relating to FPSO's were collected in 2002, while those relating to other types of installations dated from 1995-6, it was possible that general change over time in North Sea work conditions might have influenced these comparisons. However, the findings of the follow-up study (see below) tended to support the view that the effects found largely reflected real differences in the structural and psychosocial work environments of different types of installations.

Change over time: longitudinal follow-up study. This analysis was based on a sample of 288 personnel from the 1995 survey who were still working offshore in 2000 and who responded to a follow-up questionnaire sent out by mail. Among those who had remained in the same type of job, there was relatively little change in the measures of work characteristics and health. However, important exceptions were significant reductions in job clarity and satisfaction with safety, and a significant increase in anxiety. Among those who moved from non-management jobs to management positions, work perceptions, job satisfaction, and body mass index changed to levels similar to those of personnel already in management positions.

The findings of these studies are reviewed in a final chapter, some general conclusions and areas of concern are set out, and possible further research is noted.

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1. INTRODUCTION

In recent years, North Sea oil and gas installations have undergone a number of operational changes. In particular, increased automation of production processes, enhanced safety regimes, introduction of cost-reduction measures, down-manning (particularly on older installations), new working hours legislation, and changes in work/leave patterns, have all impacted on the work and living conditions of offshore personnel. In parallel with these changes, new approaches to the extraction and processing of oil from North Sea fields have been developed, including the use of smaller, floating installations as an alternative to fixed platforms or semi-submersibles.

Designated "*Floating Production, Storage and Offloading*" (FPSO) installations, these new systems are making an increasingly important contribution to offshore oil. However, in spite of the substantial number of FPSO installations now operating in the North Sea, little is currently known about the human factors issues involved, including physical and psychosocial work characteristics, and their implications for the health and safety of personnel. In contrast, considerable research into human factors, safety management, work perceptions, health and psychological well-being, has been carried out on production platforms and drilling rigs.

Earlier research in these areas was reviewed by Parkes, Clark, and Payne-Cook (1997) and by Parkes (1998). However, further offshore research studies have appeared subsequently; these more recent publications cover a range of psychosocial and human factors issues, including risk perception, safety culture, and offshore safety management (Mearns, Whitaker, & Flin, 2001; Mearns, Flin, Gordon, & Fleming, 2001; Rundmo & Sjoeberg, 1998), work environment perceptions, sleep, and health outcomes associated with offshore shift work (Parkes, 1999; Parkes, 2001; Parkes, 2002; Parkes, 2003b); and stress and health offshore (Hellesoy, Gronhaug, & Kvitastein, 2000; Parkes, 2003a; Ulleberg & Rundmo, 1997).

Other topics addressed in the recent literature on offshore work include measurement of psychosocial factors (Chen, Wong, & Yu, 2001; Mearns, Flin, Gordon, & Fleming, 1998); the lifestyle of the families of offshore personnel (Collinson, 1998; Mauthner, Maclean, & McKee, 2000; Gramling, Wooddell, & Forsyth, 1998); and sleep, fatigue, caffeine intake and health complaints among North Sea helicopter crews (Gander *et al.*, 1998). Also relevant in this context, a Canadian report reviewed sociological and psychological aspects of offshore employment from a cross-national perspective (Shrimpton & Storey, 2001).

These publications contribute to the understanding of the potential hazards to which offshore personnel are exposed, and the demands and constraints they experience in the course of their work. However, the studies relate primarily to production platforms and drilling rigs; FPSO installations are a relatively new concept in North Sea oil production, and none of the work cited above refers specifically to this type of installation. This omission is important as the work environment of FPSO's differs in several respects from that on platforms and drilling rigs.

Relative to fixed production platforms, FPSO installations tend to be smaller (usually having no more than 50-60 personnel on board), and to have more restricted living space and recreational facilities for personnel. In addition, movement of the installation in adverse wind and sea conditions, particularly on FPSO's which have been converted from oil tankers rather than purpose built, is much more severe than on fixed installations. Thus, extended periods of bad weather may give rise to sleep disturbance, fatigue, and disrupted performance.

However, as compared with production platforms, FPSO installations have a number of operational advantages. In particular, they do not require direct connection to an offshore pipeline system to transport the oil to the mainland; instead, when on-board storage tanks are full, the oil

is off-loaded to a tanker for delivery to onshore terminals, thus reducing operating costs. Moreover, although FPSO's typically remain in the same location for 10-15 years or more, they can potentially be moved to more productive fields when necessary.

Thus, the job prospects of those on board tend to be more secure than those of many other North Sea employees, particularly personnel working on older platforms. In this respect, FPSO's are more similar to drilling rigs than to production installations. Also, consistent with their development from oil tankers, FPSO personnel tend to work within a marine culture, in contrast to fixed platforms which are characterised by a more production-oriented environment. In all these respects, the work environment of FPSO's, and the safety and health of those working on them, merit specific investigation. The present report describes the findings of research designed to meet this need.

In addition, the report presents analyses of two further data sets which address offshore research questions not previously examined empirically. First, the psychosocial characteristics of different types of offshore installations (production platforms, drilling rigs and FPSO's) are directly compared; second, a five-year longitudinal follow-up study of North Sea personnel is reported.

1.1 PRESENT WORK

1.1.1 FPSO study

The main aims of the FPSO study were:

- To carry out a survey of the physical and psychosocial aspects of the FPSO work environment, job characteristics, safety procedures and measures, individual differences (including demographic factors), mental and physical health, and job satisfaction.
- To obtain data from a sample of approximately 500 personnel, including all the main occupational groups employed on the installations, and from both operating company personnel and those employed by contractors or service companies.
- To determine the extent to which the psychosocial and health-related variables differed across installations and across jobs, taking into account age and response biases.

1.1.2 Comparison of platforms, drilling rigs, and FPSO's

A further aim of the work reported here was to compare the data relating to FPSO's with data obtained previously on fixed production platforms and drilling rigs (Parkes *et al.* 1997). The survey items used in the present work were similar to those used in the earlier study; thus, work environment measures, safety perceptions, job satisfaction and health could be compared across different types of installations. However, in making such comparisons, it is important to note that there was an interval of some 6-7 years between data collection on platforms and drilling rigs in 1995 (which continued until Summer 1996) and the FPSO data collected in 2002.

1.1.3 Assessment of change over time

A difference in levels of, say, workload or anxiety, between the 1995 data and the present FPSO data could either reflect a real difference between platforms and/or drilling rigs and FPSO installations, or this result could indicate change over time in the North Sea work environment generally. With the aim of clarifying this issue, a separate longitudinal study is described (Chapter 9 of this report) which compares data collected from a follow-up group in 2000 with data from the same individuals in the 1995 survey. The results provide an assessment of the extent of change over a five-year period in psychosocial aspects of the offshore work environment, perceptions of safety, and health-related outcomes.

2. RESEARCH METHOD

Data collection closely followed the approach used in the offshore survey research carried out in 1995 by Oxford University (Parkes *et al.* 1997). The survey measures were generally similar to those used previously; however, some items (not found to be salient in the previous analyses) were dropped to reduce the length of the questionnaire, and some were modified to reflect the particular characteristics of FPSO installations as compared with platforms and drilling rigs.

2.1 PROCEDURE

2.1.1 Installations

A total of seven installations (six of which were FPSO's) took part in the study. The seventh installation (included for comparison purposes) was a fixed platform operating in close proximity to one of the FPSO installations, and similar to the FPSO's in the number of personnel on board. Three of the installations included in the study were operated by one company, and two others by another company; the remaining two installations were operated by different companies. Thus, four companies were involved in the work. In addition, two further companies expressed interest initially, but eventually decided that they were unable to participate in the study.

2.1.2 Personnel

As far as possible, all personnel on board when the researchers visited were invited to take part, with the exception of short-term contractors and specialists with less than two months' experience of the installation concerned. The main focus was thus on established 'core crew' members; this group included both operating company personnel and contractors. All occupational groups were included in the survey.

2.1.3 Data collection

The main aspects of the data collection procedure are summarized below:

- Data collection took place between June and November, 2002. All data were collected on site, rather than by postal survey, thus encouraging a high response rate and allowing the researchers to gain first-hand experience of the FPSO work environment.

- Offshore trips lasted 2-4 days depending on helicopter schedules. Two visits were made to each installation; these visits were scheduled to ensure that, as far as possible, different crews were on board on the two occasions.

- The study was introduced to potential participants by the researcher, usually in small groups arranged by the supervisors of particular work areas. These meetings provided an opportunity for the personnel concerned to ask questions about the work, and for the researcher to make arrangements for the distribution and return of the questionnaires.

- Personnel who were willing to take part were given a 'questionnaire pack' and their names recorded against the identification number included in the pack. Only rarely did individuals decline to participate at this stage.

- The questionnaire took approximately 45 minutes to complete, although there were wide variations between individuals in the time required.

- The completed questionnaires were returned to the researcher in individual sealed envelopes, either directly or via a central collection point. A very few questionnaires, not completed while the researcher was on board, were returned by mail.

- In addition, individual interviews were held with a number of personnel, usually those in key positions, on each installation. These interviews served to extend the survey material, and provided background information about the installation concerned.

- All participants were offered individual feedback (sent out after the completion of the study) outlining how their personal profile of responses related to the overall findings.

2.2 SURVEY MATERIALS

Each set of survey materials contained the following items:

- ***Introductory letter***. This letter outlined the nature of the work, and the source of funding; in addition, it guaranteed the confidentiality of all individual data, and adherence to the provisions of the Data Protection Act.

- ***Questionnaire, brief instruction sheet, and envelope for return.***

- ***Individual research number.*** The questionnaires were identified with a unique research number. The name of the individual to whom each set of materials was given was recorded on a separate confidential list against the corresponding identification number.

- '***Feedback slip***'. Participants requesting individual feedback about their response profiles relative to the overall group completed a separate slip giving the address to which they wanted the feedback to be sent. A small envelope was also provided so that this slip could be returned separately from the questionnaire.

2.3 QUESTIONNAIRE CONTENT

The first offshore visit was used to pilot the questionnaire developed for the present study. Subsequently minor modifications were made and the final version was used on all subsequent visits. As far as possible, the topics covered and the items used corresponded closely to those used in the earlier study of platforms and drilling rigs. The main measures analysed in the present report are outlined below:

- ***Demographic information***. Age, marital status, education, current job details (e.g. job title, employer, area of work), and total number of years of employment offshore.

- ***Physical working environment***. A ten-item questionnaire assessed exposure to physical environment stressors, e.g. noise, vibration, poor air quality.

- ***Job characteristics.*** Specific features of jobs (including workload, autonomy, variety, and clarity) were assessed by means of a set of 21 items. Further information requested included shift patterns, working hours, and work/leave pattern.

- ***Work satisfaction***. Three aspects of work-related satisfaction were assessed. '*Job satisfaction*' focused on satisfaction with the content of work carried out, and the skill, variety, and responsibility involved. *'Job prospects'* assessed job security, chances of promotion, and future prospects in the industry. *'Satisfaction with safety'* assessed satisfaction with safety measures and emergency response procedures on board.

- ***Health.*** Published scales were used for the assessment of minor physical/psychosomatic health problems (Vaernes et al., 1988) and for the assessment of mental health (Goldberg, 1978). Other health-related information recorded included height and weight (from which the body mass index was calculated), and smoking behaviour.

- ***Negative affectivity.*** Several personality measures were included in the questionnaire, but only one plays a major role in the present report. Neuroticism, a measure of 'negative affectivity' (known to be associated with adverse work perceptions) was assessed by the Eysenck Personality Questionnaire (Eysenck, Eysenck, & Barrett, 1985).

2.4 SAMPLE SIZE AND RESPONSE RATES

The total sample size was 494 (including 10 women) and the overall response rate was 84%. Response rates for separate visits ranged from 72% to 97% (see Table 2.1).

Table 2.1
Response rates and sample sizes across installations and visits

Installation	FIRST VISIT		SECOND VISIT		OVERALL		
	N distributed	% returned	N distributed	% returned	N distributed	% returned	Total N
1	33	90.9	43	79.1	76	84.2	64
2	38	86.8	39	71.8	77	79.2	61
3	40	82.5	38	84.2	78	83.3	65
4	50	84.0	36	94.4	86	88.4	76
5	56	80.4	30	96.7	86	86.0	74
6	54	74.1	40	92.5	94	81.9	77
7	49	89.8	41	80.5	90	85.6	77
OVERALL	**320**	**83.4**	**267**	**85.0**	**587**	**84.2**	**494**

2.5 DATA CODING AND PROCESSING

The questionnaire data were coded according to a pre-determined schedule. Nominal categories (e.g. job type, installation) were given discrete codes for identification, while individual ratings on the quantitative measures were entered numerically. An SPSS data base was created for the statistical analyses. Prior to analysis, the data set was screened to check for missing data and out-of-range values, and corrected with reference to the original questionnaires if necessary.

2.5.1 Coding of categorical variables

Installations. Installations were identified by numeric codes, 1 to 7. The fixed platform was coded 5; other codes related to FPSO's.

Job type. The questionnaire asked respondents to indicate their job title and also in which of four main areas of work they were involved. This information was used to identify six job categories: maintenance/technical, catering, production, management/supervisory, administration, and marine/deck/construction (this latter group also included a very small number of drill crew). In addition, a further category covered specialists whose jobs did not fit into any of the designated areas. Subsequent examination of job titles indicated that this group could most appropriately be combined with 'administration'.

2.6 DATA ANALYSIS

In reporting findings from the large data set available, it was necessary to focus on a limited number of analyses from the vast range of possibilities. The work reported here is primarily concerned with assessing the extent to which *objective* factors such as installation, job types, and shift patterns, are associated with *subjective* outcomes, such as perceived job characteristics, safety perceptions, and health measures, rather than examining relations between subjective measures.

The factors chosen as the basis for the initial analyses were job type and installation, with control for age and negative response biases (see below). In addition, specific points of interest were followed up in relation to particular outcomes. Several more technical aspects of the analysis are outlined below.

Multivariate analyses. As the predictor variables of interest were not independent of each other, it was necessary to use multivariate methods of analysis which allow the effects of more than one variable to be evaluated simultaneously. Although univariate methods are also reported where appropriate, multivariate analyses provide more clearly interpretable results.

Main effects, interactions, and curvilinear effects. Two predictor variables may either act separately (each showing an overall effect in relation to the outcome, independently of the other), or they may combine interactively, in which case the effect of one variable depends on the level of the other. For instance, installation and job type may both relate independently to, say, perceived workload; alternatively, the two factors may interact, the effect of job type varying across installation and, conversely, the effect of installation varying across job types. Although most of the relationships analysed were linear, in some instances, a curvilinear relationship (represented by a quadratic term) provided a better fit to the data. Overall main effects, interaction effects, and curvilinear relations were examined in the present work.

Data distributions. Some of the measures used had markedly 'skewed' distributions, that is, most scores were bunched together within a small range, but there was a tail of extreme scores at one end. For distributions of this nature (e.g. reported working hours per week, health problems scores), the overall mean is not a useful measure as it tends to be distorted by the extreme values. In these cases, the percentages of the sample falling within certain ranges of scores are reported, and statistical analyses appropriate to this format are used.

Significance levels. The sample size in the present study was such that high levels of significance were obtained in many of the analyses. The convention adopted in this report is that probability levels less than .001 (i.e. the probability of the observed result being obtained by chance is less than 1 in 1000) are reported as $p<.001$, irrespective of the actual level of significance achieved which was often much higher (i.e. a smaller probability value reflecting a more highly significant result). Probability levels which were statistically significant ($p<.05$), but which did not reach the $p<.001$ level are quoted precisely.

Control for response biases. A general tendency to perceive both self and environment in a negative light is reflected in a wide range of self-reported information, including job perceptions and health measures. In analysing survey data, individual differences in this tendency, labelled '*negative affectivity*', must be taken into account for two reasons. First, negative affectivity acts to inflate observed correlations between stressors and outcomes (e.g. Brief, Burke, George, Robinson, & Webster, 1988). Second, between-group differences in negative affectivity may distort comparisons across groups; for instance, differences between job types in, say, perceived workload, may be partially attributable to differences in the overall levels of negative affectivity in different job groups. The measure used to control for this form of response bias was *neuroticism* (Eysenck et al., 1985); it was routinely included as a covariate in the multivariate analyses.

Control for age effects. A second covariate, age, was also routinely included in the analysis models, both as a predictor variable of interest in its own right, and to take into account possible confounding due to age differences between sub-groups within the overall sample.

3. DESCRIPTION OF THE SAMPLE

3.1 CRITERIA FOR INCLUSION IN THE STUDY

A total of 494 personnel returned completed questionnaires. The data set that forms the basis of the present analysis differs in two ways from this original sample. First, as installations and jobs were main factors in the analysis, it was important not to confuse the results by including personnel for whom these factors were of little significance. Accordingly, those with less than two months' experience of the job and/or the installation were excluded from the sample prior to analysis. This screening reduced the original sample by 14 personnel (3%) to 480.

Secondly, data from female participants were not included in the analyses reported here. Women formed a very small proportion of the survey respondents (n = 10, 2% of the original sample), corresponding to their low representation in the offshore workforce. Furthermore, the women were all in the same occupational group (catering). Thus, including women in the analysis sample would have complicated the interpretation of the findings. The data analysis presented in this report is therefore restricted to the remaining sample of 470 male personnel. It is important to note that the findings reported necessarily relate only to personnel who returned a completed questionnaire; however, the high overall response rate suggests that the results can reasonably be regarded as representative of personnel on the installations concerned.

3.2 DEMOGRAPHIC AND BACKGROUND FACTORS

Broad demographic categories, and other background factors that characterise the sample, are shown in Table 3.1. Considering, first, the demographic information, the table presents a breakdown of age, educational level, marital status, and years of offshore employment. The overall average age was 38.8 years (± 8.9 years) with a range of 19-63 years. As shown in Table 3.1, personnel in the 30-49 years age range accounted for two-thirds of the sample. The majority (73%) of personnel in the sample had been employed offshore for ten years or longer, and 87% of the participants were 'core crew' members.

As also shown in Table 3.1, 75% of those taking part were married or living with a partner, and 50% had children under 18 years living at home. Other background information in Table 3.1 shows that the most frequently reported reason for having chosen to work offshore was financial advantage, although lack of opportunities onshore was the main factor for nearly 20% of the sample. In spite of increasing concern about job security, the great majority of the sample reported that they expected to be, or probably would be, in the same job in a year's time.

3.3 SAMPLE COMPOSITION

Table 3.2 sets out the proportions of the overall sample falling in sub-groups defined by company, installation, job type, employer, and work patterns. However, as noted below, these overall data conceal some significant differences across different installations and job types, and other relevant sub-groups in the sample.

Installations, job types, and day/night shift work. The proportions of personnel in the different job types did not differ significantly across installations, but there was a significant difference

across installations in the proportions working rotating day/night shift schedules as compared with day work schedules ($\chi^2 = 39.5$, df=6, p<.001). The overall average proportion of day/night shift workers in the sample was 40.3%, but across the seven installations the range was from 22.2% (Installation 1) to 67.1% (Installation 4). This wide range partially reflected the proportion of production workers among participants on different installations as almost all personnel in this job group worked day/night shifts. However, this factor could not entirely account for the three-fold variation in the proportion of day/night shift workers. On installations with two-week offshore work cycles, almost all operated a mid-cycle shift changeover for day/night shift workers; only Installation 6 worked a pattern alternating day and night shifts from one offshore tour to the next.

There were also significant differences across installations ($\chi^2 = 20.7$, df=6, p<.01) and job types ($\chi^2 = 122.1$, df=5, p<.001) in the proportions of personnel employed by the operating company as compared with those employed by contractor or service companies. On Installations 4 and 5 (operated by Company B), only 7.5% of the sample were operating company personnel, whereas on Installation 6 (operated by Company C), 28.4% of participants were employed by the operating company. As illustrated in Figure 3.1, across different job groups, the proportions of operating company personnel relative to contractors/service company employees ranged from zero among catering staff to 64.8% in the management group, with an overall average of 18.9%.

Operating company, job types, and work/leave schedules. As shown in Table 3.2, several different work/leave schedules were in operation on the installations participating in the present study. These different schedules closely reflected the operating policies of the companies involved. Thus, virtually everyone on installations operated by Company A worked a schedule of three weeks offshore followed by three weeks leave (3-3 schedule); in contrast, 71% of those working on Company B installations, and 56% of those on the Company C installation, worked a schedule of two weeks offshore followed by three weeks leave (2-3 schedule). There were also significant differences across jobs in the proportion of personnel working different work/leave schedules. In particular, no catering personnel worked 2-3 schedules; everyone in this job group worked equal time schedules, either the 2-2 pattern (67%) or the 3-3 pattern (33%).

Age. The age profiles of groups classified on the basis of employer did not differ significantly. The pattern of age distribution in each employment group is illustrated in Figure 3.2, in which the sizes of areas represent the relative numbers of personnel in each group, while the profiles show the age distribution of each group. In each employment category, the predominant age group is 40-49 years, this pattern being particularly marked in the contractor employment group relative to the operating company personnel.

Although there were no significant differences in average ages across companies or installations, there was a significant difference across job types, $F(5,464) = 2.32$, p<.05. This difference was largely accounted for by the higher age of management personnel (average 45.7 years) and to a lesser extent, of production personnel (average age 44.5 years) as compared with other job groups (average age 42.4 years). The pattern of age in relation to job type differed for dayworkers and day/night shiftworkers; in particular, production operators who did day work (a small proportion of this occupational group) tended to be younger than those who did day/night shiftwork.

Table 3.1

Demographic and background characteristics

Factor	Levels	N	% of sample
Age range (years)	19 - 29	33	7.0
	30 - 39	107	22.8
	40 - 49	208	44.3
	50 - 59	118	25.1
	60+	4	0.9
Years of offshore work	< 5	58	12.3
	5 - 9	69	14.7
	10 - 14	134	28.5
	15 - 19	75	16.0
	20 - 24	91	19.4
	25+	43	9.1
Marital status	Married, with children	202	43.4
	Married / living with partner	145	31.2
	Separated / divorced / widowed	44	9.5
	Single	74	15.9
Educational level	No formal qualifications	59	12.7
	GCSE-O level or equivalent	88	19.0
	A-level / technical qualifications	251	54.1
	Degree or equivalent	66	14.2
Reason for taking offshore employment	Financial advantage	134	28.6
	Lack of opportunities onshore	66	14.1
	Better career prospects	15	3.2
	Onshore leave weeks	124	26.5
	Other reason	25	5.3
	Combination of above reasons	104	22.2
Expectation of being in same job in a year's time	No	30	6.9
	Probably not	63	14.4
	Probably yes	263	60.3
	Yes	80	18.3

Sample size, 436 - 470

Table 3.2

Sample composition

Factors	Levels	N	%
Operating companies	Company A	178	37.9
	Company B	146	31.1
	Company C	74	15.7
	Company D	72	15.3
Installation	1	60	12.8
	2	55	11.7
	3	63	13.4
	4	75	16.0
	5	71	15.1
	6	74	15.7
	7	72	15.3
Employer	Operating company	89	18.9
	Contractor company	344	73.2
	Service company	37	7.9
Job type	Technical/maintenance	136	28.9
	Catering/flotel	33	7.0
	Production	85	18.1
	Management/supervisory	71	15.1
	Administration/specialist	36	7.7
	Marine/deck/construction/drilling	109	23.2
Shift pattern	Day work	270	57.6
	Day/night shiftwork	182	38.8
	Other	17	3.6
	Missing data	*1*	
Hours/week > 84 hrs.	None	287	61.1
	1 - 9 hours	112	23.8
	10 - 16 hours	38	8.1
	> 16 hours	28	6
	Missing data	*5*	
Work/leave cycle	2 weeks on, 3 weeks off	140	29.9
	2 weeks on, 2 weeks off	109	23.3
	3 weeks on, 3 weeks off	173	37.0
	Other	46	9.8
	Missing data	*2*	
TOTAL		**470**	**100**

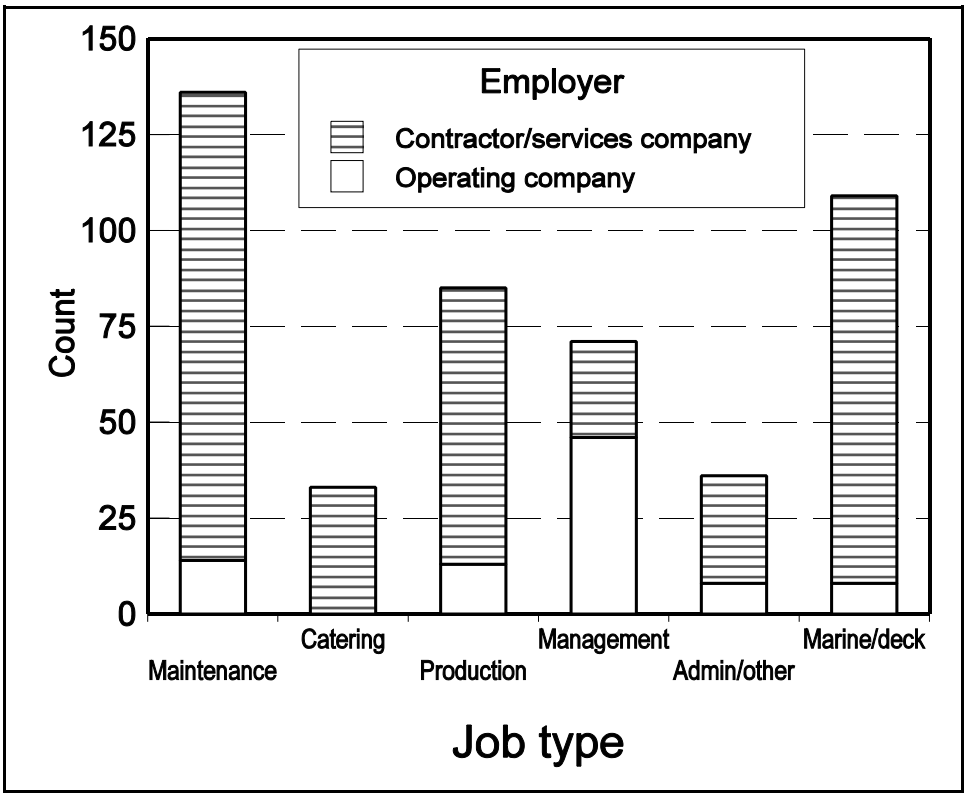


Figure 3.1
Sample characteristics: Job type by employing company

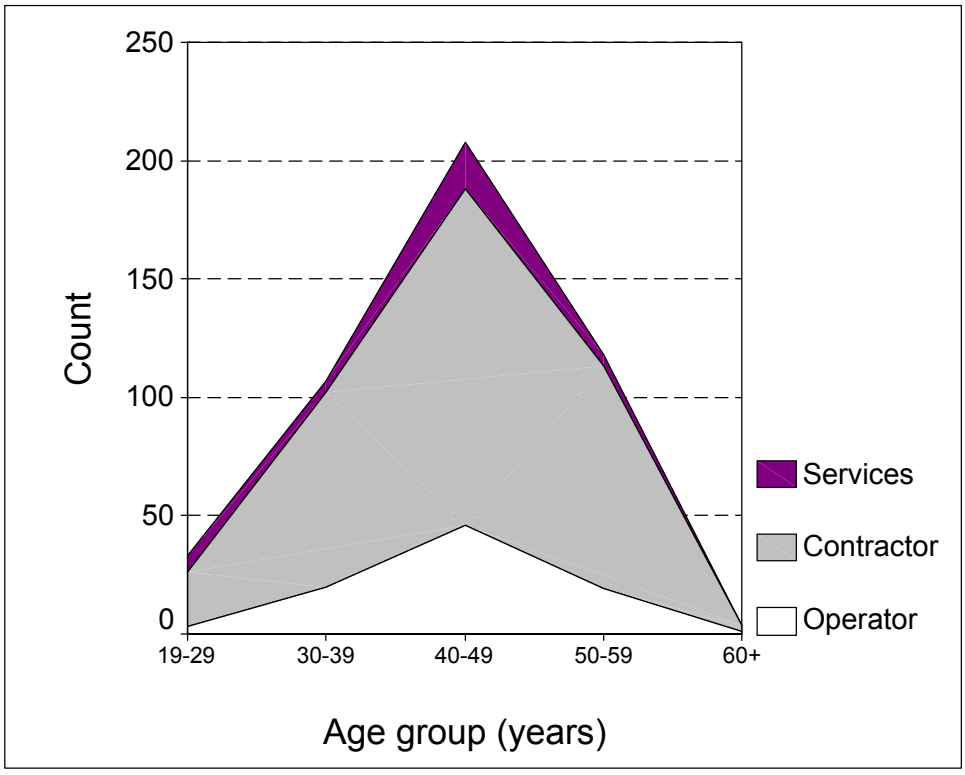


Figure 3.2
Sample characteristics: Age group by employing company

3.4 PERSONALITY

Although personality variables are not considered in detail in this report, two dimensions assessed in the present study are relevant to the description of sample characteristics in that they throw light on the general adaptability and emotional stability of offshore personnel. The overall mean score on the *extraversion-introversion* scale was 8.0 (± 3.4), and the mean score on the *neuroticism scale* was 3.8 (± 3.1). Average scores on these personality variables did not differ across installations, and there was only a marginal difference across job types (catering personnel tending to show high scores on the neuroticism measure).

Relative to normative data (Eysenck *et al*. 1985), in the sample as a whole, extraversion scores were significantly high and neuroticism scores were significantly low. This combination of low neuroticism and high extraversion (reflecting a tendency to be sociable, active, emotionally resilient, and adaptable) is associated with better-than-average mental health, and good coping skills.

Thus, in general, the present data suggest that selection processes involved in seeking, obtaining, and remaining in, offshore employment give rise to a workforce that, on average, shows personality characteristics likely to promote favourable adaptation to the offshore environment. However, it should be noted that on both scales the full range of scores (0-12 in each case) was observed, indicating considerable individual variation around the overall mean values.

3.5 COMPARISON OF PLATFORMS, DRILLING RIGS AND FPSO's

3.5.1 Background

The present report includes a comparison of the FPSO data with similar data sets collected previously from production platforms and drilling rigs (Parkes *et al.* 1997). As a background to these comparisons, Table 3.3 sets out the overall sample characteristics in terms of numbers of operating companies, installations and personnel involved, personnel-on-board (POB) levels, and response rates, for each of the three different types of installations. The inclusion criteria noted in Section 3.1 were also applied to data from platforms and drilling rigs.

3.5.2 Demographic and job-related factors

Several demographic and job-related factors varied significantly across different types of installations as shown in Table 3.4. For instance, drilling rigs had the highest proportion of personnel employed by the operating company relative to those employed by contractors/services companies; FPSO's had the lowest proportion of personnel working day/night shifts; personnel working on production platforms were the most likely to report overtime hours of 10 or more hours a week; and personnel aged 45+ years were most strongly represented on FPSO's. Thus, in making comparisons of psychosocial and health measures across different types of installations, it was necessary to take into account these differences in demographic and work-related factors.

Table 3.3
Details of data sets used in comparing different types of installations

	TYPE OF INSTALLATION		
	Production platforms	**Drilling rigs**	**FPSO's**
Number of operating companies	7	5	4
Number of installations	11	6	6
Range of normal POB levels	32 - 205	86 - 112	50-65
Year of data collection	1995-6	1995-6	2002
Total number of participants	1169	478	494
Overall response rate	86.7%	76.7%	84.2%
Analysis sample size*	1056	406	399
Average age of analysis sample (yrs)	39.0 ± 8.7	38.4 ± 9.3	42.9 ± 8.6

* *On each type of installation, the analysis sample size is less than the total number of participants as not all personnel who took part met the inclusion criteria (see Section 3.1).*

Also, data from the one production platform included in the FPSO study were not used when making comparisons across different types of installation; thus, the sample size (N = 470) in the FPSO group was reduced to 399 in these analyses.

Table 3.4
Demographic and work-related factors: comparisons across installation types

FACTOR	TYPE OF INSTALLATION					
	Production platforms		Drilling rigs		FPSO's	
	N	%	N	%	N	%
Employer						
Operating company	385	*36.5*	324	*79.8*	85	*21.3*
Contractor/services	670	*63.5*	82	*20.2*	314	*78.7*
Job type						
Maintenance/technical	371	*35.1*	120	*29.6*	117	*29.3*
Catering	74	*7.0*	38	*9.4*	28	*7.0*
Production	223	*21.1*	—	—	69	*17.3*
Management	115	*10.9*	49	*12.1*	62	*15.5*
Administration/specialist	63	*6.0*	38	*9.4*	32	*8.0*
Drilling	91	*8.6*	154	*37.9*	—	—
Deck/construction/marine	119	*11.3*	7	*1.7*	91	*22.8*
Shift pattern						
Day work	532	*50.7*	160	*39.5*	232	*58.3*
Day/night shiftwork	469	*44.7*	193	*47.7*	151	*37.9*
Other (e.g. nights only)	48	*4.6*	52	*12.8*	15	*3.8*
Hours/week >84 hrs.						
None	609	*58.2*	291	*73.5*	248	*62.6*
1 - 9 hours	114	*10.9*	33	*8.3*	99	*25.0*
10 - 16 hours	164	*15.7*	33	*8.3*	31	*7.8*
> 16 hours	160	*15.3*	39	*9.8*	18	*4.5*
Age distribution						
< 30 years	185	*17.5*	77	*19.0*	31	*7.8*
30 - 34.9 years	147	*13.9*	74	*18.2*	40	*10.0*
35 - 39.9 years	189	*17.9*	81	*20.0*	48	*12.0*
40 - 44.9 years	231	*21.9*	70	*17.2*	90	*22.6*
45 - 49.9 years	183	*17.3*	53	*13.1*	95	*23.8*
50+ years	121	*8.8*	51	*12.5*	95	*23.8*
Years offshore						
0 - 4.9 years	175	*16.8*	62	*15.4*	55	*13.8*
5 - 9.9 years	165	*23.5*	124	*30.8*	62	*15.5*
10 - 14.9 years	245	*30.6*	68	*16.9*	111	*27.8*
15 - 19.9 years	319	*23.7*	85	*21.1*	64	*16.0*
20 - 24.9 year	247	*5.3*	54	*13.4*	72	*18.0*
25+ years	57	*0.2*	10	*2.5*	35	*8.8*

Differences in the proportions of personnel in each category across installation type were significant for each of the factors shown in this table (chi-square tests).

3.6 DESCRIPTION OF SAMPLE

FPSO study

- The survey data analysed were obtained from 470 male personnel on seven offshore installations (six FPSO's and one production platform operated in conjunction with one of the FPSO's).
- The sample covered the operating company personnel (19%), contractors (73%) and services personnel (8%); 88% were core crew members. All occupational groups were represented.
- The age range was 19-64 years, with 67% in the 30-49 years age range. The majority of the sample (73%) reported more than 12 years of offshore work.
- In the sample as a whole, scores on personality measures indicated relatively high extraversion and low neuroticism, characteristics typically associated with adaptability, emotional resilience, and above-average mental health.

Comparisons across different types of installation

- Comparisons across different types of installation were based on data from a total sample of 1861 personnel. Data from production platforms (n=1056; response rate, 87%) and from drilling rigs (n=478; response rate, 77%) were collected in 1995-6; the FPSO data (n=399; response rate, 84%) were collected in 2002.
- Several demographic (e.g. age) and job-related factors (e.g. work hours, and shift work) differed significantly across different types of installation; these factors had to be taken into account in subsequent analyses.

4. PHYSICAL WORK ENVIRONMENT

4.1 PHYSICAL WORK ENVIRONMENT: FPSO STUDY

4.1.1 Measures of the physical work environment

Participants were asked to indicate to what extent their work exposed them to various physical environment stressors, such as noise, cold, air pollution, and heavy physical workload. Responses were scored on a five-point (0 - 4) scale, ranging from *'not at all*' to '*to a high extent*'. Factor analysis identified three factors in this item set, from which three scales were constructed.

The *'general environmental stressors'* scale included six items concerned with poor workplace design, noise, vibration, cold, poor ventilation, and exposure to chemical hazards. The *'specific environmental stressors'* scale had three items (heavy physical workload, working at heights, and working over the side). Two items defined a third scale assessing *exposure to VDU /CDT screens and comparable electrical equipment*. Mean item scores for each scale were calculated.

4.1.2 Analysis of physical environment measures: installations and job types

The extent to which *installations* and *job types* predicted scores on the physical environment measures was evaluated for each of the scales separately, with age and neuroticism as covariates (see Section 2.6 for details of the analysis model). The results are summarised in Table 4.1. Significant results were found both for installations and for job types, but neither age nor neuroticism was related to the physical environment scores. Mean scores on the general physical stressors scale and the specific stressors scale are plotted in Figure 4.1, separately for installations and for job types. Overall, the general measure of environment stressors showed higher mean item scores than the specific measure (reflecting the more widespread occupational exposure to general environmental stressors).

Installations. Differences across installations in levels of both *general physical environment stressors* and *specific stressors* were less marked than the differences across job types; however, one installation (Installation 2) was found to show significantly higher levels of general environment stressors as compared with all other installations in the study. Conversely, one installation (Installation 4) had lower levels of specific stressors than other installations in the study. Levels of exposure to VDU/CDT screens and comparable electrical equipment did not differ across installations. Overall differences between operating companies were found to be non-significant, indicating that particular installations were associated with adverse environmental characteristics, rather than this being a problem of particular companies.

Job types. The analyses showed significant differences across job types on each of the physical environment measures. For general physical stressors, the groups that worked in the production and deck areas (i.e. the maintenance, production, and marine/deck/construction groups) showed high scores while other groups (especially management and administration/specialist groups) had relatively low scores. Exposure to specific stressors applied primarily to the marine/deck/ construction group, who frequently worked outside, and to a lesser extent to maintenance personnel. Differences across job types were also significant for the third measure of the physical environment, use of VDU/CDT screens and electrical equipment. Two job groups (catering and marine/deck/construction) had low scores on this measure; the remaining groups all showed relatively high scores.

Table 4.1

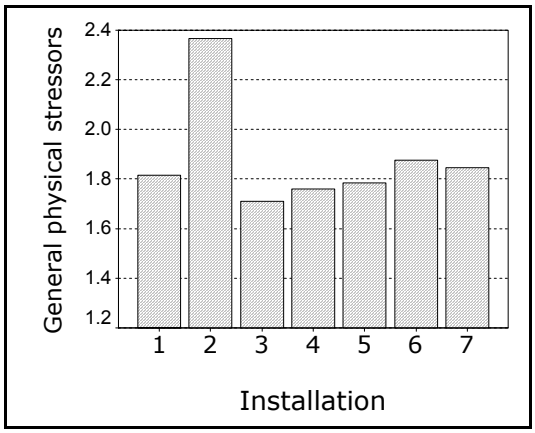
Analysis of physical environment measures in relation to installations and jobs

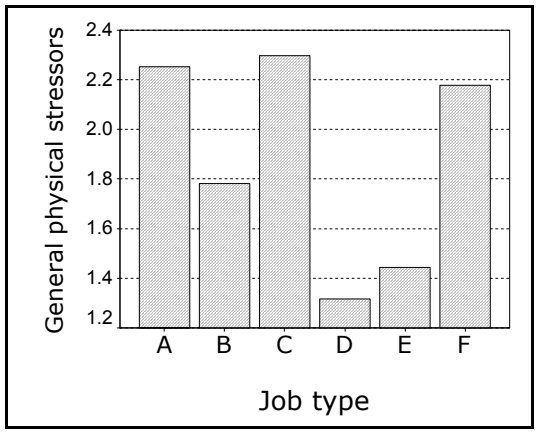
	Main factors		***Covariates***		***Overall***
Measure	*Installations df=6*	*Job types df=5*	*Age df=1*	*Neuroticism df=1*	*Additive model df=13,463*
General physical environment stressors	F = 5.16 p<.001	F = 23.53 p<.001	F = 1.04 *ns*	F = 3.83 p = .05 [+]	F = 11.58 p<.001 R^2 = .25
Specific environment stressors	F = 2.42 p<.05	F = 31.04 p<.001	F < 1 *ns*	F < 1 *ns*	F = 13.01 p<.001 R^2 = .27
Frequent use of VDU/CDT screens, and electrical equipment	F = 1.05 *ns*	F = 30.15 p<.001	F < 1 *ns*	F < 1 *ns*	F = 12.64 p<.001 R^2 = .27
Multivariate analysis	F = 3.33 p<.001	F = 24.23 p<.001	F < 1 *ns*	F = 1.51 *ns*	----

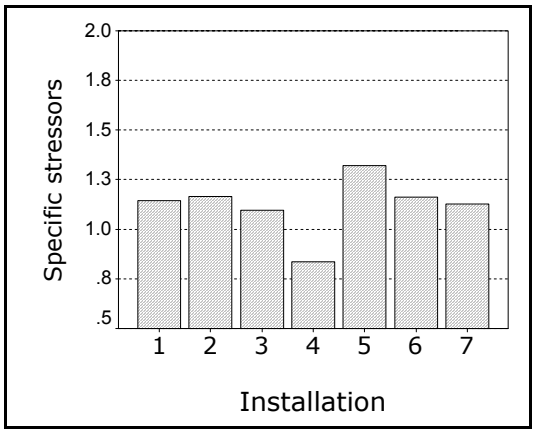
Note. *The sign in brackets indicates the direction of the significant covariate effect.*

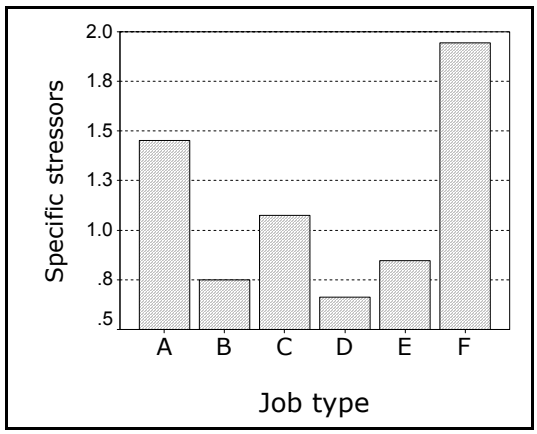
4.1.3 Further analyses of physical environment measures

The factors considered above, job type and installation, were major predictors of physical environment ratings but other factors were also potentially relevant. Differences between day workers and day/night shift workers were non-significant, but there was a significant difference (over and above the factors considered in the initial analysis) between operating company personnel and contractor/services personnel. As compared with operator personnel, those employed by contractor/service companies reported significantly greater exposure to general environment stressors and to specific stressors.









JOB TYPES

A = Maintenance, technical
B = Catering personnel
C = Production
D = Management, supervisory
E = Administration, and specialist personnel
F = Marine, deck, construction

Figure 4.1
General and specific physical environmental stressors in relation to installations and job types

4.2 PHYSICAL WORK ENVIRONMENT: COMPARISON OF PLATFORMS, DRILLING RIGS, AND FPSO's

4.2.1 Measures and analysis model

In comparing the physical work environment across different types of installations (production platforms, drilling rigs, and FPSO's), only two measures were available for all participants, *general physical environment stressors* and *specific stressors*. These measures were the same as those described in Section 4.1.1. The predictor variables in the analysis were type of installation and job type, age and neuroticism being treated as control variables. In presenting the results, the focus is on the significance of the effects of installation type over and above those of the other variables. In addition, FPSO installations are separately contrasted with production platforms and drilling rigs.

4.2.2 Results

The results are summarised in Table 4.2. The overall comparisons across type of installation were significant for each measure. Drilling rigs had the highest scores on general physical environment stressors; direct comparisons showed that personnel working on FSPO installations reported significantly less exposure to physical environment stressors than those working on drilling rigs, although the difference between FPSO installations and platforms was not significant. On the measure of specific stressors, FPSO's had significantly lower scores than either platforms or drilling rigs. There was a tendency for scores on the general physical environment measure to be higher than on the specific stressors measure, reflecting the fact that most personnel had little exposure to the specific stressors (e.g. working over the side). These results are illustrated in Figure 4.2.

Table 4.2
Physical environment stressors in relation to installation type

Variable	Significance of installation type	Mean adjusted scores			Significance of contrasts	
		1 Platform	2 Rig	3 FPSO	1 vs 3	2 vs. 3
General physical environment stressors	F= 2.99, df 2,1834, p=.05	1.98	2.08	1.88	ns	p<.001
Specific physical stressors	F= 7.41, df = 2,1834, p<.001	1.43	1.52	1.11	p<.02	p<.01

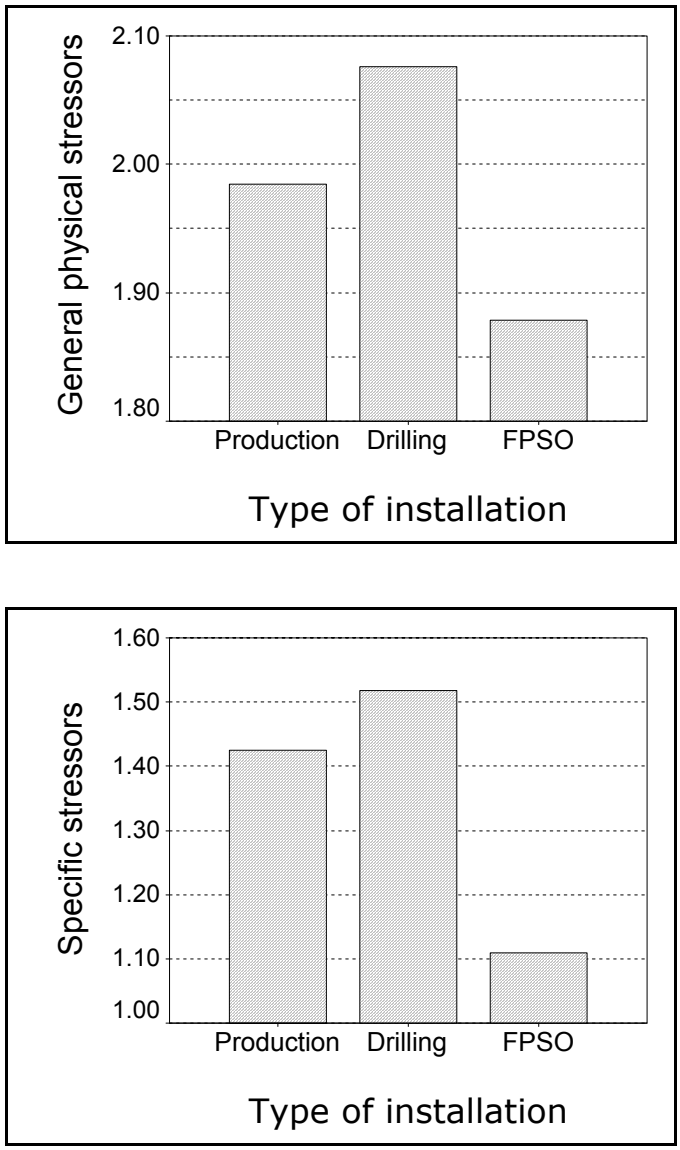


Figure 4.2
General and specific physical environmental stressors in relation to type of installation.

4.3 PHYSICAL WORK ENVIRONMENT

FPSO study

- There were significant differences between installations in exposure to general physical environment stressors (e.g. cold, noise, poor ventilation). High exposure ratings were associated with particular installations, rather than being characteristic of particular operating companies.
- There were large differences in ratings of physical environment stressors among different job groups. Levels of exposure were highest among production, maintenance and marine/deck/construction groups and lowest in the management group.
- In general, the scores did not suggest an unduly adverse physical environment, although there were significant differences between sub-groups in the sample.
- Age was not related to ratings of exposure to physical environment stressors.
- As compared with operating company employees, personnel employed by contractor/service companies reported greater exposure to physical environment stressors.

Comparisons across different types of installation

- Personnel working on FPSO's reported less exposure to physical environment stressors than those on other types of installation. Personnel on drilling rigs had the highest exposure scores.

5. PSYCHOSOCIAL WORK ENVIRONMENT

5.1 PSYCHOSOCIAL WORK ENVIRONMENT: FPSO STUDY

5.1.1 Measures of psychosocial work characteristics

The term psychosocial work environment refers to perceptions of the psychological and social characteristics of work tasks, and the more general organizational environment in which work is carried out. Four measures of job characteristics and two measures of social support in the work environment were used. The job characteristics scale consisted of 21 statements describing particular aspects of jobs. Participants were asked to indicate to what extent they agreed with the statements as applied to their jobs; each item had a five-point response format, ranging from 0 (*do not agree at all*) to 4 (*agree strongly*). These items had previously been identified as assessing four separate job dimensions.

Social support from two different work sources, supervisors and co-workers, was assessed using a measure derived from House (1981). Five items related to supervisor support, and three items to co-worker support. A four-point response format (0-3) ranging from *'not at all'* to '*very much*' was used; mean item scores were analysed. Details of all the measures are shown in Table 5.1.

5.1.2 Multivariate analysis: installations and job types

A multivariate analysis of variance (MANOVA) was carried out to determine whether installation, job type, age, and neuroticism were significant predictors of the overall set of work environment variables. The results showed that installations and job types, together with neuroticism, were highly significant predictors, but age was non-significant overall. The interaction between installations and job types was also non-significant (indicating that installations and job types had independent effects on the work environment measures). These results justified the use of an additive effects model in the separate analyses of the six measures, as reported in the following sections.

The results of the overall multivariate analysis, together with the separate analyses of each measure, are shown in Table 5.2. The mean scores for each installation and for each job type (adjusted for other variables in the model) are shown diagrammatically in Figure 5.1.

Installations. Differences between installations were highly significant for each of the six work environment measures. Installation 5, with a moderate level of workload and relatively high levels of the other work dimensions assessed, was generally perceived most favourably. Conversely, Installation 2 with high perceived workload and relatively low levels of the other measures appeared to be the least favourable; however, co-worker support was a marked exception to this pattern in that personnel on Installation 2 reported relatively high scores on this dimension. In contrast, Installation 3 had markedly low scores on both co-worker support and supervisor support; moreover, job clarity was also low on this installation.

Job types. As shown in Figure 5.1, differences in the perceived work environment measures among the six different types of jobs were generally of comparable magnitude (job clarity, support from supervisor and support from co-workers) or greater than (workload, task variety/skill, and autonomy) those between installations. Profiles across the six measures varied

considerably for different jobs. For instance, management/supervisory jobs were rated relatively highly on all the job characteristics assessed, whereas maintenance jobs tended to have low ratings on all measures with the exception of a high rating for co-worker support. Job clarity was markedly low in the administration/specialist personnel group, possibly reflecting the more diverse range of activities carried out by this group, while the catering group had low ratings on task variety/skill and on both measures of support.

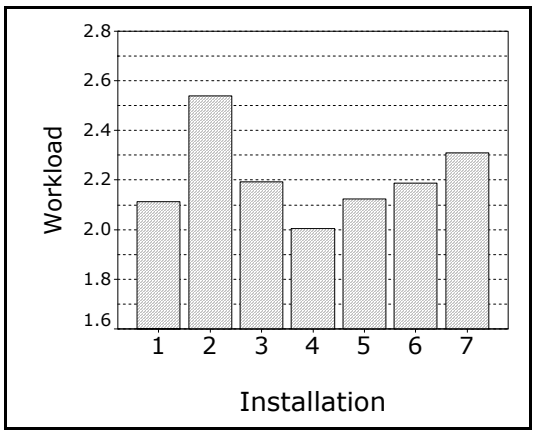
Table 5.1
Psychosocial work environment measures

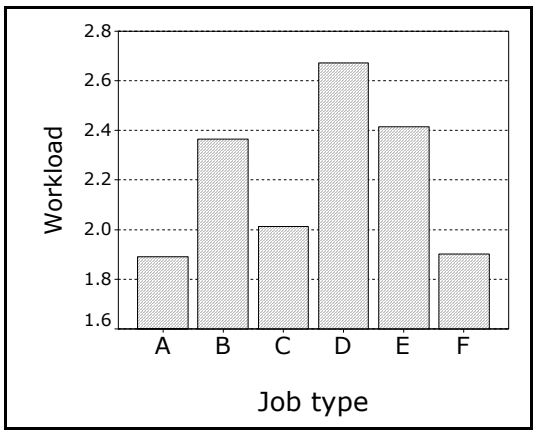
Scale	Content area	Response scale	Mean item score ± s.d.
Workload 5 items	*Time pressures, quantity of work, difficult to get work done in time, have to work very hard*	0 - 4	2.10 ± 0.82
Task variety / skill utilisation 6 items	*Varied activities, opportunities to learn new skills, interesting work. Repetitive tasks (reverse-scored)*	0 - 4	2.24 ± 0.71
Autonomy 4 items	*Can decide own workpace, work in own way, work independently, take short breaks*	0 - 4	2.87 ± 0.72
Clarity 5 items	*Clear instructions, details of tasks planned by others, know what to expect from others*	0 - 4	2.47 ± 0.61
Support from supervisor 5 items	*Help with work problems; relied on when things get difficult at work; willing to listen; concerned about welfare of team; praise good work.*	0 - 3	1.69 ± 0.71
Support from co-workers 3 items	*Help with work problems, can be relied on when things get difficult at work, willing to listen.*	0 - 3	1.92 ± 0.65

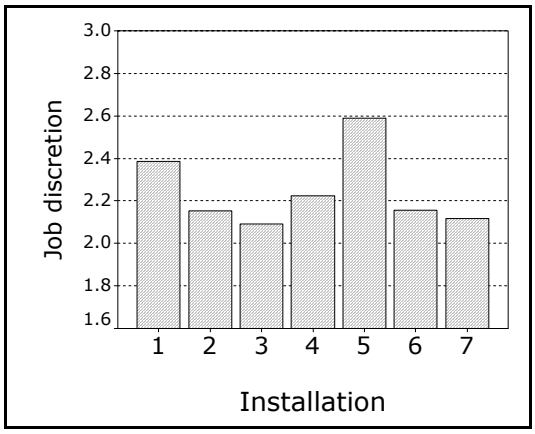
Table 5.2
Analysis of psychosocial variables in relation to installations and job types

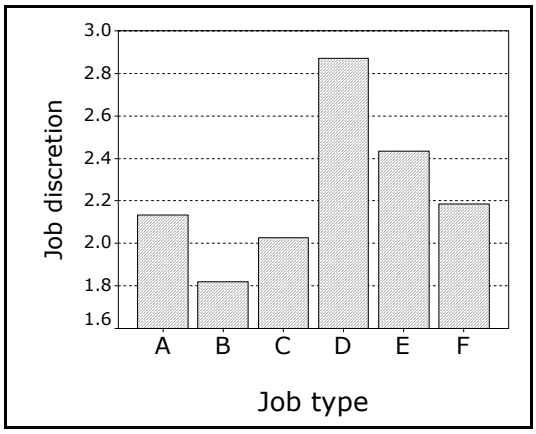
	Main factors		***Covariates***		***Overall***
Measure	*Installations df=6*	*Job types df=5*	*Age df=1*	*Neuroticism df=1*	*Additive model df=13,463*
Workload	F=3.12 p<.01	F=13.30 p<.001	F=2.91 [p<.10]	F=13.30 p<.001 [+]	F=8.43 p<.001 R^2 = .20
Task variety and skill utilisation	F=5.41 p<.001	F=19.41 p<.001	F < 1 *ns*	F=12.59 p<.001 [−]	F=11.88 p<.001 R^2 = .26
Autonomy	F=3.16 p<.01	F=8.40 p<.001	F < 1 *ns*	F < 1 *ns*	F=4.32 p<.001 R^2 = .11
Job clarity	F=3.57 p<.01	F=2.26 p<.05	F < 1 *ns*	F=18.32 p<.001 [−]	F=4.01 p<.001 R^2 = .08
Support from supervisor	F=3.11 p<.01	F=2.91 p<.05	F=1.12 *ns*	F=17.60 p<.001 [−]	F=4.63 p<.001 R^2 = .12
Support from co-workers	F=1.97 [p<.10]	F=1.77 ns	F=3.59 [p<.10]	F=11.73 p<.001 [−]	F=3.31 p<.001 R^2 = .09
Multivariate analysis	F=2.53 p<.001	F=7.10 p<.001	F=1.75 *ns*	F=6.49 p<.001	

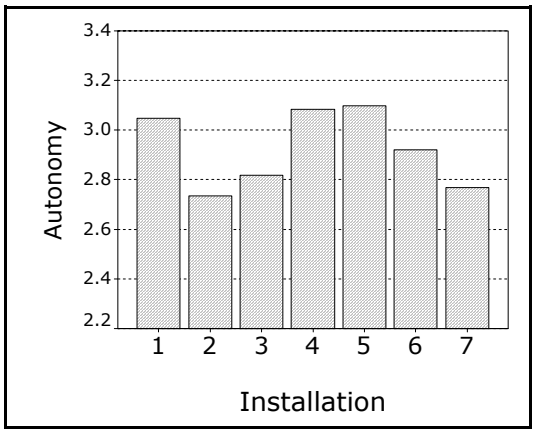
Note. *The signs in brackets indicate the direction of the covariate effects*

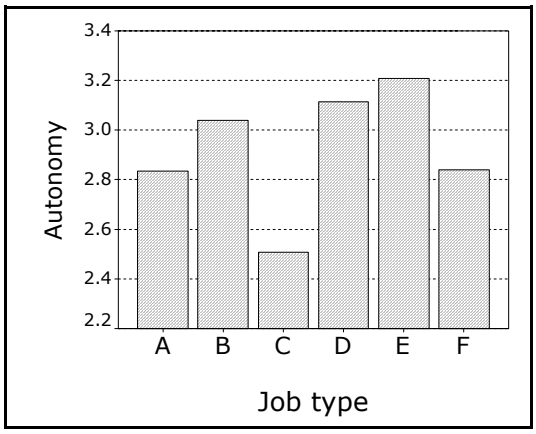








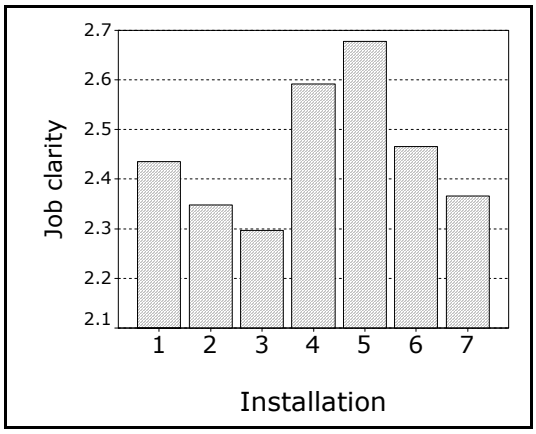


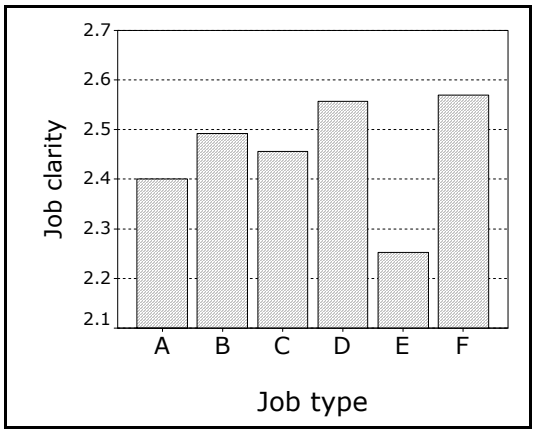


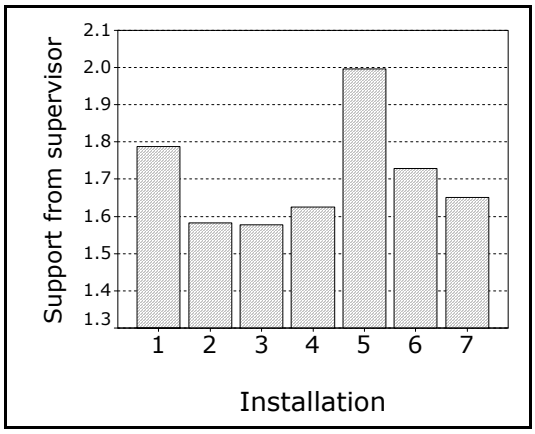
JOB TYPES

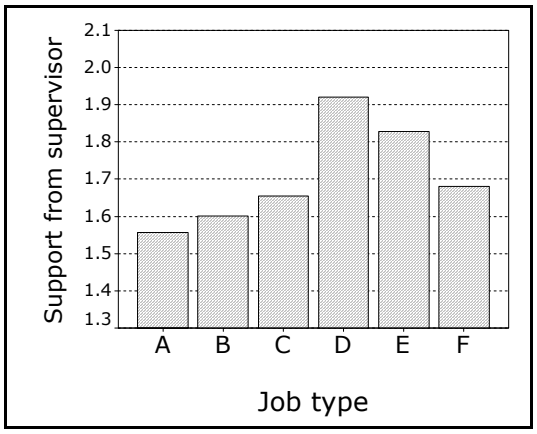
A = Maintenance, technical
B = Catering personnel
C = Production
D = Management, supervisory
E = Administration, and specialist personnel
F = Marine, deck, construction

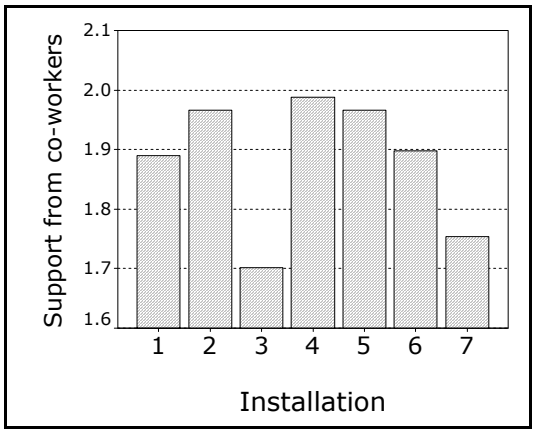
Figure 5.1
Job characteristics in relation to installations and job types











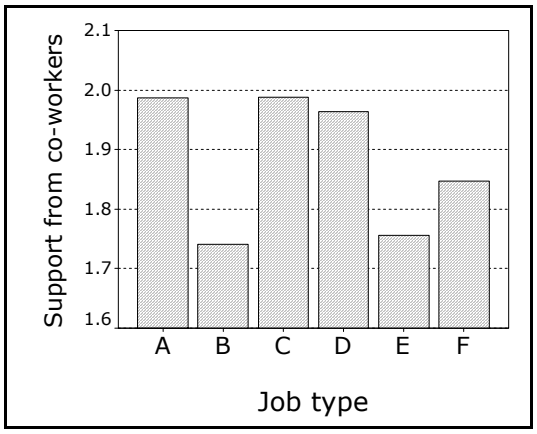


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Figure 5.1 (continued)
Job characteristics in relation to installations and job types

Combination of workload and job skill/variety. Current theories of work-related stress identify two dimensions, workload and job discretion (one component of which is assessed by the present task variety/skill scale) as being especially important in relation to health; these dimensions jointly predict health and job satisfaction outcomes, high workload and time pressures coupled with low variety/skill being a particularly unfavourable combination. It was of interest therefore to examine installations and job types in terms of the combination of these two work characteristics. This information is shown diagrammatically in Figure 5.2. The shaded areas identify two installations (Installations 2 and 7) for which workload is perceived to be high relative to variety/skill. Conversely, Installations 1, 4 and 5 represent the more favourable situation in which variety/skill component is perceived to be high relative to workload.

In relation to job types, reported workload levels and perceived skill/variety were high for managers and, to a lesser extent, for the administrative group. In contrast, catering personnel rated their workload as high but this group was markedly low in task variety/skill. Thus, in terms of the balance between these two components, the management group appeared to have the most favourable work conditions, while catering personnel were in a particularly unfavourable situation.

5.1.3 Covariates: age and personality

Age had very little effect on the measures of job characteristics, but the personality dimension of neuroticism (which assesses psychological vulnerability) was a strong predictor of all the measures except autonomy. In each case, high neuroticism was associated with less favourable perceptions of the work environment.

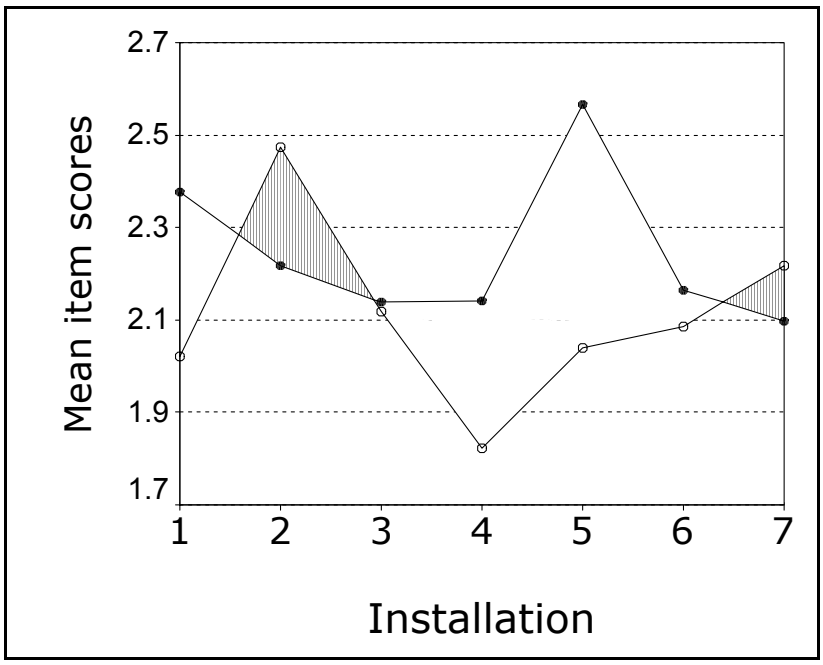
5.1.4 Day work vs day/night shifts

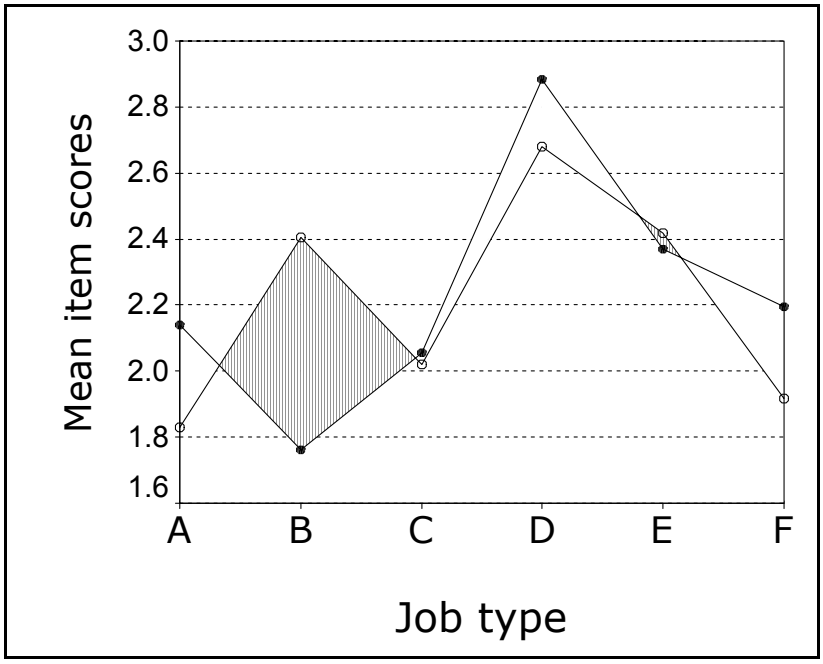
Over and above the effects of installations and job types reported in the previous sections, some differences in perceived job characteristics were found between personnel who worked day shifts and those who did day/night rotating shifts. Day/night shift workers reported significantly lower autonomy, marginally lower workload, and higher levels of co-worker support, relative to day workers.

5.1.5 Work/leave cycles

Almost all participants in the present study worked one of three work/leave cycles: *2-on, 2-off* (n=109); *2-on, 3-off* (n=141); or *3-on, 3-off* (n=172). A small number (n=46) reported working non-standard patterns. Evaluation of whether these different cycles were associated with different work perceptions had to take into account that different cycles tended to be associated with different installations/companies (e.g. almost all personnel on three of the installations in the study worked 3-3 schedules whereas, on the other four installations, no one worked this pattern).

Analyses indicated that (over and above the effects of installation, job type, age and neuroticism) several aspects of the perceived work environment were less favourable among those working 3-3 patterns as compared with those working other work/leave schedules. Thus, as shown in Figure 5.3, perceived workload was significantly higher, autonomy significantly lower, and social support from supervisors and co-workers also significantly lower, among those working 3-3 patterns relative to those working the other patterns.





• ***Task variety / skill utilisation*** o ***Workload***

JOB TYPES

A = Maintenance, technical	D = Management, supervisory
B = Catering personnel	E = Administration, and specialist personnel
C = Production	F = Marine, deck, construction

Figure 5.2
Difference plots for measures of workload and task variety/skill in relation to installations and job types

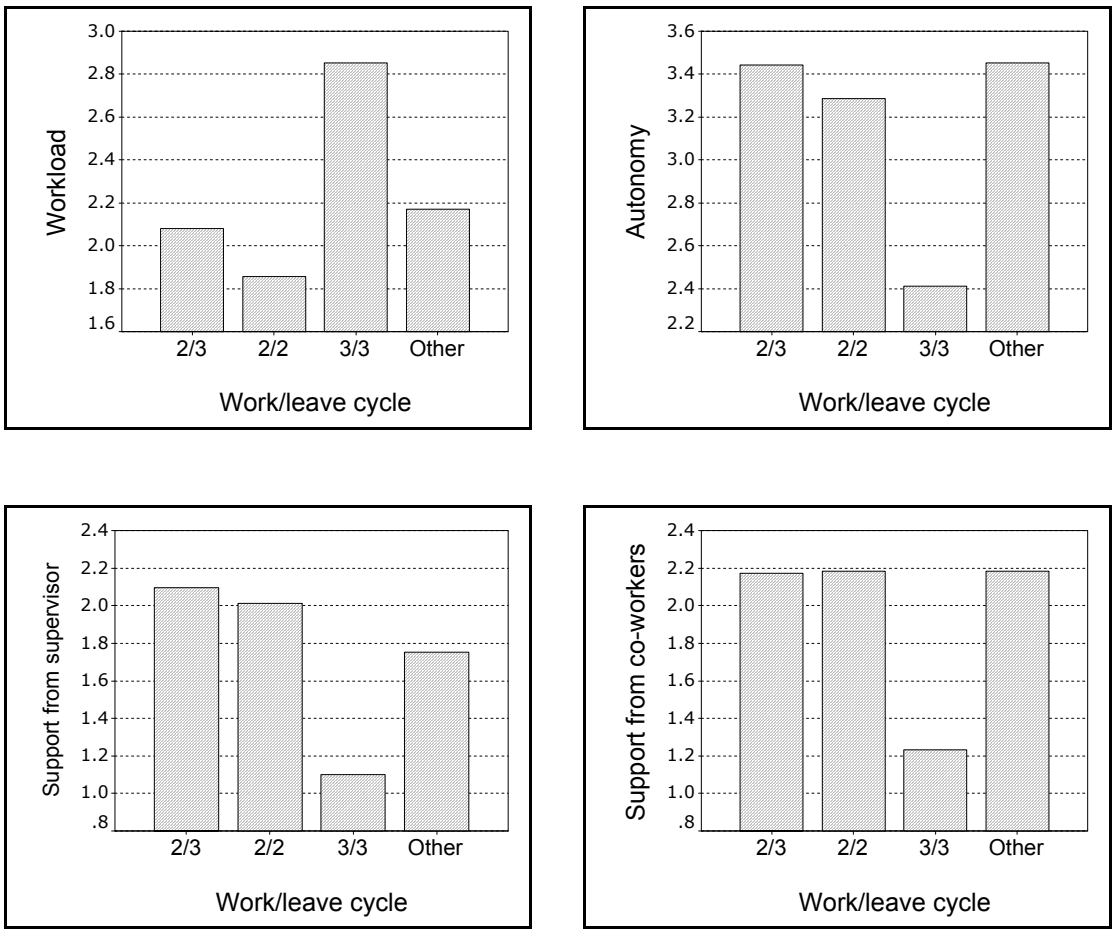


Figure 5.3
Job characteristics in relation to work/leave cycles, taking into account installations, job types, age and neuroticism

5.2 REPORTED NUMBER OF WORK HOURS PER WEEK

In addition to the scale measuring perceived workload, a separate item in the survey questionnaire asked participants to indicate how many hours they normally worked each week when offshore; a significant proportion (38.3% overall) reported that they worked overtime hours in addition to the normal 84-hour week.This information was not included in the analysis of perceived workload, as long work hours are more appropriately regarded as an outcome of high workload rather than as an antecedent factor. However, the correlation between perceived workload and reported work hours was positive and highly significant ($r=.34$, $p<.001$), consistent with the view that higher perceived workload is associated with longer work hours.

Which groups report overtime hours? Logistic regression analysis was used to examine the extent to which installation, job type, employer, and daywork vs. day/night shiftwork jointly predicted whether or not overtime hours were reported. Each of these factors was found to make an independent and highly significant contribution to the regression model ($p<.001$ in each case), except employer which was only marginally significant ($p<.10$). Personnel on Installation 2 were most likely (57%), and those on Installation 4 least likely (15%), to report overtime hours. A high proportion (86%) of those in management roles reported working hours in excess of 84 hrs per offshore week, and the proportion among administrative personnel was also high (67%). As

expected, the proportion of day/night shift workers reporting overtime was relatively low (16%); in normal circumstances, back-to-back crews take over at the end of a 12-hour shift, an arrangement that does not apply to those who only work day shifts among whom only 45% reported a standard 84-hour week.

How many overtime hours? The analysis of work hours was extended to examine the actual number of overtime hours worked by different groups. Table 5.3 shows the proportions of personnel reporting a standard 84-hour week, or one of three levels of longer work hours (85-93 hours, 94-100 hours, and >100 hours), the data being shown separately for installations, job types, and in relation to shift pattern. Chi-square tests showed that the proportions in each overtime category were significantly different across each of these factors ($p<.001$ in each case). Overall, 14% of the entire sample reported working in excess of 94 hours per week (i.e. more than 10 hours overtime).

Table 5.3
Reported working hours per offshore week

		Percentage of sample reporting work hours per week in each of four ranges			
	N	**84**	**85 - 93**	**94 - 100**	**>100**
Installation		%	%	%	%
1	60	68.3	23.8	7.9	0
2	55	43.3	36.7	15.0	5.0
3	63	52.3	35.4	7.7	4.6
4	75	84.2	6.6	6.6	2.6
5	71	58.3	18.1	9.7	13.9
6	74	63.6	20.8	6.5	9.1
7	72	55.3	34.2	3.9	6.6
Job type					
Maintenance/technical	136	72.4	19.4	3.0	5.2
Catering	33	84.8	9.1	6.1	0
Production	85	82.4	15.3	1.2	1.2
Management	71	14.3	42.9	25.7	17.1
Administration/specialist	36	33.3	55.6	11.1	0
Marine/deck/construction	109	65.4	18.7	8.4	7.5
Shift pattern					
Day shifts	270	44.9	32.1	13.6	9.4
Day/night shifts	182	84.1	13.2	1.1	1.6
Other	17	88.2	11.8	0	0
Missing	1				
OVERALL	*470*	***61.7***	***24.1***	***8.2***	***6.0***

Note. *The percentages shown in each category are observed values; they are not adjusted for inter-relationships between the factors.*

5.3 PSYCHOSOCIAL WORK ENVIRONMENT: COMPARISON OF PLATFORMS, DRILLING RIGS, AND FPSO's

5.3.1 Measures and analysis

The psychosocial work environment measures were compared across production platforms, drilling rigs, and FPSO's, using a model similar to that described in Section 4.2.1. The six measures analysed were the same as those described in Section 5.1.1. In presenting the results, the focus is on the significance of the effects of installation type over and above those of the other variables in the model (job type, neuroticism, and age).

5.3.2 Comparisons across type of installation

The results are summarised in Table 5.4 which presents the data for the four measures that showed significant or marginally significant differences across installation type. It can be seen that in each case the significant contrast was between FPSO's and production platforms; FPSO's did not differ significantly from drilling rigs on any of the measures. The mean scores (represented diagrammatically in Figure 5.4) showed that personnel working on platforms reported higher workload, marginally greater task variety/skill, greater job clarity, and higher levels of support from co-workers.

Table 5.4
Psychosocial work environment in relation to installation type

Variable	Significance of installation type	Mean adjusted scores			Significance of contrasts	
		1 Platform	2 Rig	3 FPSO	1 vs 3	2 vs. 3
Workload *0-4 scale*	F= 9.63, df = 2,1822, p<.001	2.40	2.21	2.17	p<.001	ns
Task variety / skill *0-4 scale*	F= 2.68, df = 2,1822, p<.07	2.25	2.17	2.16	[p<.07]	ns
Job clarity *0-4 scale*	F= 10.07, df = 2,1822, p<.001	2.62	2.57	2.42	p<.001	ns
Co-worker support *0-3 scale*	F=3.94, df = 2,1822, p<.02	1.95	1.87	1.83	p<.01	ns

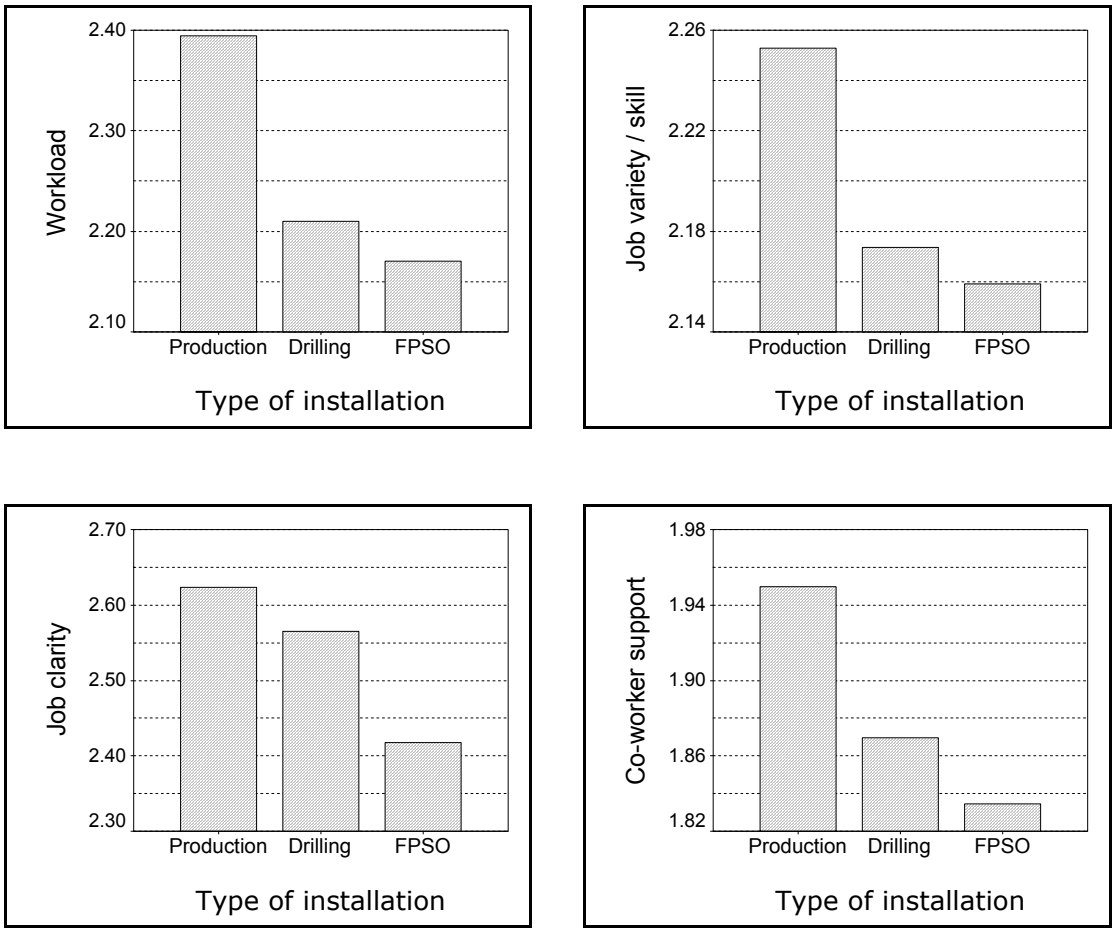


Figure 5.4
Psychosocial work environment measures in relation to type of installation

5.3.3 Work hours

The working hours of personnel were compared across the different types of installations. Reported work hours per offshore week were divided into three categories, 84 hours (i.e. a standard work week), 85-93 hours, and 94+ hours. In examining work hours, day workers (N=1021) and day/night shift-workers (N=813) were considered separately as day/night shift personnel normally hand over to their 'back-to-back' co-worker at the end of each shift, and consequently overtime hours are relatively infrequent. Thus, 77.6% of day/night shift workers reported a standard 84-hour working week, as compared with only 46.7% of day workers. Figure 5.5 shows the proportions of personnel on each type of installation reporting working hours in each of the different categories, separately for day workers and day/night shift workers.

Further analyses were carried out on the data for the day-work group. In this group, the proportions of personnel reporting each level of working hours differed across different types of installations ($\chi = 96.2$, df=6, $p<.001$). This effect remained significant ($p<.001$) over and above the effects of job type ($p<.001$) and age ($p<.01$). In addition, older personnel reported longer work hours than their younger colleagues, possibly reflecting the increased workload and responsibility associated with greater seniority.

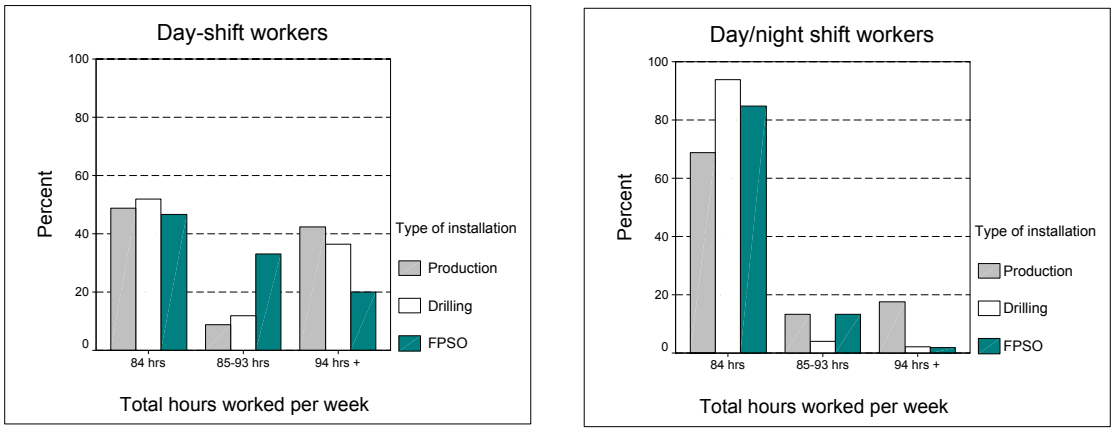


Figure 5.5
Total hours worked per offshore week for day-shift and day/night shift workers on different types of installation

Figure 5.6 shows the percentages of day-work personnel on each type of installation reporting each level of work hours per week. In this analysis, to identify long work hours more precisely, the '94 hours per week' category was split into '94-100 hours' and '100+ hours'. On production platforms and drilling rigs, more than 20% of day-work personnel reported more than 100 hours per week. However, on FPSO's, this level of extended overtime work was less frequent (7.5%), although the proportion reporting 85-93 hours per week was greater than on other types of installations.

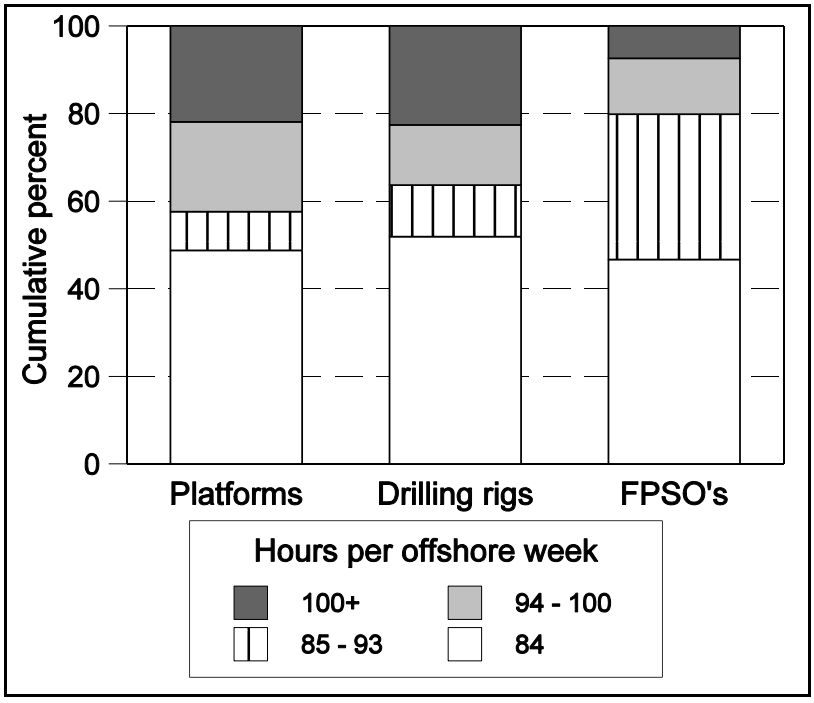


Figure 5.6
Working hours per offshore week reported by day-workers on platforms, drilling rigs and FPSO installations

5.4 PSYCHOSOCIAL WORK ENVIRONMENT

FPSO study

- Six dimensions of the psychosocial work environment were assessed: workload; task variety/skill; autonomy; clarity; support from supervisor; and support from co-workers.

- Each of these measures differed significantly across installations. No single installation was most favourable on all measures, but installations with a generally more favourable, or a generally less favourable, pattern of results could be identified.

- Differences in work environment measures across job groups tended to be greater than those across installations. Management jobs were rated relatively highly on all characteristics, whereas maintenance jobs tended to have less favourable ratings. Catering staff reported high workload combined with low levels of task skill/variety, a particularly unfavourable situation.

- Some differences were found in the perceived environment of day workers and day/night shift workers, but work/leave cycles gave rise to more marked effects. In particular, the 3-3 work/leave pattern was associated with higher perceived workload, lower autonomy and lower support than either the 2-2 or 2-3 work/leave patterns.

- Day-workers were more likely to report overtime hours than day/night shiftworkers; only 45% of day-workers reported a standard 84-hour week as compared with 84% of day/night shift workers. Reported work hours differed across installations and across job types

Comparisons of platforms, drilling rigs, and FPSO installations

- FPSO installations were more similar to drilling rigs than to platforms in work environment measures. Workload on platforms was higher than that on rigs or FPSO's, but job variety/skill and co-worker support were also higher. On FPSO installations, ratings of job clarity were lower than those on both rigs and platforms.

- Day-workers on FPSO installations were less likely to report working hours in excess of 94 hours per offshore week than day-workers on platforms or drilling rigs. The great majority of day/night shift workers reported working a standard 84-hour week, irrespective of type of installation.

6. PSYCHOLOGICAL WELL-BEING

6.1 WORK SATISFACTION: FPSO STUDY

6.1.1 Measures of work satisfaction

Three aspects of overall satisfaction with the work situation were assessed. The '*job satisfaction'* scale (7 items) focused on satisfaction with the job itself and the content of work tasks (including responsibility, interest, variety, use of abilities, and recognition of good work). The '*job security'* scale (9 items) assessed satisfaction with broader aspects of employment, including job security, manning levels, opportunities for promotion, and future career prospects. The third measure of satisfaction related specifically to *'satisfaction with safety and emergency response measures'*; this scale had 18 items concerned with aspects of safety and first aid training, reliability of alarm systems, communication of safety information, and evacuation devices.

Items on each of these three measures had a five-point response scale, ranging from -2 ('*very dissatisfied*') to +2 ('*very satisfied*'), with zero as the neutral point. For analyses purposes, responses were recoded to a 1-5 scale, and mean item scores were calculated for each measure. The overall mean item score for the job satisfaction scale was 3.51 ± 0.76, as compared with 3.03 ± 0.71 for the scale assessing job security. The mean score on the scale assessing satisfaction with safety procedures was 3.93 ± 0.63. The difference in the overall level of these three scores was highly significant ($F=116.9$, $df=2,900$, $p<.001$); average ratings of items relating to satisfaction with safety were more favourable than those of job satisfaction and job security, the latter being low relative to both the other measures.

6.1.2 Work satisfaction in relation to installations and job types

The results of the initial multivariate analysis of the three work satisfaction scores (using installations and job types as factors, and age and neuroticism as covariates) are shown in Table 6.1. In this analysis, the effect of each factor and covariate is taken into account simultaneously. Both the factors and the covariates were highly significant predictors of the work satisfaction measures, but there was no significant interaction between installation and job type (i.e. the pattern of scores across installations was the same for all job types, and *vice versa*). For each of the three measures, the adjusted scores for each installation and job type are shown in Figure 6.1.

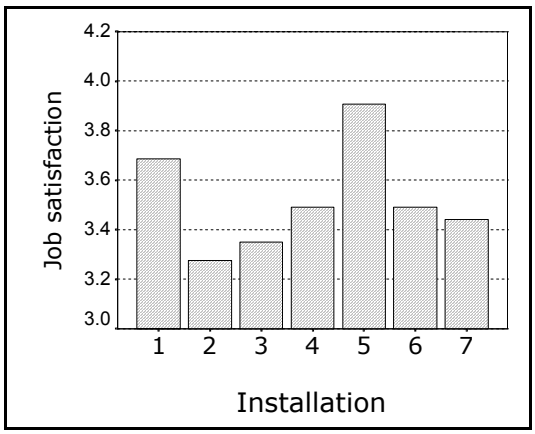
Installations. There were significant differences among installations on each of the three measures of work satisfaction. Reflecting a general satisfaction dimension underlying the scales, the pattern of scores across installations was similar (although not identical) for the separate measures. Thus, Installation 1 and, in particular, Installation 5 tended to record the highest scores on each measure, while Installation 2 was markedly low on all three measures, and Installation 7 stood out as having the lowest score on the 'satisfaction with safety' measure.

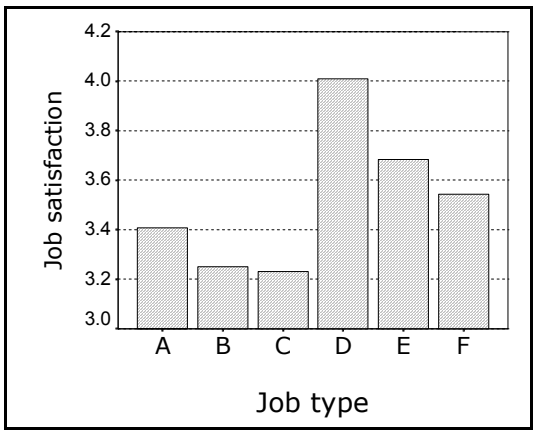
Job types. Comparisons across job types showed that the management/supervisory group recorded the highest scores on the job satisfaction and job security measures while production personnel had relatively low scores on both these measures. Catering personnel had low levels of job satisfaction and only moderate job security; however, reflecting the indoor nature of their work, this group rated satisfaction with safety higher than any other job group, although the ratings of management personnel were only marginally lower.

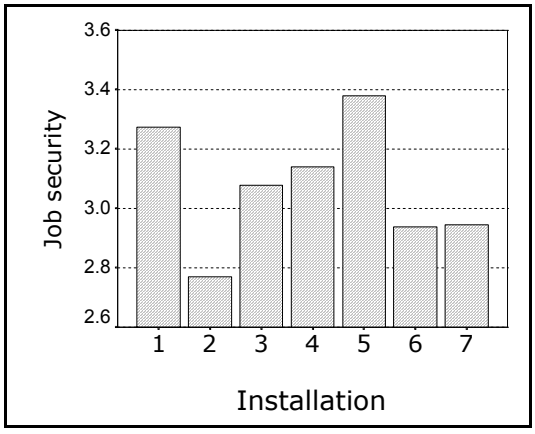
Table 6.1
Analysis of work satisfaction measures in relation to installations and job types

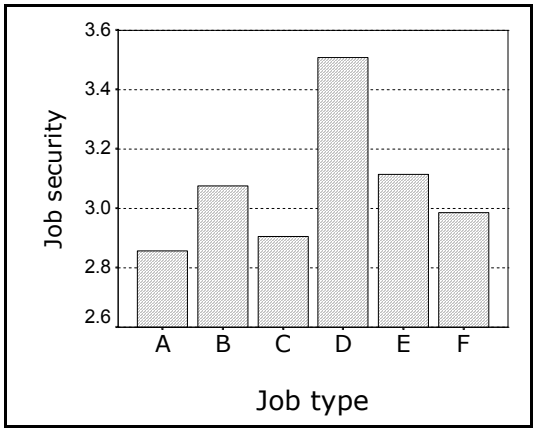
Measure	*Main factors*		*Covariates*		*Overall*
	Installations *df=6*	Job types *df=5*	Age *df=1*	Neuroticism *df=1*	Additive model *df=13,463*
Job satisfaction	F=6.24 p<.001	F=11.89 p<.001	F=1.65 *ns*	F=19.48 p<.001 [−]	F=10.02 p<.001 R^2 = .22
Job security	F=6.91 p<.001	F=10.55 p<.001	F=9.64 *p<.01* [−]	F=28.33 p<.001 [−]	F=9.883 p<.001 R^2 = .22
Satisfaction with safety	F=9.78 p<.001	F=10.07 p<.001	F=1.79 *ns*	F=9.18 *p<.01* [−]	F=9.02 p<.001 R^2 = .21
Multivariate model	F = 5.01 p<.001	F=7.61 p<.001	F=10.86 p<.001	F=10.00 p<.001	---

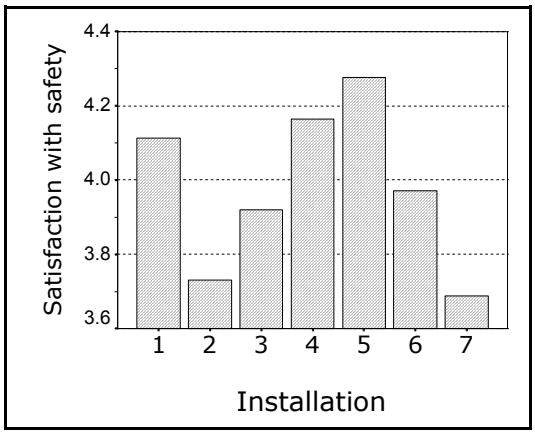
Note. *The signs in brackets indicate the direction of the significant covariate effects.*











JOB TYPES

A = Maintenance, technical
B = Catering personnel
C = Production
D = Management, supervisory
E = Administration, and specialist personnel
F = Marine, deck, construction

Figure 6.1
Job satisfaction, job security, and satisfaction with safety in relation to installations and job types

6.1.3 Covariates: age and personality

Consistent with the generalised tendency of individuals high in the personality dimension of neuroticism to view both self and the environment unfavourably, high neuroticism was a significant and negative predictor of each of the three work satisfaction measures. In contrast, age (considered as a linear effect) did not predict either job satisfaction or satisfaction with safety, but was significantly negatively related to the measure of satisfaction with job security and career prospects. However, further analysis of age effects for the job security measure showed a curvilinear trend whereby satisfaction with job security was highest at the youngest ages but decreased markedly up to the age of about 42 years, before showing a slight upturn among those aged 50+ years. This relationship is shown in Figure 6.2.

Figure 6.2
Relationship between age and satisfaction with job security

6.1.4 Further analyses of work satisfaction measures

The measures of work satisfaction were further examined in relation to daywork vs day/night shiftwork, employer (operator company vs contractor/services) and work/leave cycle. The effects of these factors on the satisfaction measures were evaluated over and above the factors included in the initial analysis (Table 6.1). Employer was a significant factor overall; those employed by operating companies reported higher levels of job satisfaction ($p<.01$) and, to a lesser extent, higher scores on satisfaction with job security ($p<.05$) and with safety ($p<.10$), as compared with those employed by contractor/service companies. However, neither daywork vs. day/night shiftwork nor work/leave cycle was significant in relation to the work satisfaction measures.

6.2 WORK SATISFACTION: COMPARISON OF PLATFORMS, DRILLING RIGS AND FPSO's

6.2.1 Measures and analysis

The three measures of work satisfaction (job satisfaction, satisfaction with job security, and satisfaction with safety measures and procedures) were compared across production platforms, drilling rigs, and FPSO's. The measures analysed were the same as those described in Section 6.1.1. The main focus of the analysis was on the significance of the effects of installation type over and above those of the other variables in the model (job type, neuroticism, and age).

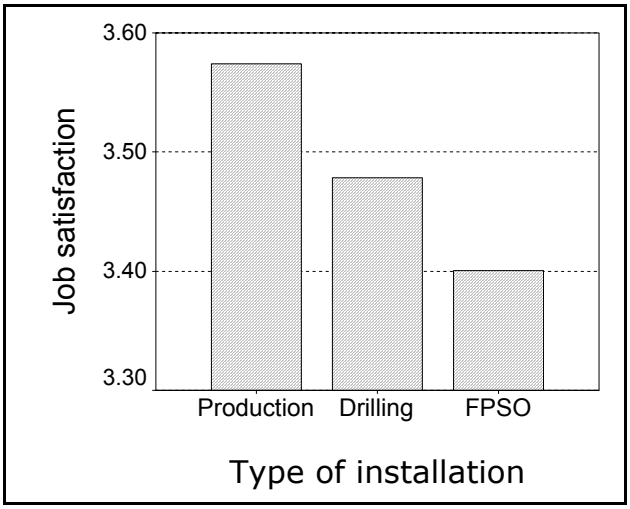
6.2.2 Comparisons across types of installations

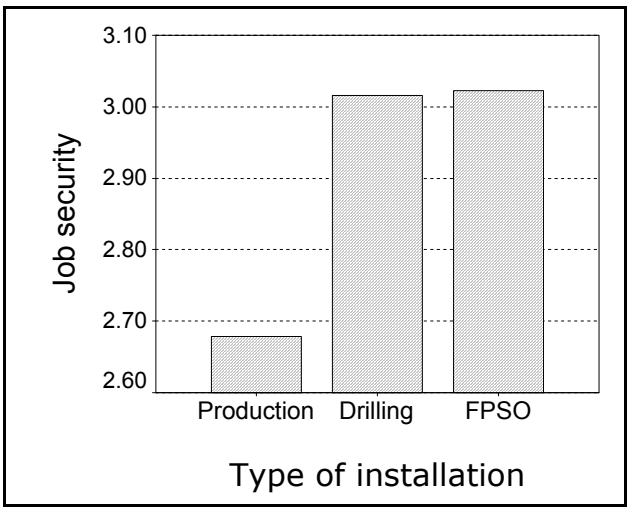
The three types of installations differed significantly in each of the work satisfaction measures. Detailed results of the analysis are shown in Table 6.2. FPSO's had significantly lower scores on job satisfaction than production platforms, but did not differ significantly from drilling rigs on this measure; in contrast, on the measure of satisfaction with job security, both drilling rigs and FPSO's had higher scores than production platforms. For the measure of satisfaction with safety, scores on FPSO's were significantly lower than those on either production platforms or drilling rigs. Thus, as shown diagrammatically in Figure 6.3, the pattern of results across the three types of installations was different for each of the measures of work satisfaction.

Table 6.2
Measures of work satisfaction: comparisons across platforms, rigs and FPSO's

Variable	Significance of installation type	Mean adjusted scores			Significance of contrasts	
		1 Platform	2 Rig	3 FPSO	1 vs 3	2 vs. 3
Job satisfaction	F= 8.72, df 2,1824 p<.001	3.57	3.48	3.40	p<.001	ns
Satisfaction with job security	F= 44.38, df =2,1824, p<.001	2.68	3.01	3.02	p<.001	ns
Satisfaction with safety measures	F= 22.22, df = 2,1824, p<.001	4.12	4.06	3.89	p<.001	p<.001

Note: *Each measure is scored on a 1-5 scale*





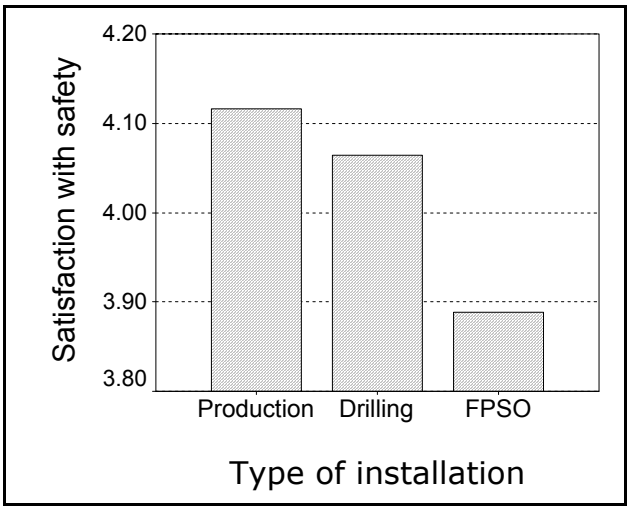


Figure 6.3
Job satisfaction, job security, and satisfaction with safety measures in relation to type of installation

6.3 MENTAL HEALTH: FPSO STUDY

6.3.1 Overall mental health levels

Overall mental health was assessed by the 12-item General Health Questionnaire (GHQ), which asks respondents to what extent they have experienced each of 12 symptoms of psychological distress over the previous six-week period. Responses were scored using the 0-0-1-1 format (Goldberg, 1978); in this method of scoring, the first two points of the four-point response scale ('*not at all*', and *'no more than usual*') score zero, while the last two points (which represent responses of worse than usual or much worse than usual, the exact form of wording depending on the item) score one. A total score is calculated by summing the scores on individual items.

The overall proportion of personnel (N = 469) with 'high' GHQ scores was 16.4%, taking the recommended 2/3 cutting point (Banks *et al.* 1980) as the criterion for identifying high scorers (i.e. those whose scores indicate possible clinical or near-clinical levels of distress). Consistent with the above-average health status of the offshore population, and their generally favourable personality characteristics (see Section 3.4), the proportion of 'high' GHQ scores in the present sample was lower than published data for male population groups employed onshore.

For instance, a survey carried out in several UK manufacturing companies (Wall *et al.* 1995) showed an overall proportion of 'high' GHQ scores (based on the 2/3 cutting point for the 12-item GHQ, as in the present study) among male participants (N=651) of 25.0% (Wall, personal communication). This level is significantly different from, and higher than, the overall rate of 16.4% in the present sample ($\chi^2 = 18.42$, df=1, $p<.001$). Similarly, in a large sample of civil servants, the proportions of male employees with 'high' GHQ scores varied between 21.6% and 24.8% in different job grades (Stansfeld & Marmot, 1992).

In the present study, there were no differences in the proportions of personnel with 'high' GHQ scores across operating companies, installations, employer, or work/leave patterns. Whilst some variation was observed, none of the effects reached statistical significance. However, there was a significant difference across job types ($\chi^2 = 14.3$, df=5, $p<.02$); this finding was almost entirely due to the proportion of catering personnel recording 'high' GHQ scores relative to other job types. Thus, 39% of the catering personnel (n=33) had scores at the level of potential clinical 'cases' as compared with only 13 - 17% of those in other job groups.

There was also a trend ($p<.06$) reflecting the difference in the proportions of 'high' GHQ scores among day workers (18.9%) and day/night shift workers (12.2%). This finding was primarily attributable to the disproportionate number of production personnel (the job group with the lowest proportion of 'high' GHQ scores) among the day/night shift workers.

6.3.2 Anxiety and low morale

Overall GHQ scores are a relatively insensitive measure of specific mental health problems in that they combine a number of different symptom types; furthermore, if items are dichotomously coded (as above, in the identification of 'high' overall scores), they produce markedly skewed distributions with many scores clustered at the low end of the scale and a long tail of high scores. For the purpose of examining predictive factors in the present study, therefore, two other scales derived from the GHQ, *anxiety* and *low morale* were analysed.

The measure of low morale (designated 'social dysfunction' in the GHQ literature) assesses the extent to which individuals feel demoralised, unable to make decisions, and dissatisfied with life

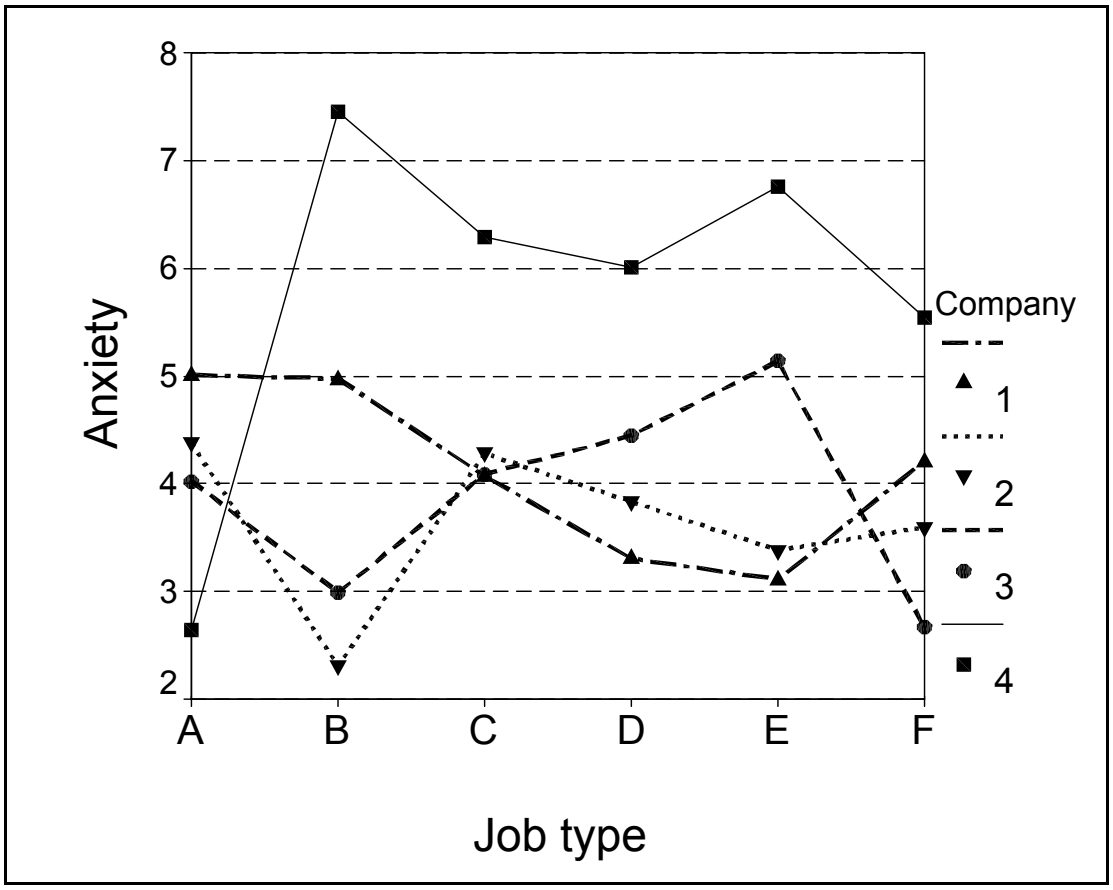
in general. For each of these analyses, items were scored on a 0-1-2-3 scale, differentiating between each of the four points of the original response format (Goldberg & Hillier, 1979). Using this method of scoring, the mean total score on the anxiety scale was 4.19 ± 3.59; for the measure of low morale, the corresponding mean score was 7.06 ± 1.69 (it should be noted that these mean scores are not directly comparable because of different wording of possible responses for the two sets of items). In the initial analysis of these scales, the effects of installations, job types, age and neuroticism were evaluated.

Personality. Neuroticism was by far the strongest predictor of anxiety ($F=219.22$, $df=1,440$, $p<.001$), highlighting the central role played by this personality trait in mental health. As has been widely found previously, high neuroticism was associated with high anxiety. Neuroticism was also a positive predictor of low morale, although to a lesser extent ($F=27.38$, $df=1,440$, $p<.001$).

Age. The relationship of age to levels of anxiety and low morale was curvilinear. As shown in Figure 6.4, anxiety symptoms increased quite steeply from age 20 years up to an age of about 40 years, then levelled off, and started to reduce from about age 50 years. Thus, the age group 40-50 years showed the highest anxiety levels. Low morale followed a generally similar, but less marked, pattern.

Figure 6.4
The relationship between age and anxiety

Installations and job types. The results for *anxiety* in relation to installations and job types showed a complex pattern, reflecting the significant interaction between these factors ($F=2.14$, $df=30$, $p<.001$); the effect of jobs on anxiety levels differed across installations and, conversely, the effects of installations differed across jobs. However, there were no such differences across installations within Companies 1 and 2. To simplify the overall picture, therefore, the analysis was repeated evaluating the effects of job types on anxiety for company groups rather than individual installations. Company 4 (with a single installation, #7, in the study) showed relatively high anxiety levels for all job types except maintenance/technical personnel. Among the other companies, anxiety levels were generally lower but, as shown in Figure 6.5, there was considerable variation in the patterns of anxiety across different types of jobs.



JOB TYPES

A = Maintenance, technical	D = Management, supervisory
B = Catering personnel	E = Administration, and specialist personnel
C = Production	F = Marine, deck, construction

Figure 6.5
Anxiety in relation to job type for different operating companies

There were no significant differences in the extent of *low morale* across different installations, but there was a significant effect of job type ($F=2.37$, $df=5,450$, $p<.05$). As shown in Figure 6.6, the job groups most affected by low morale were maintenance, catering, and marine/deck/ construction, while the administration/specialist group was least affected.

JOB TYPES

A = Maintenance, technical	D = Management, supervisory
B = Catering personnel	E = Administration, and specialist personnel
C = Production	F = Marine, deck, construction

Figure 6.6
Low morale in relation to job type

Work/leave cycles. Further analyses revealed that, over and above the effects of job types and installations/companies reported above, work/leave cycles also played a role in low morale; the results suggested that personnel working 3-3 work/leave cycles had poorer morale than those working other work/leave patterns, but this finding only applied to those working in catering, maintenance, or management roles. It was not possible to evaluate these effects in detail because work/leave cycles tended to be specific to particular companies.

Comparison with previous data. The anxiety levels reported here were compared with those obtained previously using the same GHQ scale. The mean anxiety score for production personnel in the present study (4.36 ± 2.82) was significantly higher ($t = 3.04$, $df = 83$, $p < .01$) than the corresponding mean score (3.42 ± 3.42) in 1990 data from personnel in the same job group (Parkes, 1992). However, a similar comparison of the mean scores on the measure of low morale showed no significant difference from the corresponding value obtained in the earlier study.

6.4 MENTAL HEALTH: COMPARISON OF PLATFORMS, DRILLING RIGS AND FPSO's

Analyses were carried out (using the same model as in Section 5.3) to examine whether the measures of mental health differed across types of installations (production platforms, drilling rigs, and FPSO's). No significant differences were found.

6.5 PSYCHOLOGICAL WELL-BEING: THE ROLE OF JOB CHARACTERISTICS

In the analyses presented in this report so far, measures of the perceived work environment (workload, autonomy, skill/variety, clarity, supervisor support and co-worker support) and of psychological well-being, were examined in relation to installations and job types. However, from a theoretical perspective, objective work factors (such as job type) are seen as influencing health-related outcomes through the intermediate processes of perception and appraisal (e.g. Israel *et al*. 1996; Lazarus, 1991). Thus, theoretical models propose a sequence by which objective characteristics influence individual perceptions of the work environment and these perceptions in turn influence well-being.

Preliminary analyses were carried out to determine to what extent the present data reflected this theoretical approach. These analyses examined the role of work environment variables as 'mediators' of relations between objective factors (job type and installations) and measures of psychological well-being (job satisfaction and anxiety). The analyses involved testing a sequence of predictive models which evaluated relations between job type and measures of psychological well-being, with and without including measures of perceived job characteristics. The findings were consistent with the view that perceptions of the work environment act as intermediate variables in the sequence by which objective work factors impact on health.

In particular, it was found that differences in job satisfaction between different job types were primarily attributable to differences in four work environment variables, supervisor support, task skill/variety, autonomy and job clarity. Jobs which were perceived to offer higher levels of any or all of these characteristics were associated with higher levels of job satisfaction. This mechanism almost entirely explained the relationship between job types/installations and job satisfaction; were there no differences in levels of these work environment variables, there would be no significant differences in job satisfaction across installations and job types. This pattern of results is illustrated in Figure 6.7.

A similar analysis showed that the combined effects of job type and companies/installations on anxiety (Section 6.3.2) were primarily mediated by workload. As described in Section 5.1.2, certain jobs (e.g. management, administration/specialist, and catering) were perceived to be high in workload, and high workload in turn predicted high anxiety (see Figure 6.8). These more complex pathways identify potential ways in which levels of well-being could be enhanced on particular installations and in particular types of jobs.

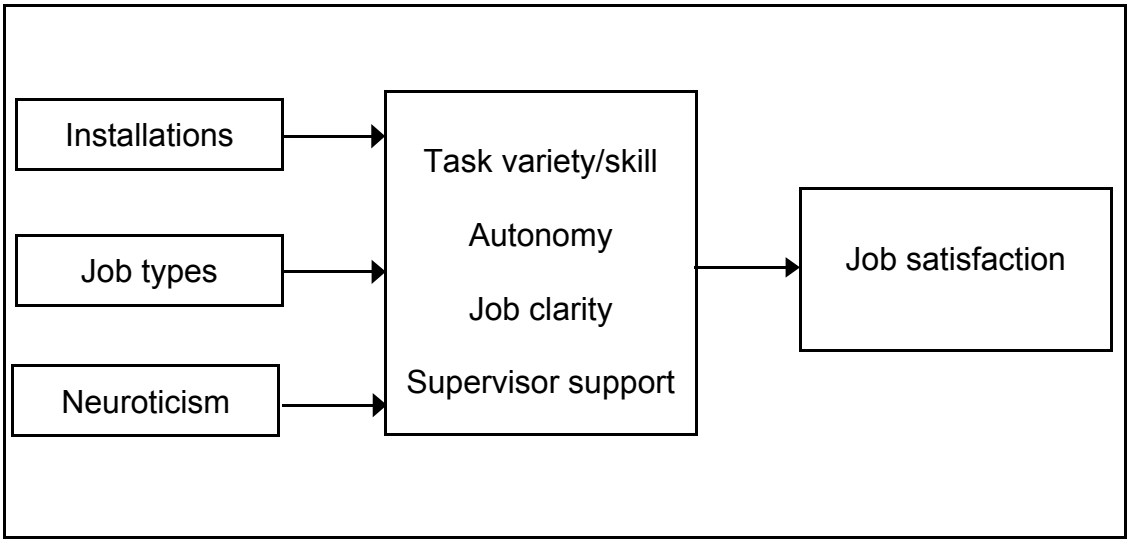


Figure 6.7
The role of job characteristics as mediator variables in relations between job satisfaction and installations, job types and neuroticism.

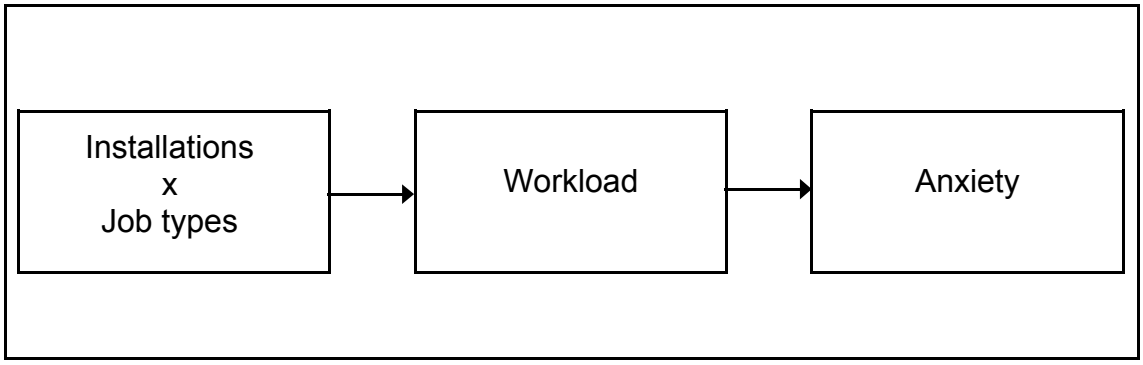


Figure 6.8
The role of workload as a mediator variable in the relation between anxiety and objective work environment variables (installations and job types)

6. PSYCHOLOGICAL WELL-BEING

FPSO study

Work satisfaction measures

- Three aspects of work satisfaction were assessed (job satisfaction; satisfaction with job security and job prospects; and satisfaction with safety measures and procedures).
- Each of these measures differed significantly across installations and job types. Two installations stood out as having particularly favourable ratings of each of these measures. Two other installations were characterised by low ratings on satisfaction with safety.
- Two job groups (management/supervisory and catering) had higher ratings of satisfaction with safety than other groups.
- Personnel employed by operating companies reported higher levels of satisfaction than those employed by contractor or service companies.
- Age was related to satisfaction with job security in a curvilinear manner.

Mental health

- The proportion of high scorers on a standard measure of 'stress' symptoms was 16.4%, in good agreement with other recent offshore data, and more favourable than comparable onshore employees.
- Catering personnel were significantly more likely than other job groups to report high levels of overall distress.
- Two measures of specific psychological symptoms were analysed. *Anxiety* was jointly predicted by job type and operating company. '*Low morale*' was particularly evident among maintenance personnel.
- The effects of installations and job types on job satisfaction and anxiety were mediated by work environment variables (supervisor support, autonomy, task variety/skill, job clarity, and workload).

Comparisons of platforms, drilling rigs, and FPSO installations

- Job satisfaction and satisfaction with safety were lowest on FPSO's, and highest on production platforms. The job security measure was low on platforms relative to both drilling rigs and FPSO's.
- There were no significant overall differences in mental health measures among platforms, rigs and FPSO's.

7. HEALTH PROBLEMS AND BEHAVIOURS

7.1 MINOR HEALTH PROBLEMS: FPSO STUDY

7.1.1 Assessment

Minor health problems were assessed by an eight-item checklist (Vaernes *et al.* 1988). For each of the items listed, participants were asked to report whether or not they had experienced the problem concerned during offshore work periods over the previous six weeks and, if so, to rate its severity. Responses were coded 0-3, with zero representing negative responses, and 1-3 representing mild, moderate, or severe positive responses. Thus, the overall maximum score was 24 (although only seven individuals had scores of 17 or more).

7.1.2 Distributions of overall scores

Table 7.1 shows the percentage of responses falling into each category for each item. Sleep problems and headaches were the most frequently reported; in particular, more than half the sample reported experiencing sleep problems. Although the highest level of severity was rarely endorsed, only 19.7% of the sample recorded no health complaints.

Table 7.1
Minor health problems: Percentage of responses in each category

	No reported problem 0	Severity		
		Mild 1	Moderate 2	Severe 3
Sleep disturbance	43.5	19.0	30.9	6.6
Headache	57.5	17.7	20.9	3.7
Musculo-skeletal				
Neck pain	70.2	14.1	13.3	2.4
Shoulder pain	77.7	9.4	9.6	2.1
Back pain	67.1	14.1	15.2	2.6
Gastric problems				
Indigestion	70.3	9.2	7.7	1.7
Heartburn	72.7	9.4	6.7	1.1
Stomach	76.3	7.3	5.6	0.9
Total scores	***0***	***1-2***	***3-5***	***6+***
% of sample	***19.7***	***23.9***	***29.3***	***27.1***
Sample size: 466 - 469				

7.1.3 Health problems in relation to installations and job types

Variations in the distribution of minor health problems across installations and job types were evaluated using the Kruskal-Wallis one-way non-parametric analysis. There was a significant difference across installations ($\chi^2 = 13.6$, df=6, $p<.05$); Installations 2 and 7 reported the highest overall levels of health problems. This result was largely accounted for by the higher incidence of headaches on these installations (56.4% and 54.7% respectively, as compared with an average of 37% on the other installations). Differences in total health scores among personnel in different types of jobs were not significant.

7.1.4 Multivariate prediction of health problems

The analyses above examined installations and job types separately in relation to health scores. However, other variables may also be related to reports of health problems. In particular, individual differences in neuroticism are known to predict responses to the health scale used (Parkes, 1993). Therefore, the analyses were extended using multivariate methods. In view of the skewed distribution of the data (see Section 2.6), dichotomous health scores were created, and logistic regression methods were used. These analyses confirmed the strong association between neuroticism and reporting of health problems, but otherwise added little to the results reported above.

7.1.5 Health problems in relation to other work factors

Further analyses were carried out to evaluate daywork vs. day/night shiftwork, and the measure of physical environment stressors, as additional predictors (over and above other factors in the model) in the logistic regression analyses predicting health outcomes. Shiftwork was not found to be significant except in that day/night shiftworkers were marginally more likely to report sleep problems and gastric problems than dayworkers. In addition, exposure to physical environment stressors was a significant predictor of both musculo-skeletal problems (particularly back pain) and sleep problems ($p<.01$ in each case).

Adverse sea, wind and weather conditions. FPSO installations are more vulnerable than fixed installations to sea, wind, and weather conditions. Accordingly, an additional set of items, not used in previous work, was developed to assess the extent to which personnel considered their health and performance was impaired by movement of the installation in severe weather conditions. Responses to these items were scored on a 0-4 scale. Personnel on the one fixed platform included in the present study also responded to these items; as would be expected, these personnel recorded significantly lower scores (mean item score = .21) than personnel on FPSO's (mean item score = .96). The remaining analyses were therefore carried out only on the FPSO data, the fixed platform data being omitted.

As shown in Table 7.2, none of the items had mean values higher than the mid-point of the response scale, but there was significant variation in scores for individual items ($F=4.66$, df=7, $p<.001$). The most marked effect of FPSO movement in adverse weather and sea conditions was reported to be increased fatigue and loss of sleep; the items concerned with increased workload and impaired work performance also had relatively high scores.

Table 7.2
Mean item scores for health and performance effects of installation movement

Item	Mean item score	Standard error
Loss of sleep	1.53	.09
Disrupted eating patterns	.66	.06
Increased workload	1.21	.08
Impaired work performance	1.19	.07
Increased fatigue	1.66	.09
Increased frequency/severity of headaches	.62	.07
Sea sickness	.35	.06
Increased anxiety	.65	.06

The eight items shown in Table 7.2 were found to form a single scale. Analysed in relation to installations, job types, age and neuroticism, installations were found to be significant ($F=2.63$, $df=5$, $p<.025$) but there were no significant differences between different jobs. The adjusted mean scores for each of the six FPSO installations are shown in Figure 7.1. It can be seen that on two of the FPSO's (Installation 4 and Installation 6) the adverse effects of installation movement were perceived to be markedly less severe than those on the other four installations.

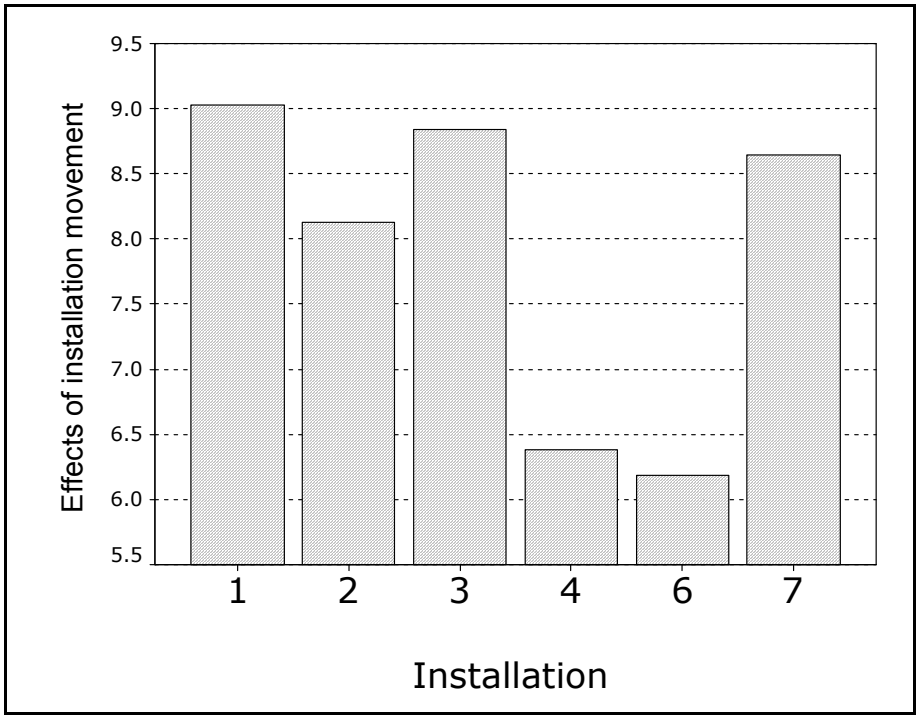


Figure 7.1
Ratings of the adverse effects of FPSO movement (due to sea/wind conditions) on health and performance: total scores for installations

7.2 SMOKING BEHAVIOUR

7.2.1 Rates of smoking

For analysis purposes, smoking behaviour was coded into three categories, *non-smoker*, '*moderate smoker*', and '*heavy smoker'*, as shown in Table 7.3. Taking the two latter categories together, the overall proportion of smokers in the present sample was 28.8%.

Table 7.3
Proportions of non-smokers, moderate smokers, and heavy smokers

Category	Amount smoked	N	% of sample
Non-smoker	-----	330	71.2%
Moderate smoker	< 20 cigarettes per day	66	14.3%
Heavy smoker	20+ cigarettes per day	67	14.5%
Total N = 463 (missing data, n = 7)			

Installations and job types. The data were examined to determine whether the proportions of smokers varied by installation and/or job type. Installations did not differ in overall rates of smoking, but there were significant differences between personnel in different job groups (χ^2 = 23.44, df = 10, p<.01). As shown in Table 7.4, *non-smokers* were most frequent among production and management personnel, while three job groups (catering, adminstration/specialist, and marine/deck/ construction) had markedly higher proportions of *'heavy smokers'* than the other groups. However, it should be noted that sample sizes were relatively small in some cells of the table.

Table 7.4
Smoking behaviour in relation to job types

Job type	Non-smoker		Moderate smoker		Heavy smoker	
	%	n	%	n	%	n
Maintenance/ technical	76.1	102	14.9	20	9.0	12
Catering	63.6	21	9.1	3	27.3	9
Production	79.3	65	12.2	10	8.5	7
Management	78.6	55	12.9	9	8.6	6
Admin/other	58.3	21	16.7	6	25.0	9
Marine/deck/ construction	61.1	66	16.7	18	22.2	24

7.3 BODY MASS INDEX

7.3.1 Overall levels

Research findings indicate that self-reported height and weight are accurate enough to be used in place of formal measurements for research purposes (e.g. Stunkard & Albaum, 1981; Rowland, 1990). The present survey questionnaire included items asking for details of weight and height, and this information was used to calculate the body mass index (BMI), weight in kg /(height in ms)^2. The overall mean BMI value was 26.6 ± 3.0 kg/ms^2 (range 19.5 - 37.6). Of the overall sample, 32.2% were within the *normal* range (BMI, 19.0 - 24.9), 56.0% were *overweight* (BMI, 25 - 29.9), and 11.6% were *obese* (BMI >30).

7.3.2 Body mass index in relation to age

BMI levels did not differ across installations or job types, and were unrelated to neuroticism. However, age was a significant predictor; as shown in Figure 7.2, the relationship was curvilinear, BMI increasing steadily up to about age 45 years, then levelling off and subsequently tending to decrease. Relationships between BMI and health problems were also examined, but there was no evidence to suggest that BMI was predictive of any of the health complaints assessed.

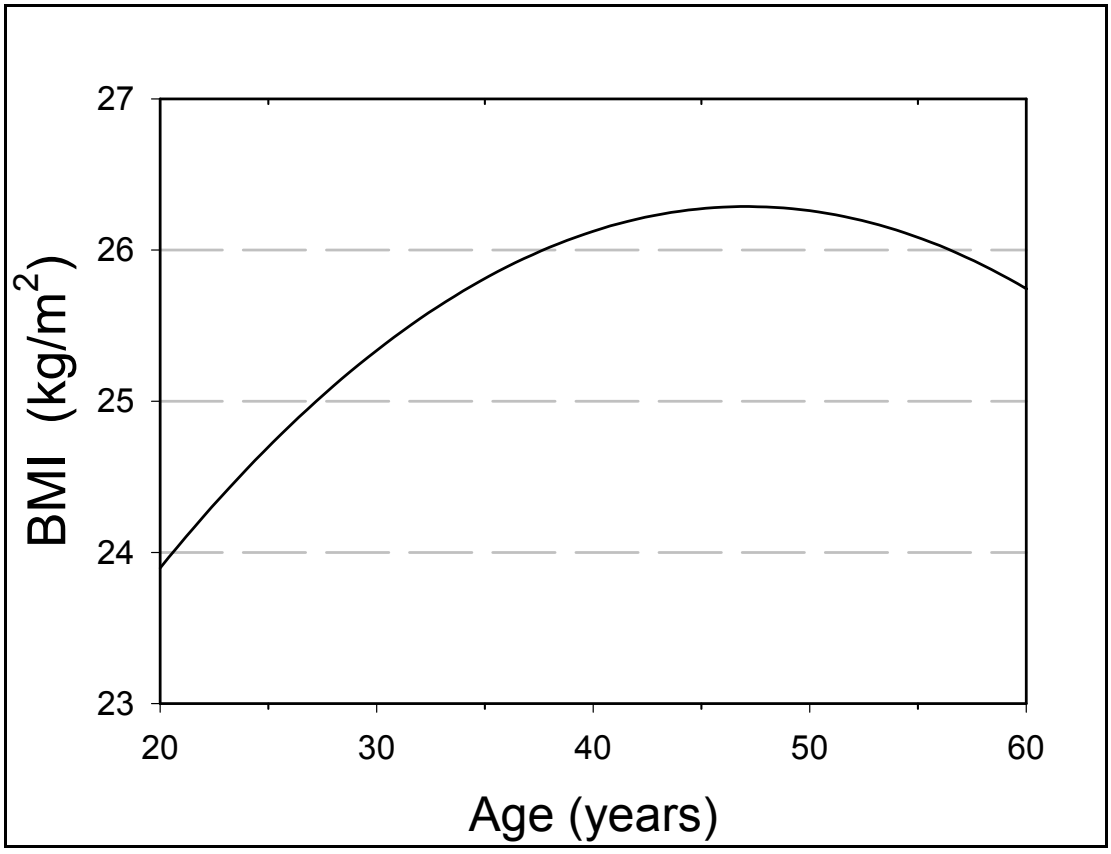


Figure 7.2
The relationship between age and BMI

7.4 HEALTH PROBLEMS AND BEHAVIOURS: COMPARISON OF PLATFORMS, DRILLING RIGS, AND FPSO's

7.4.1 Minor health problems

Table 7.5 summarises the responses of personnel on platforms, drilling rigs and FPSO's to the checklist of minor health problems. As evaluated by the Kruskal-Wallis non-parametric test, differences in levels of health problems reported by personnel on the different types of installations were significant for musculo-skeletal problems, for sleep complaints, and for headaches, but non-significant for gastric problems. The most marked difference was for sleep problems ($p<.001$); personnel working on FPSO's reported greater sleep disturbance than those working on platforms or drilling rigs. Similarly, the FPSO personnel also reported more headache ($p<.01$) and musculo-skeletal problems ($p<.05$) than those on other types of installations.

To take into account the higher age of personnel on FPSO's relative to those on platforms and drilling rigs, these analyses were extended using logistic regression methods in which age, neuroticism and job type were included in the model in addition to type of installation. The results were essentially similar to those reported above, that is, personnel working on FPSO's reported greater incidence of headaches, sleep problems and musculo-skeletal complaints than those working on other types of installations even after age and the other factors in the model had been taken into account.

Table 7.5
Minor health problems: Percentage of responses in each category for personnel on production platforms, drilling rigs and FPSO installations

	No reported problem	Severity		
		Mild	Moderate	Severe
	%	%	%	%
Sleep disturbance [1]				
Platforms	54.9	20.8	19.8	4.5
Drilling rigs	53.8	18.3	21.0	6.9
FPSO installations	41.9	19.3	32.3	6.5
Headache [1]				
Platforms	62.9	19.9	14.9	2.3
Drilling rigs	59.8	20.2	17.0	3.0
FPSO installations	55.8	19.1	21.1	4.0
Musculo-skeletal [2]				
Platforms	53.7	32.0	11.1	3.3
Drilling rigs	53.8	28.6	14.5	2.9
FPSO installations	49.0	29.4	16.6	5.0
Gastric problems [2]				
Platforms	69.3	20.8	7.5	2.5
Drilling rigs	67.7	19.0	9.8	3.4
FPSO installations	67.6	22.4	8.3	1.9

[1] Single measures: 0 = no problem reported; 1=mild; 2 = moderate; 3 = severe
[2] Composite measures: 0 = no problem; 1-2 = mild; 3-5 = moderate; 6+ = severe

7.4.2 Smoking behaviour

The proportions of non-smokers, moderate smokers, and heavy smokers on production platforms, drilling rigs, and FPSO installations are shown in Table 7.6. Differences across the three types of installations in the proportions of personnel in each category of smoking behaviour were highly significant. Drilling rig personnel had the highest proportion of heavy smokers, while FPSO installations had the highest proportion of non-smokers, and a substantially smaller proportion of heavy smokers relative to both rigs and platforms.

Table 7.6
Proportions of non-smokers, moderate, and heavy smokers among personnel on different types of installations

Installation type	*Non-smoker*		*Moderate smoker* < 20 cigarettes per day		*Heavy smoker* 20+ cigarettes per day	
	%	**n**	**%**	**n**	**%**	**n**
Platforms	**66.9**	704	**13.0**	137	**20.1**	211
Drilling rigs	**55.4**	224	**17.6**	71	**27.0**	109
FPSO's	**71.6**	283	**13.7**	54	**14.7**	58
Significance test: $\chi^2 = 28.15,\ df = 4,\ p<.001$						

7.4.3 Body mass index

Mean BMI levels were compared across types of installations taking into account age, job type and neuroticism. In addition, as smoking is strongly negatively related to BMI, a variable representing smoking behaviour was included in the model. Although age (both linear and curvilinear terms), smoking, and job type were the strongest predictor variables ($p<.001$ in each case), mean BMI levels also differed significantly across types of installation ($p<.025$). The difference between personnel on production platforms and drilling rigs was not significant, but those on FPSO installations had significantly higher BMI levels than those on platforms ($p<.01$) and marginally higher levels than those on drilling rigs ($p<.10$) (see Figure 7.3).

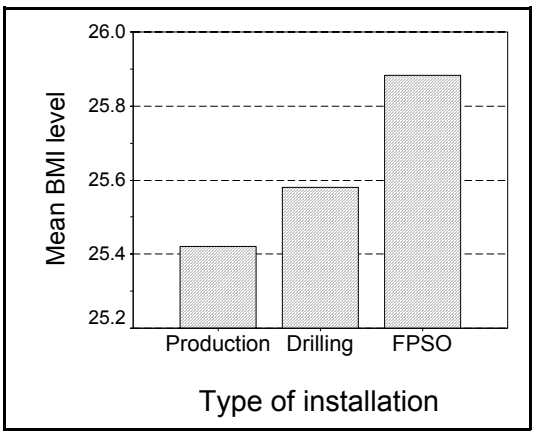


Figure 7.3
Mean BMI levels on platforms, drilling rigs, and FPSO's

7.5 HEALTH PROBLEMS AND HEALTH BEHAVIOURS

FPSO study

- Four types of minor health problems were assessed: headaches, sleep disturbance, musculo-skeletal, and gastric problems. Overall, the most frequently reported problems were sleep complaints (56.5% of the sample) and headaches (42.5% of the sample).

- The incidence and severity of minor health problems differed across installations; two installations stood out as having relatively high levels, especially of headaches. Differences across job types were not significant.

- Multivariate analyses showed that (over and above other factors) shiftworkers were marginally more likely to report sleep problems and gastric problems than dayworkers. Exposure to an adverse physical environment was associated with musculoskeletal and sleep problems.

- Overall, 71.2% of the FPSO sample were non-smokers, 14.3% were 'moderate' smokers, and 14.5% were 'heavy' smokers. Personnel in production and management roles had lower rates of smoking than those in other job groups.

- The relationship between body mass index (BMI) and age was curvilinear, increasing sharply at younger ages but levelling off from age 45 years.

Comparisons of platforms, drilling rigs and FPSO installations

- As compared with personnel on production platforms or drilling rigs, those on FPSO's were more likely to report sleep problems and, to a lesser extent, musculo-skeletal problems and headaches.

- Rates of smoking differed significantly across installation types; 76.1% of those on FPSO's were non-smokers, as compared with 66.9% and 55.4% on production platforms and drilling rigs, respectively.

- Personnel on FPSO's had higher BMI levels than those on platforms, but did not differ significantly from those on drilling rigs.

8. PSYCHOSOCIAL PROFILES: INSTALLATIONS AND JOBS

8.1 DISCRIMINANT ANALYSIS: FPSO STUDY

In the previous sections of this report, the work environment, satisfaction and health measures used in the present study were analysed separately in relation to installations and job types with control for age and a measure of negative affectivity. In this section, *'discriminant analysis'*, a statistical method used to identify the characteristics associated with particular groups (e.g. personnel working on different installations), is used to combine the measures that differed significantly across FPSO's and/or jobs to provide a composite profile of each of the seven participating installations and of each job group. The variables included in the discriminant analysis were the work environment measures (general physical stressors and the psychosocial measures), work satisfaction measures, and an overall physical health measure.

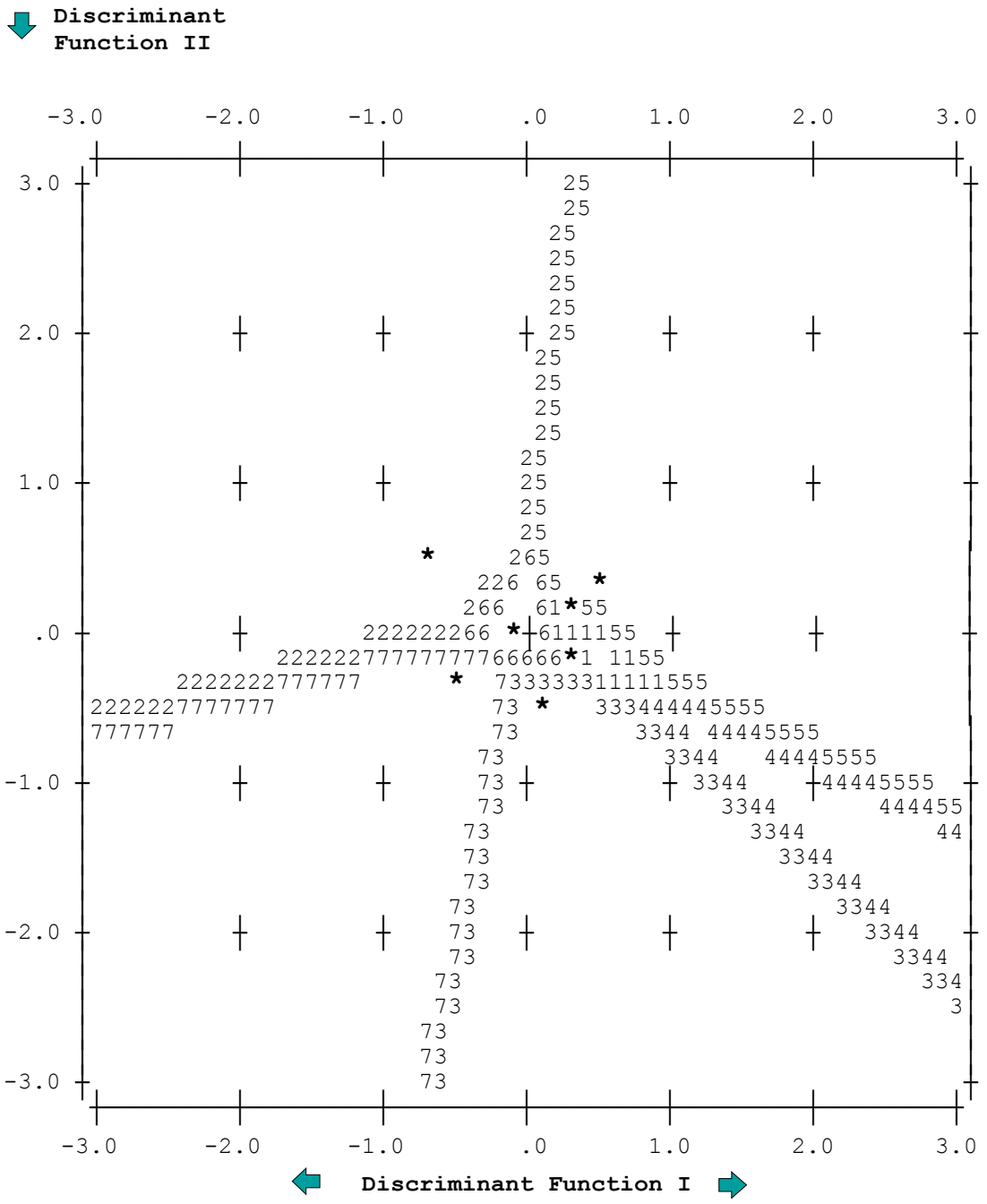
8.1.1 Installations

The discriminant analysis revealed two highly significant 'discriminant functions'; a third function was also significant although to a lesser extent. The remaining three functions defining the seven installations were non-significant. The loadings of the individual measures on the three significant functions are shown in Table 8.1.

Table 8.1
Loadings on first three functions in discriminant analysis of FPSO installations

	Function loadings		
Measure	Function I	Function II	Function III
Satisfaction with safety	.80*	.27	.01
Satisfaction with job security	.64*	.11	-.37
Job satisfaction	.48*	.39	-.44
Workload	-.47*	.22	-.30
Autonomy	.38*	.11	.07
Task variety and skill	.37	.52*	-34
Job clarity	.39	.29	.25
Physical environment stressors	-.34	.50*	.29
Support from supervisors	.30	.38*	-.38
Support from co-workers	.15	.43*	.33
Physical health complaints	-.26	-.16	.22
Significance of function in discriminant analysis	p<.001	p<.001	p=.01

* *The asterisks indicate the measures that most strongly define the first two functions.*



* *Represents the 'group centroids' (centre points) for each area*

Figure 8.1
Territorial plot indicating the relative positions of the FPSO installation on the first two discriminant functions

The information from the discriminant analysis can be used to create a two-dimensional plot showing the relative positions of each installation on the first two functions. This plot is shown in Figure 8.1, in which the numbers 1-7 in the plot represent the installations; scores for Function I are plotted on the horizontal axis, and those for Function II on the vertical axis.

It can be seen from Figure 8.1 that the discriminant analysis distinguishes clearly between four of the installations (#2, 3, 5 and 7). Installation 4 lies on the boundary of Installations 3 and 5, while Installations 1 and 6 are not clearly differentiated by the first two discriminant functions.

The plot in Figure 8.1 can be interpreted by reference to the discriminant function loadings shown in Table 8.1. High scores on Function I imply high levels on one or more of the three work satisfaction measures and autonomy, and/or relatively low levels of workload. High scores on Function II imply relatively high levels of support from supervisors and co-workers, and/or high levels of task variety/skill and physical stressors. However, it is important to note in interpreting the data that the two-dimensional plot in Figure 8.1 disregards the third discriminant function, and other higher-order but non-significant functions.

In Figure 8.1, Installation 5 is characterized by above-average levels (i.e. positive scores) on Function I, but is less clearly defined by Function II, with scores ranging from -1 to +3. Installation 3 is average or above-average on Function I, but low on Function II (largely due to low perceived support in this installation). Conversely, Installation 2 is low on Function I (relatively low work satisfaction and high workload) and high on Function II (high co-worker support but also high levels of physical environment stressors). Installation 7 is low on both functions (negative scores in each case), reflecting low work satisfaction ratings and moderately high workload coupled with low co-worker support and low levels of task variety/skill.

8.1.2 Job types

An analysis similar to that described above was applied to the six job groups identified in the present study. Three highly significant discriminant functions were found ($p<.001$ in each case). The loadings of each of the psychosocial measures on these functions are shown in Table 8.2, and the corresponding 'territorial map' of job types is shown in Figure 8.2.

Table 8.2
Loadings on first three functions in discriminant analysis of job types

	Function loadings		
Measure	Function I	Function II	Function III
Physical environment stressors	-.60*	.05	.17
Workload	.48*	.09	.23
Job security	.37*	-.16	.30
Task variety / skill	.44	-.68*	.28
Autonomy	.29	-.03	-.51*
Support from co-workers	-.05	-.30	.40*
Satisfaction with safety	.30	.23	.19
Job clarity	.01	.00	.40*
Job satisfaction	.35	-.44	.05
Support from supervisors	.19	-.15	.23
Physical health complaints	-.12	.12	.04
Significance of function in discriminant analysis	$p<.001$	$p<.001$	$p<.001$

* *The asterisks indicate the measures that most strongly define the functions.*

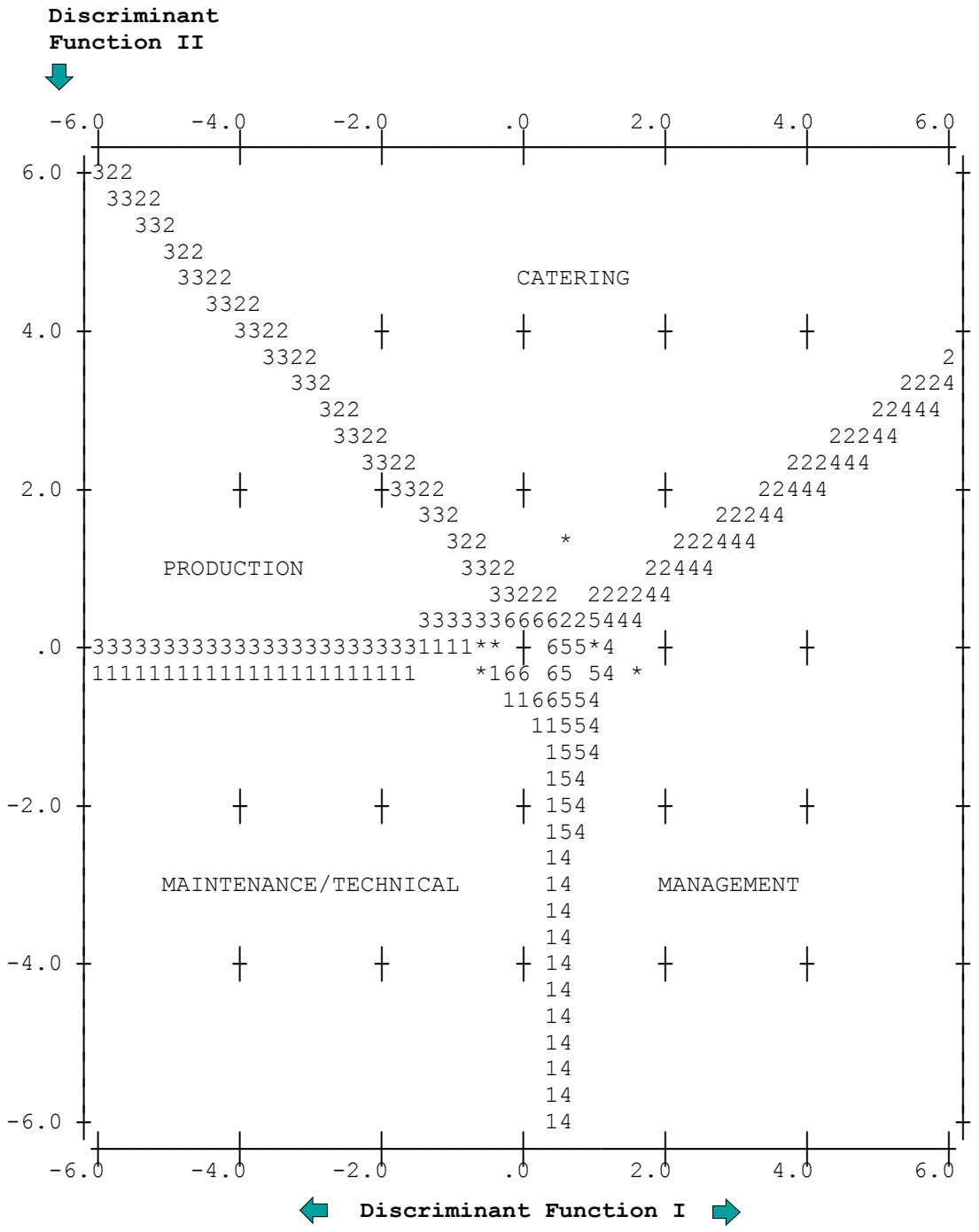


Figure 8.2
Territorial plot indicating the relative positions of the six job types on the first two discriminant functions

Four job types were clearly distinguished by the territorial plot. The *maintenance/technical* group was characterised by low scores on both functions; thus, these personnel perceived relatively high exposure to physical environment stressors, low job security, and low workload, together with moderate levels of task variety/skill utilisation and autonomy. The *catering* group was identified by high scores on Function II but was not differentiated by Function I; thus, in this group, the most significant work perceptions were of low task variety/skill, low job satisfaction, and low support from co-workers. *Production operators* were also characterised by high scores on Function 2; this group also had low scores on Function 1 implying low workload, low job security and high exposure to physical stressors.

Finally, the *management* group were high on Function I and generally low on Function II, indicating relatively high workload, job security, task variety/skill, job satisfaction and satisfaction with safety, and low exposure to physical environment stressors. The other two groups (administration, and marine/deck/construction) were not clearly differentiated by the plot of the first two functions, although the administration group was located between the maintenance/technical and the management groups, sharing some characteristics of each.

8.2 DISCRIMINANT ANALYSES: PLATFORMS, DRILLING RIGS AND FPSO's

An analysis similar to that reported in Section 8.1 above was carried out to determine the particular combinations of characteristics that distinguished the three types of installation, fixed platforms, drilling rigs, and FPSO's. Three groups are fully defined by two discriminant functions and, in this case, both discriminant functions were significant; Table 8.3 shows the loadings on each function. The 'territorial plot' showing the relative positions of the three types of installations on the two-dimensional plot of the function scores is shown in Figure 8.3.

Table 8.3
Function loadings from the discriminant analysis of installation types

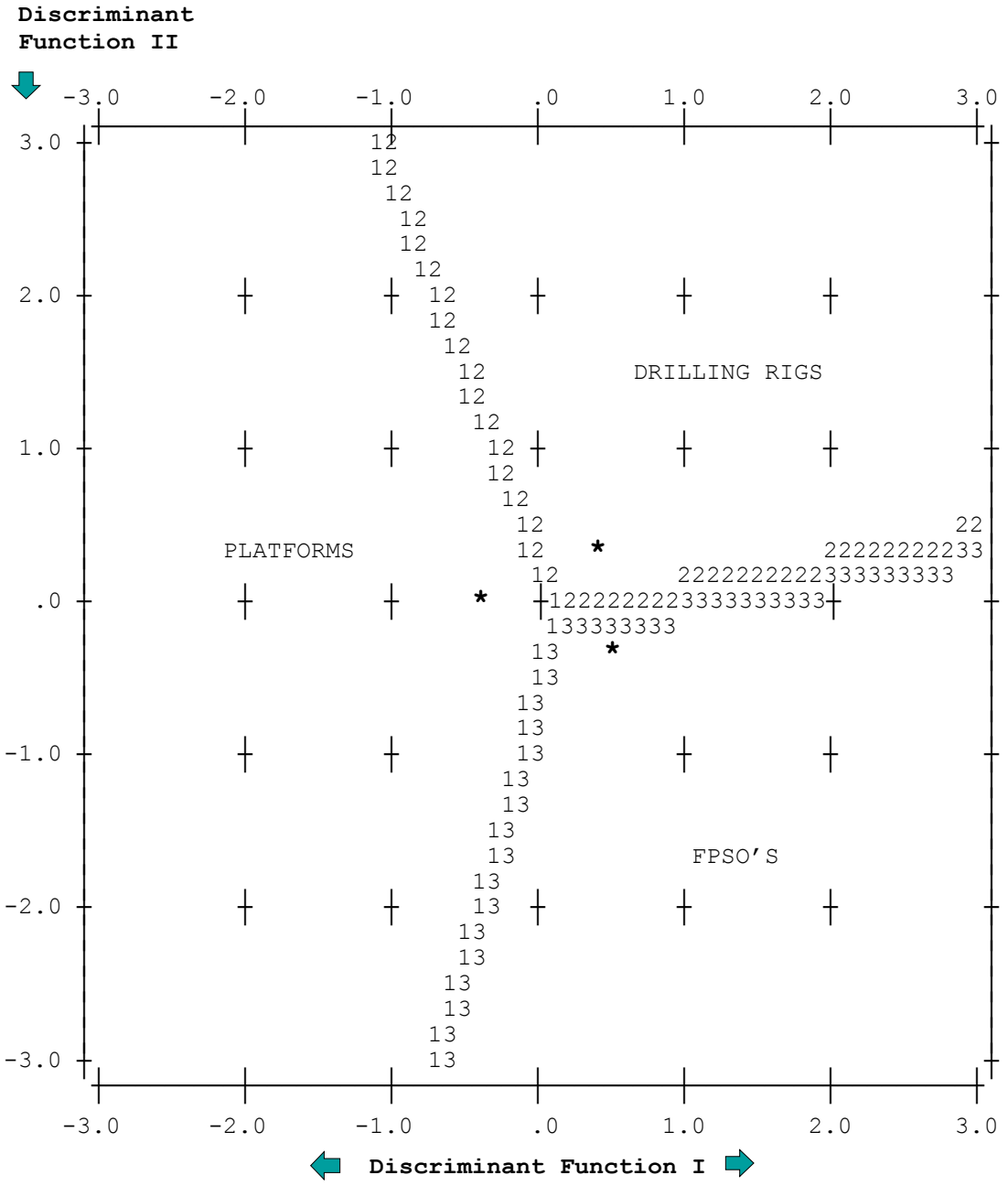
	Function loadings	
Measure	Function I	Function II
Satisfaction with job security	.60*	.31
Workload	-.24*	.02
Support from co-workers	-.18*	-.08
Job clarity	-.12	.73*
Physical environment stressors	-.07	.28*
Autonomy	.07	-.27*
Task variety and skill	-.01	.27*
Physical health complaints	.20	-.23*
Job satisfaction	-.11	.17*
Significance of function in discriminant analysis	p<.001	p<.001

* *The asterisks indicate the measures that most strongly define the two functions.*

It can be seen from Figure 8.3 that fixed platforms are identified by low scores on Function I, but are not differentiated by Function II. Thus, the perceptions of personnel working on production platforms are characterised by low job security and future prospects, but also by high workload and high co-worker support, relative to those on other types of installations. Conversely, both drilling rigs and FPSO installations tend to be high on Function I (implying greater job security,

lower workload, and higher co-worker support) but are differentiated from each other by their scores on Function II.

Drilling rigs are characterised by high scores on Function II, indicating relatively high levels of variety and clarity in jobs, and of job satisfaction, but also low levels of autonomy and high exposure to physical environment stressors. FPSO's have low scores on Function II indicating (as compared with drilling rigs) greater autonomy and less exposure to physical stressors, but also less variety and clarity in jobs, and lower job satisfaction.



1 =Fixed platforms 2 = Drilling rigs 3 = FPSO installations

***** *Represents the 'group centroids' (centre points) for each area*

Figure 8.3
Territorial plot indicating the relative positions of platforms, drilling rigs, and FPSO installations on the two discriminant functions

SUMMARY

8.3 PSYCHOSOCIAL PROFILES: INSTALLATIONS AND JOBS

FPSO study

- 'Discriminant analyses' were used to evaluate the combinations of work environment measures that characterized different installations and job types.

- In the analysis of installations, work satisfaction, autonomy, and relatively low workload levels defined one dimension; high levels of support, task variety/skill, and the physical work environment defined the second dimension. These dimensions distinguished four of the seven installations; the remaining three were not clearly differentiated in this analysis.

- A similar analysis focusing on job types distinguished four job types (management/supervisory, maintenance, catering, and production). The analysis identified the favourable characteristics of management roles in contrast to other job types.

Comparisons of platforms, drilling rigs and FPSO installations

- A similar 'discriminant analysis' differentiated between the three types of installations, platforms, drilling rigs and FPSO's. In particular, platforms were characterized by low job security, high workload, and high co-worker support relative to rigs and FPSO's.

- Drilling rigs were characterized by high job variety and clarity, and by job satisfaction, but also by low autonomy and high exposure to physical environment stressors.

- On FPSO's, work perceptions reflected greater autonomy, and less exposure to physical stressors, as compared with drilling rigs, but FPSO's were also lower in job variety and clarity, and lower in job satisfaction.

9. OFFSHORE FOLLOW-UP STUDY, 1995 - 2000

9.1 INTRODUCTION

The aim of the work reported in this chapter was to evaluate the extent to which the physical and psychosocial work environment of offshore personnel changed over a period of approximately five years (from 1995-6 to Summer 2000), and the extent of the corresponding changes in health and psychological well-being. No previous longitudinal studies of offshore personnel have been reported in which the same individuals are followed up over an extended period of time. In the current climate of developments in oil and gas production in the North Sea, the present study represents an attempt to increase understanding of the offshore environment, and factors that affect change over time in the work perceptions and health of offshore personnel.

9.2 RESEARCH METHOD AND PARTICIPANTS

9.2.1 Data collection

Participants in the initial survey (Parkes *et al.* 1997) were asked in 1995 if they would be willing to take part in a follow-up study at a later date. As many as possible of those who responded positively (n=1034) were contacted in 2000 by mail at the addresses they had given, or through their employing companies. Of those who replied (n=490), the great majority (n=450) agreed to take part in the follow-up. In the group from whom no reply was received in 2000 (n=544), approximately a third of those concerned could not be traced at the addresses given in 1995.

The response rate to the follow-up questionnaires (sent out to those who agreed to participate) was 81% (n=359). Of this number, 291 male personnel (of whom 288 had complete data) were still working offshore. This data set forms the basis of the results reported below. Except when otherwise stated, the measures used were the same as those used in 1995.

9.2.2 Sample characteristics

The representativeness of the follow-up sample relative to the initial 1995 sample was evaluated in relation to the main factors used in the analyses.

Type of installation, employer, and job type. Relative to their proportions among the initial participants, personnel employed by operating companies, as compared with contractor/service agencies ($\chi^2 = 4.2$, df=1, $p<.05$) , and personnel in production, management and administrative jobs, as compared with those in catering, construction and drilling ($\chi^2 = 17.9$, df=7, $p<.02$), were over-represented in the follow-up survey. Personnel working on production platforms, as compared with those on drilling rigs, also tended to be disproportionately represented in the follow-up group. These differences reflected the high mobility of some North Sea employees, and the consequent difficulty of contacting them for follow-up purposes. Of the follow-up sample, 76% worked on platforms in 1995 and 24% on drilling rigs. Table 9.1 shows the distribution of follow-up participants in terms of type of installation and job type reported in 1995.

Age and neuroticism. Average age at the time of the initial survey did not differ between those who were, or were not, subsequently followed-up. The average age of the follow-up group in 2000 was 45.1 ± 8.1 years. Similarly, there was no difference between the groups in their mean scores on the measure of neuroticism.

Table 9.1
Follow-up study: distributions of participants in relation to type of installation and type of job in 1995

Job type in 1995	Production platforms		Drilling rigs		TOTAL	
	N	%	N	%	N	%
Maintenance	61	28.0	13	18.6	**74**	**25.7**
Technical/mechanical	11	5.0	13	18.6	**24**	**8.3**
Catering/flotel	5	2.3	5	7.1	**10**	**3.5**
Production	55	25.2	---	---	**55**	**19.1**
Management/supervisory	32	14.7	10	14.3	**42**	**14.6**
Administration/other	16	7.3	9	12.9	**25**	**8.7**
Construction	14	6.4	2	2.9	**16**	**5.6**
Drilling	24	11.0	18	25.7	**42**	**14.6**
TOTAL	218	100	70	100	**288**	**100**

9.2.3 Changes in employment, 1995 - 2000

Job types and job changes. In the analysis of the 1995 data, eight types of jobs (maintenance, technical, catering, production, management/supervisory, administration/specialist, drilling, and deck/construction) were identified. These categories were also used in analysing the follow-up data. Between 1995 and 2000, 66% of the follow-up sample (designated Group A) had remained in the same non-management job (ie. all job categories other than the management/supervisory group); 14% had remained in the same management job (Group B); 13% had been promoted to management roles from other jobs (Group C); and 7% had changed from one non-management job to another (Group D).

Other work changes. Between 1995 and 2000, 41% of the sample had moved to a different offshore installation, 10% had transferred from operator company employment to contractor status (as compared with 1% who had moved from contractor to operator company), 8% were no longer doing day/night shift work, while 9% had moved from day work to day/night shift work.

9.3 OVERALL CHANGES IN SURVEY MEASURES FROM 1995 TO 2000

9.3.1 Physical and psychosocial work environment

There was no evidence of significant overall change between 1995 and 2000 in levels of workload, task variety/skill, or autonomy. However, direct pairwise comparisons (t-tests) showed significant change over time in two variables; *job clarity* decreased from 2.62 to 2.42 ($p<.001$), and exposure to *physical environment stressors* decreased from 2.06 to 1.91 ($p<.01$).

9.3.2 Work satisfaction measures

Changes over time in the measures of job satisfaction and job security were not significant. There was a significant decrease ($p<.05$) in *satisfaction with safety measures and procedures* from 1995 to 2000, but the overall change was modest in size (from 4.06 to 3.98) relative to the generally high ratings on this measure. This effect was mediated by the change in job clarity, implying that the reduction in satisfaction with safety resulted, at least in part, from the reduction in job clarity.

9.3.3 Psychological well-being

Overall, there was no change between 1995 and 2000 in scores on the GHQ symptom checklist, or in the separate measure of low morale. However, there was a significant ($p<.01$) overall increase in the measure of *anxiety* (from 4.22 to 4.84).

9.4 CHANGES IN WORK PERCEPTIONS IN RELATION TO JOB CHANGES AND INSTALLATION TYPE

9.4.1 Analysis model

Preliminary analyses indicated that job change (or absence of change) was more important than job type *per se* in predicting changes in the perceived physical and psychosocial work environment over the five-year follow-up period. Accordingly, in the analysis model, job change (coded into the four groups, A, B, C, and D, as detailed in Section 9.2.3) was treated as an independent variable, together with installation type (platforms vs. rigs), and individual differences in age and neuroticism, in evaluating changes in work perceptions and well-being from 1995 to 2000.

A repeated-measures analysis was used. The dependent variables were corresponding measures obtained in the years 1995 and 2000 (e.g. workload levels in 1995 and in 2000). These analyses allowed the overall effect of 'year' to be evaluated and, more importantly, analysis of interactions with the 'year' factor. A significant interaction between 'year' and job change indicates that the extent of change between 1995 and 2000 depends on the type of job change, if any, that occurred between the two time points. Similarly, an interaction between 'year' and installation type indicates that the extent of change from 1995 to 2000 is different for platforms and drilling rigs.

Table 9.2 summarises the results of these analyses, showing the significance of interactions of 'year' with job change, installation type, and individual differences in age. Measures were not included in this table if none of these interactions was significant (ie. autonomy and job clarity). Interactions with neuroticism are not shown in the table; they were generally non-significant, and were not of direct relevance in the present context.

9.4.2 Physical environment stressors

As shown in Table 9.2, the '*year x job change*' interaction was highly significant for the measure of physical environment stressors, indicating that the extent of change between 1995 and 2000 depended on job changes. Figure 9.1(a) illustrates these results. The most marked reduction in exposure occurred for those who moved from non-management to management posts. Exposure ratings for personnel remaining in the same non-management jobs did not change significantly.

Table 9.2
Analysis of change over time: work environment measures

	Repeated measures factor	Interactions			
Measure	*Year 1995 to 2000*	*Year x job change group*	*Year x installation type*	*Year x age*	*Year x job change contrast **
	df = 1	df = 3	df = 1	df = 1	df = 1
Physical environment stressors	F < 1 ns	F = 6.27 p<.001	F < 1 ns	F < 1 ns	F = 15.44 p<.001
Workload	F = 10.07 p < .01	F = 1.84 ns	F < 1 ns	F = 11.29 p <.001	F = 5.01 p < .03
Task variety /skill	F =3.94 p<.05	F = 7.57 p < 001	F <1 ns	F < 1 ns	F = 22.80 p<.001

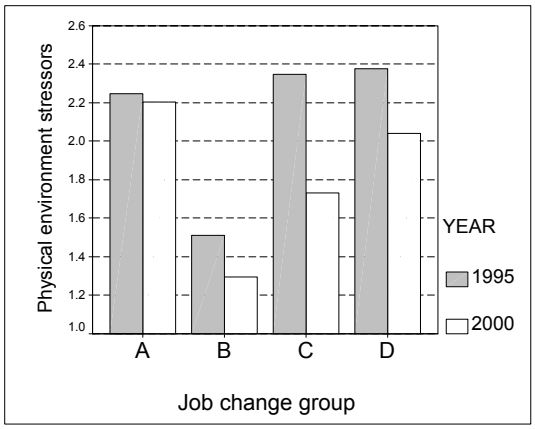
* *This column shows the significance of the interaction of the 'year' variable with the contrast between 'no job change' (Groups A + B) and 'job change' (Groups C + D).*

9.4.3 Workload

As shown in Figure 9.1(b), the effect of 'year' in this analysis was entirely due to personnel who changed jobs, particularly those in Group C who moved from non-management to management posts. Although the *year x job change* interaction did not reach significance, the contrast between those who changed jobs and those who remained in the same job was significant (final column of Table 9.2). Thus, changing jobs was associated with an increase in workload, which did not occur among those who continued in the same job. Moreover, the group that moved to management posts (Group C) reported levels of workload in 2000 that corresponded closely with those of those who were already managers in 1995 (Group B). The relatively low workload reported by Group D in 1995 (who moved into a different non-management job) suggests that this group may have been seeking more challenging career opportunities, or may have been forced to move by redundancy.

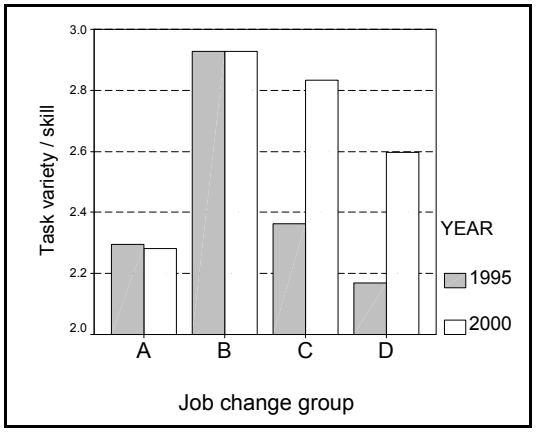
9.4.4 Task variety and skill utilisation

For the measure of task variety and skill utilisation, the interaction between year and job change was highly significant. The pattern of results, shown in Figure 9.1(c), was very clear; personnel who remained in the same jobs (whether management or non-management) showed no change in this measure, whereas among those who changed jobs, there was a marked increase in scores. In particular, personnel who moved to management positions showed increases in task variety/skill utilisation to a level closely comparable with that of personnel who had been in management positions at the time of the initial survey in 1995. Personnel who changed jobs but not to management positions showed a similarly large increase in task variety/skill, suggesting that promotion or increased responsibility and challenge may have been involved.



(a) Physical environment stressors

(b) Workload



(c) Task variety/skill utilisation

KEY TO GROUPS

A = No change, non management job (n=191)
B = No-change, management job (n=40)
C = Change to management job (n=37)
D = Change of job, non-management (n=20)

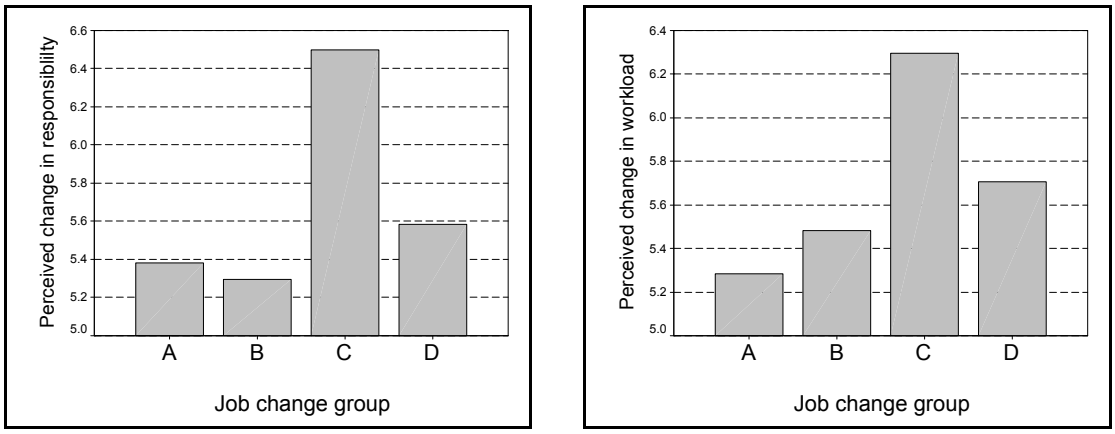
Figure 9.1
Changes in work environment variables, 1995 - 2000, in relation to job changes

9.4.5 Analysis of perceived change in workload and responsibility

In the follow-up study, participants were asked to rate the extent to which they perceived workload and responsibility to have changed between 1995 and 2000. The response scale for each measure ran from -3 (much less) to +3 (much greater), with zero representing no change. This scale was re-coded to a 1-7 scale for analysis purposes. Overall mean scores were 5.58 ± 1.30 (responsibility change) and 5.55 ± 1.22 (workload change).

The ratings were analysed in relation to job change, installation type, age and neuroticism. Job change was the strongest predictor of perceived change in both workload ($F = 8.01$, $df=3,281$, $p<.001$) and responsibility ($F = 9.00$, $df=3,281$, $p<.001$). For each measure, the group that moved from non-management to management posts recorded significantly higher ratings than the other groups, although the mean scores for each group indicated perceived increases in both responsibility and workload from 1995 to 2000. These results are illustrated in Figure 9.2. Two

further significant ($p<.05$) findings were that personnel on platforms perceived workload to have increased to a greater extent than those on drilling rigs, and that younger personnel perceived their responsibilities to have increased to a significantly ($p<.01$) greater extent than older personnel.



KEY TO GROUPS

A = No change, non-management job (n=191)
B = No-change, management job (n=40)
C = Change to management job (n=37)
D = Change of job, non-management (n=20)

Figure 9.2
Ratings of change in responsibility and workload, 1995 - 2000, in relation to job changes

9.5 CHANGES IN WORK SATISFACTION MEASURES IN RELATION TO JOB CHANGES AND INSTALLATION TYPE

9.5.1 Analysis model

The analysis model described in Section 9.4.1 was used to evaluate change from 1995 to 2000 in measures of work satisfaction (job satisfaction, satisfaction with job security and future prospects, and satisfaction with safety measures and procedures), in relation to job changes, installation type and age. The results are shown in Table 9.3.

9.5.2 Job satisfaction

As shown in Table 9.3, there was a significant interaction between 'year' and job change in the analysis of job satisfaction. Figure 9.3 illustrates the pattern of results; job satisfaction decreased marginally among those who did not change their jobs, but it increased among both groups that reported job changes. The increase in satisfaction was particularly marked among those who moved from non-management to management jobs (Group C). Further analysis showed that, among those moving from one non-management job to another (Group D), the favourable effect on job satisfaction occurred only on drilling rigs; on production platforms no increase in job satisfaction was found for GroupD.

Table 9.3
Analysis of change over time: work satisfaction measures

Measure	Repeated measures factor	Interactions with repeated measures factor			
	Year 1995 to 2000	*Year x job change group*	*Year x installation type*	*Year x age*	*Year x job change contrast* *
	df = 1	df = 3	df = 1	df = 1	df = 1
Job satisfaction	F = 1.58 ns	F = 4.93 p < 01	F < 1 ns	F = 1.75 ns	F = 12.83 p <.001
Job security	F < 1 ns	F = 1.46 ns	F = 6.37 p < 02	F < 1 ns	F < 1 ns
Satisfaction with safety	F = 5.77 p < .02	F = 1.10 ns	F < 1 ns	F < 1 ns	F < 1 ns

* *This column shows the significance of the interaction of the 'year' variable with the contrast between 'no job change' (Groups A + B) and 'job change' (Groups C + D).*

KEY TO GROUPS

A = No change, non-management job (n=191)
B = No-change, management job (n=40)
C = Change to management job (n=37)
D = Change of job, non-management (n=20)

Figure 9.3
Changes in job satisfaction, 1995 to 2000, in relation job changes

9.5.3 Job security and satisfaction with safety

The measure of *job security* showed a significant interaction of 'year' with installation type, but no significant interaction with job change. Whereas job security showed a marginal decrease between 1995 and 2000 on drilling rigs, there was an increase of comparable magnitude on production platforms. As shown in Table 9.3, there was a significant overall change in *satisfaction with safety* over time, but no significant interaction effects. Confirming the overall comparison noted in Section 9.3.2, satisfaction with safety decreased between 1995 and 2000.

9.6 CHANGES IN HEALTH-RELATED MEASURES IN RELATION TO JOB CHANGES AND INSTALLATION TYPE

In general, changes between 1995 and 2000 in mental health and physical health outcomes were less marked than changes in work perceptions and work satisfaction measures. The analyses of outcome measures that showed significant results are outlined below.

9.6.1 Measures of mental health

Scores on the General Health Questionnaire measure of psychological distress, and its sub-scales of anxiety and low morale, showed generally weak and/or complex patterns of results. The findings for anxiety were typical. For this measure, there was a significant three-way interaction, *year x job change x installation type* ($F=5.62$, $df=1, 281$, $p<.02$). Examination of the data showed that on production platforms, the effects of job change were non-significant although there was a significant overall increase in anxiety from 1995 to 2000 ($F=6.87$, $df=1,216$, $p<.01$). However, on drilling rigs, job change had a significant effect; personnel who changed jobs (Groups C and D) showed a marked decrease in anxiety whereas for those who remained in the same jobs (Groups A and B) anxiety increased between 1995 and 2000. These results are shown in Figure 9.4.

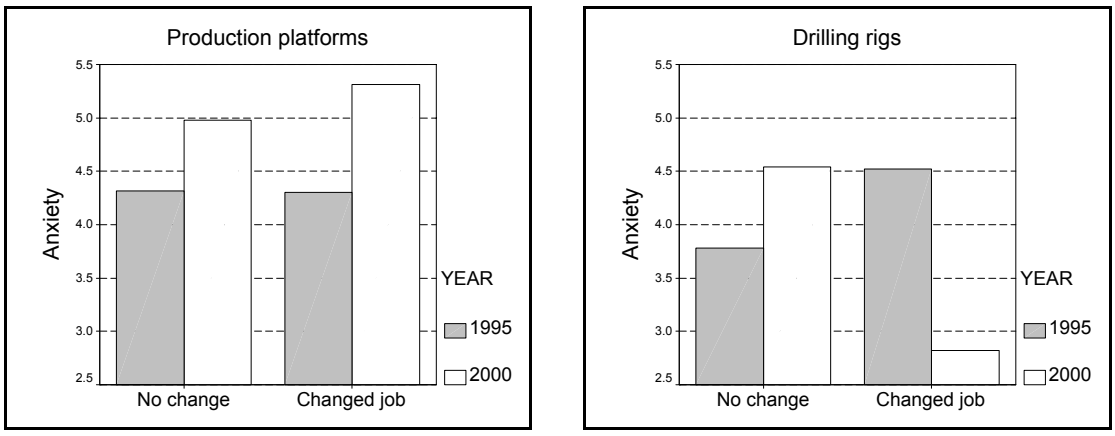


Figure 9.4
Changes in anxiety in relation to job change on platforms and rigs

9.6.2 Subjective ratings of health

A single item, "*Overall, how would you rate your physical health at the moment*?", was used to assess perceived health in 1995 and 2000. The response scale ran from 'poor' (1) to 'excellent' (5). Overall, ratings decreased significantly over time. There was also a significant *year x job change* interaction;

personnel who subsequently changed jobs rated their health more highly in 1995 than those who did not change jobs. However, in 2000 those who had changed jobs showed a more marked decrease in health ratings than those who had not changed jobs. This pattern of findings is shown in Figure 9.5.

9.6.3 Minor health complaints

Total scores were calculated for the minor health complaints scale (described in Section 7.1.1) in 1995 and in 2000. Tested by non-parametric analyses, scores increased significantly ($p<.005$) between 1995 and 2000. This effect was largely due to an increase in musculo-skeletal problems, particularly among those working on production platforms, and in older age groups.

9.6.4 Body mass index

Body mass index (BMI) was calculated from reported height and weight in 1995 and in 2000. Overall, the increase in BMI (from 26.1 to 26.8 kg/m^2) was highly significant ($t=7.79$, $df=282$, $p<.001$). Repeated-measures analysis showed a highly significant *year x age* interaction ($F=13.34$, $df=1$, $p<.001$), the increase in BMI being particularly marked among younger personnel. There was also a marginally significant interaction between year and job change group ($p<.10$); as shown in Figure 9.6, although all groups increased in BMI, the increase was greatest among those who moved to management jobs (Group C). In this group, BMI increased to a level closely comparable with that of continuing managers in 2000 (Group B).

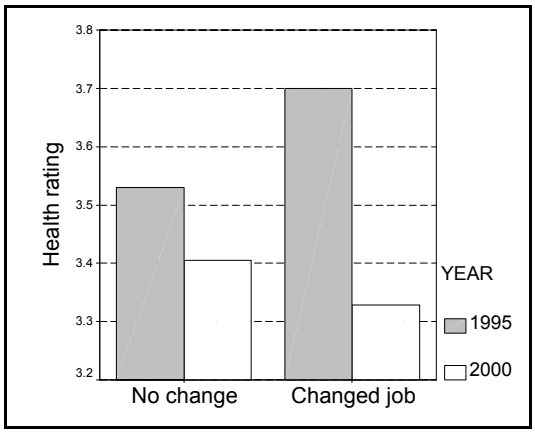


Figure 9.5
Change in health ratings in relation to job changes

Figure 9.6
Change in BMI in relation to job changes

9.7 CHANGE IN WORK ENVIRONMENT, WORK SATISFACTION AND HEALTH MEASURES IN RELATION TO JOB TYPE

The analyses reported above focus on the effects of job changes and type of installation rather than on differences between job categories; however, it is also possible that among personnel who remained in the same jobs between 1995 and 2000, the extent of change over time depended on job type. This possibility was examined by eliminating from the analysis participants who changed jobs, leaving a sample of 231 personnel in eight job types. In excluding personnel who moved to different jobs, any change in outcomes could be interpreted as due to change over time, rather than with change of job.

Changes between 1995 and 2000 in measures of the perceived work environment, work satisfaction, and health outcomes were examined in relation to installation type, job type, age, and neuroticism. The focus of interest in these analyses was the *year x job type* interaction. The

interaction was significant for one of the psychosocial measures analysed in this way, job satisfaction, F = 2.56, df=7,219, p<.015. The mean levels of job satisfaction for personnel in each job type in 1995 and 2000 are shown in Figure 9.7 in the form of a 'difference plot'.

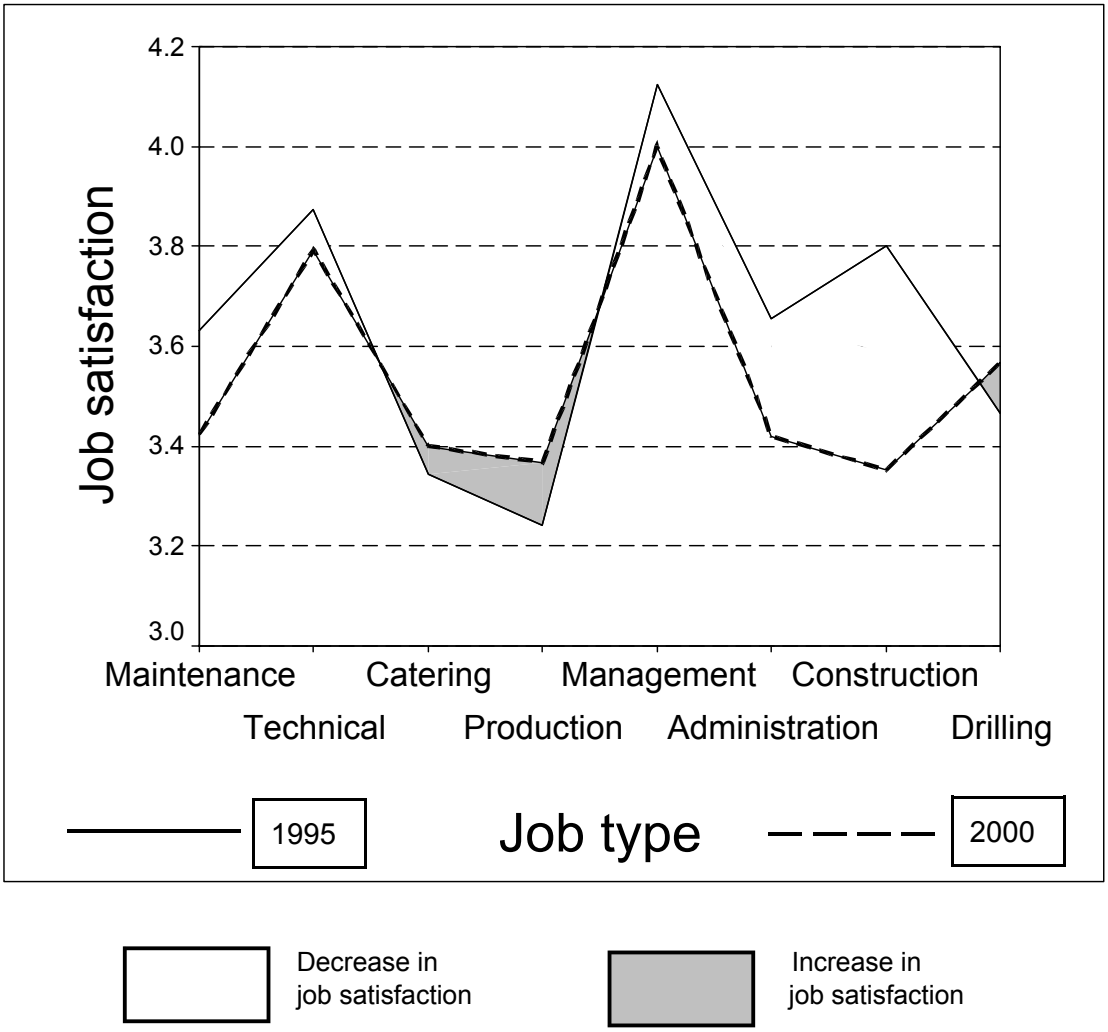


Figure 9.7
'Difference plot' showing increases and decreases in job satisfaction, 1995-2000, in relation to job type

It can be seen in Figure 9.7 that personnel in most job types show relatively small changes in job satisfaction. Only administration/specialist personnel and, in particular, construction workers, show marked decreases between 1995 and 2000, while three job groups (production, catering, and drilling) showed modest increases.

It is also clear from Figure 9.7 that differences in job satisfaction between personnel in different job groups are considerably larger than the changes that occurred between 1995 and 2000. As reported from the 1995 offshore survey data (Parkes et al. 1997), job types differed significantly on almost all psychosocial measures. However, the aim of the present analysis was not to examine differences between job types in absolute scores on the measures used, but to examine whether change over time differed significantly for different job types. With the exception of job satisfaction, as detailed above, no such differences were found to be significant in the present study.

SUMMARY

9.8 OFFSHORE FOLLOW-UP STUDY, 1995-2000

- This study evaluated the extent to which the perceived physical and psychosocial work environment, and the psychological well-being and health, of offshore personnel (N=288) changed over a period of five years. Both production platform and drilling rig personnel were included in the sample, as were personnel in all job types.

- Direct comparisons revealed few overall changes in psychosocial measures between 1995 and 2000. The main exceptions were significant reductions in job clarity, exposure to physical stressors, and satisfaction with safety, and an increase in anxiety. The reduction in satisfaction with safety was linked to the reduction in job clarity.

- Four groups were identified on the basis of job changes between 1995 and 2000. 66% of the sample had remained in the same non-management job (Group A); 14% had remained in the same management job (Group B); 13% had been promoted to management positions (Group C); and 7% had moved from one non-management job to another (Group D.

- Job change predicted change in physical stressors, workload, task variety/skill, job satisfaction, physical health ratings, and body mass index. Changes in these measures were primarily associated with job change; those who remained in the same jobs showed little change. In general, job change tended to be associated with favourable outcomes.

- The group that moved from non-management jobs to management roles (Group C) showed the most marked effects; between 1995 to 2000, this group became more similar to the continuing management group (Group B) in work perceptions, job satisfaction, and body mass index.

- On platforms, anxiety increased among all participants, whereas on drilling rigs, anxiety increased among those remaining in the same jobs, but decreased markedly among those moving to management positions.

- Among personnel who remained in the same jobs, no differences were found between different job types in the extent to which psychosocial measures changed between 1995 and 2000. The only exception was that change in job satisfaction varied significantly across job types.

10. CONCLUSIONS

The purpose of this concluding section is to bring together information about particular topics addressed in the report, highlighting points of general interest, and noting relevant health and safety issues; it is not intended to consider details of the analyses presented, nor to discuss the findings in an academic manner. First, however, to set the findings in context, it is important to note the nature of the data sets analysed, and the methodological strengths and limitations of the research as a whole.

10.1 METHODOLOGY

Considering, first, some favourable methodological features of the present work, the data set on which the FPSO study is based was moderately large, and the response rate from the installations concerned (84% overall) was high in comparison to most survey work carried out in the UK sector of the North Sea. The research also had the advantage that, thanks to the excellent co-operation received from the companies involved, it was possible for the data to be collected in the offshore environment rather than by postal survey, and for all the main occupational groups working offshore to be included.

Furthermore, the study reflects current conditions on FPSO installations (data collection continued until November 2002), and a wide range of measures was used. The analyses reported here do not cover all the information obtained, but were intended to focus on objective factors, such as installation characteristics and job types, in relation to subjective psychosocial data. The statistical methods allowed the independent effects of the predictor variables to be identified, and incorporated control for individual differences in 'negative affectivity', a major source of response bias in self-report data of this kind.

However, the favourable features of the present work do not overcome the inherent limitations of survey work in which information is collected by self-report, and in which data from individual participants are obtained on one occasion only ('cross-sectional' data). Data of this kind provide only a snapshot of conditions at one point in time, and are thus limited to evaluating associations between variables, rather than establishing the direction of effects. Although some directions of causation can be identified as being more plausible than others, and although survey data can highlight work areas in which particular problems exist, it is not possible to demonstrate unambiguously that a particular factor is a cause of some observed outcome.

The issue of cross-sectional data is also relevant to the comparison of different types of installations. The same methodological approach was used in the FPSO study as in the survey of production platforms and drilling rigs carried out in 1995 (Parkes *et al.*1997). The present report includes, in addition to the detailed analysis of FPSO data, comparisons of the psychosocial work environment and health outcomes on the three different types of installations. However, using cross-sectional data obtained at two different time points as the basis of these comparisons complicates interpretation of the findings.

In particular, it is not possible to distinguish between effects due to the different demands and constraints characteristic of different types of installations, effects due to differences in the selection and self-selection of personnel working on the different installations, and effects due to changes over the years between 1995 and 2002 applicable to the North Sea workforce generally. This final point was addressed in the follow-up study reported in Chapter 9.

The follow-up study demonstrated that among personnel who remained in the same type of job between 1995 and 2000 there were few significant changes in work perceptions, work satisfaction measures, and health-related variables. This finding reduces the possibility that comparisons across different types of installations were significantly distorted by the time interval between the collection of data on platforms and drilling rigs in 1995 and the collection of data on FPSO's in 2002.

Whilst the question of differential selection and self-selection of personnel into jobs on different types of installations cannot be directly resolved, it is unlikely to have played a major role in the findings reported here as personnel frequently transfer from one type of North Sea installation to another. Thus, to a large extent, differences observed among production platforms, drilling rigs, and FPSO's can be regarded as arising from the structural and psychosocial characteristics of work conditions on particular types of installations.

In reviewing the findings of the present work, the main emphasis is on the study of FPSO installations operating in the North Sea (which have not hitherto been the subject of research focusing on psychosocial factors). In addition, the direct comparison of three different types of installations, and the longitudinal study of change over time in offshore work conditions and well-being, contribute new information to the literature on offshore work.

10.2 REVIEW OF FINDINGS: FPSO STUDY

In the following sections, general aspects of the findings relating to FPSO installations are considered, with particular reference to points of interest which cut across the separate sections in which the data analyses were reported.

10.2.1 Installations

The installations that took part in the present study differed significantly on virtually all the measures described in the present report. Although no installation stood out as having the most favourable or the most unfavourable scores on all measures, some installations presented a generally more favourable picture than others, and some a generally less favourable picture. Differences between installations appeared to reflect the structure, design, and psychosocial environment of individual FPSO's , rather than the ethos of the operating company. Thus, whilst Installations 4 and 5 (both operated by the same company) were generally similar, Installations 1, 2, and 3 (also operated by a single company) showed considerable differences. Brief profiles of the seven installations that took part in the study are given below.

- *Installations 4 and 5.* These installations (both operated by the same company) had favourable profiles on all the work satisfaction measures, together with low/moderate workload ratings, and high levels of autonomy, job clarity, and co-worker support. Supervisor support was also perceived to be high on Installation 5, but not on Installation 4. Relative to other FPSO's, Installation 4 had low (i.e. favourable) scores on the measure assessing the effects on health and performance of installation movement in adverse weather conditions (this measure did not apply to Installation 5).

- *Installation 3.* This installation shared a number of favourable characteristics with Installations 4 and 5, but differed primarily in relation to social support, with relatively low scores on the measure of supervisor support, and particularly on the measure of co-worker support. Job clarity was also perceived to be low.

- *Installations 2 and 7.* The analyses revealed similarities between these two installations (operated by different companies) reflecting a relatively unfavourable work environment. Both installations had high workload ratings, low satisfaction with safety, low perceived autonomy, and high rates of minor health problems, especially headaches. Installation 7 also had high levels of anxiety in all job groups except maintenance, and low perceived support from co-workers, while job satisfaction and job security were moderate relative to other installations. Installation 2 had low scores on all work satisfaction measures, high exposure to physical environment stressors, and low supervisor support; however, co-worker support was perceived to be high on this installation.

- *Installations 1 and 6.* These installations were not clearly distinguished as either high scoring or low scoring on most of the measures used in the present study; relative to other installations, they tended to have moderate scores throughout. However, task variety/skill, autonomy, and supervisor support were relatively high on Installation 1, while on Installation 6 reported a particularly low level of adverse effects due to installation movement.

In part, the differences noted above can be attributed to differences in the age and design of the FPSO installations concerned. New, purpose-built installations tend to be more stable in relation to sea conditions and more modern in design; thus, both operational areas and accommodation/ recreational facilities are easier to maintain, and provide an environment which is more convenient and comfortable for work and leisure activities. Conversely, the oldest installation in the present study was originally built as a tanker some 20 years ago, and converted into an FPSO approximately eight years ago; in these circumstances, the physical surroundings are inevitably less favourable than on newer installations, and levels of workload and physical stressors reflected this more demanding environment.

10.2.2 Job types

The classification of job types in the FPSO data was more difficult than in the data collected in 1995. For instance, whereas previously it had been possible to identify separate 'maintenance' and 'technical/mechanical' groups, in the FPSO data analysis these categories were combined as they could not be clearly distinguished from the job titles and descriptions given. One reason for this difference may be increased requirements for multi-skilling among North Sea personnel and for flexibility in moving between previously separate roles.

None the less, significant differences between the job types identified were found for almost all the measures used in the present study. Moreover, the composite profiles (reported in Chapter 8) differentiated four of the six job groups in terms of work environment, work satisfaction and health measures. In general, the results corresponded closely to those reported in the previous study of fixed platforms and drilling rigs (Parkes et al. 1997); thus broad job categories tend to have generally similar characteristics irrespective of type of installation.

In particular, as previously, the combination of high workload and low variety/skill utilisation marked out catering as a particularly demanding occupation. Moreover, in the present study, all the catering staff worked 'equal time' work/leave cycles (i.e. 2-2 or 3-3) in contrast to the significant proportion (40%) of other personnel in the present study who worked more generous 2-3 work/leave schedules. The most favourable job characteristics were associated with management roles; although perceived workload was high in this group, it was balanced by high levels of task variety /skill utilisation, autonomy, social support, and job clarity.

Whilst structural features of installations do not lend themselves readily to modification, the psychosocial environment is potentially more amenable to change. As indicated by the analyses in Section 6.5, four work environment variables appeared to be particularly important as mediating variables in the process by which installations and job types impacted on psychological well-being and job satisfaction; these variables were supervisor support, task variety/skill utilisation, autonomy, and (inversely) workload.

These aspects of the work environment could form an initial intervention focus on installations that currently have a less favourable environment with the aim of enhancing conditions to levels more comparable with the 'benchmarks' represented by the most favourable scores. Similarly, the work conditions of personnel in job types characterised by adverse combinations of psychosocial and physical environment features could be re-examined.

10.2.3 Shift patterns and work/leave cycles

The present study did not allow a detailed empirical analysis of the effects of shift patterns and work/leave cycles as these factors could not be clearly separated from differences among installations and among job types; thus, some jobs (e.g. production) virtually always involved day/night shiftwork, and some work/leave cycles (e.g. 3-3 working) only operated on particular installations. Nonetheless, over and above the effects of installations, jobs, age and neuroticism, some significant findings relating to work/leave cycles were obtained, although the effects of day/night shifts as compared with day shifts were largely restricted to health outcomes (particularly sleep disturbance and gastric problems).

Consistent with earlier work (Parkes & Clark, 1997), the present study highlighted the unfavourable perceptions associated with 3-3 work cycles; thus, among FPSO personnel working 3-3 schedules, workload was perceived to be higher, and autonomy and support from supervisors and co-workers lower, than among personnel working other work cycles, over and above the effects of installations, job types, and control variables.

It was also clear from interviews that personnel considered the three-week offshore work periods to be of excessive duration (particularly in view of the intensive 12-hour shift duration, and the overtime hours worked by some personnel), and compared them unfavourably with the work patterns operating on other North Sea installations. Evidence from the literature (e.g. Krueger, 1989), on cumulative fatigue and performance impairments associated with extended work periods is relevant in this context.

An equally contentious issue arose on installations which had more than one work/leave cycle in operation (e.g. for different groups of personnel); thus, on several of the FPSO's in the present study, most personnel worked a 2-3 cycle (2-on, 3-off), but some worked a 2-2 cycle (2-on, 2-off). Inevitably, this discrepancy was a source of discontent among those with less generous shore leave, and the issue gave rise to widespread dissatisfaction among those concerned.

Whilst economic, employment, and logistic factors underlie the decisions made about work/leave cycles by different operating and contracting companies, the issue of discrepancies in work/leave cycles within and across different installations is potentially highly relevant to the work satisfaction, health and performance of offshore personnel. Although not amenable to detailed empirical analysis in the present study, it clearly merits further attention.

10.2.4 Psychological and physical health

Two initial points should be made in considering the levels of mental and physical health reported by the FPSO personnel. First, it is important to note that all offshore personnel must have a current medical certificate that requires a more rigorous medical examination than would be necessary for most onshore jobs. Consequently, the offshore population represents an unusually 'healthy worker' sample, and would therefore be expected to show more favourable health profiles as compared with onshore data (see Section 6.3.1).

Second, individual differences in personality are strong predictors of psychological symptoms and other affective measures (including work satisfaction) in survey data. In particular, the personality dimension of neuroticism accounts for a substantial proportion of the variation in measures of well-being; individuals with high scores on this measure tend to report high levels of psychological distress. Whilst wide variation in neuroticism is found among offshore personnel, the average level tends to be relatively low.

Offshore personnel also have relatively high scores on extraversion, and the combination of low neuroticism and high extraversion is associated with adaptability and good coping skills. Thus, personality plays an underlying role in the well-being of offshore personnel; however, work-related factors are also important. In the present study, there were significant differences in mental and physical health outcomes associated with job types, although differences between installations were less marked.

Installations. A complex pattern of findings was observed for the measure of anxiety in relation to installations. Installation 7 showed high anxiety levels (relative to other installations) for personnel in all job types except maintenance. On other installations, and in other operating companies, anxiety levels were generally lower but there was no consistency in the patterns across different job types. One possible factor underlying the anxiety findings was the differing levels of workload associated with particular jobs on different installations. This explanation is consistent with the pathways shown diagrammatically in Figure 6.8 which represents the central role of workload in relation to anxiety.

There were also significant differences between installations in the extent to which personnel considered that movement of the installation (in severe wind and sea conditions) had an adverse effect on health and performance. Of the six FPSO's (this measure did not apply to the fixed platform), two FPSO's (Installations 4 and 6) recorded particularly low scores, indicating greater stability of the installation, but none of the scores suggested that lack of stability caused major impairment of health or performance. The two installations on which personnel were most likely to report headaches (Installations 2 and 7) were among those on which relatively high levels of impairment due to installation movement were reported; the age and design of the installations concerned may have played a role in both these effects.

Job types. The most marked feature of the findings for differences in mental health across job types was the high rate of potential 'cases' (i.e. clinical or near-clinical levels of distress) among catering staff; the level of 39% (albeit on a small sample of 33 personnel) was more than double that among personnel in other job groups. However, the overall rate of 16.4% compared favourably with onshore comparison groups (see Section 6.3.1). More specifically, three job groups (maintenance, catering, and marine/deck/construction) reported poorer morale than other personnel. A shared feature of these roles is that they tend to be lower in job security than other offshore occupations.

10.3 REVIEW OF FINDINGS: COMPARISON OF PLATFORMS, DRILLING RIGS AND FPSO's

Combining the present FPSO data with the data obtained in 1995 from personnel working on production platforms and drilling rigs allowed the different types of installations to be compared on measures of the physical and psychosocial environment, work satisfaction, and measures of health and health-related behaviours. Before examining specific differences in psychosocial, safety, and health measures, some features of different types of installations should be noted.

In general, FPSO installations are more similar to drilling rigs than to fixed platforms. Thus, FPSO's and drilling rigs tend to have in common a marine culture (as opposed to a more production-oriented culture on platforms); in particular, a significant proportion of personnel on FPSO's and drilling rigs are directly involved in marine activities on board, or have previous experience on supply ships or other marine vessels. This seafaring background is much less frequent among personnel on platforms and has implications for, among other things, the attitudes of personnel to being away from home for extended periods.

A further difference between rigs and FPSO's on one hand, and production platforms on the other, is in size and stability. Thus, platforms tend to be larger than FPSO's or drilling rigs, to have a greater number of personnel on board (although recently-commissioned platforms are smaller than those built in the 1970's and 1980's) and, consequently, to have better recreational facilities and living accommodation. Moreover, platforms are more stable in severe sea or wind conditions, particularly as compared with FPSO installations. In all these respects, platforms may have a more favourable physical environment.

However, in other respects, FPSO's have a number of advantages. Thus, although FPSO's tend to remain in one location for a number of years, they are potentially mobile, and can be moved from one field to another when production from any particular well system decreases below economic levels. Similarly, drilling rigs move to new locations when work is completed in any particular field. This mobility does not apply to production platforms, whose personnel may become demoralised and concerned about possible redundancy as production levels decrease.

In the sections that follow, differences in psychosocial measures, safety perceptions, and health across the three types of installations are considered. In each case, the analyses took account of effects associated with job types, age profiles of personnel, and negative response biases.

10.3.1 Work environment

Physical environment measures. Personnel working on drilling rigs reported higher exposure to physical environment stressors than those on platforms or FPSO installations; in particular, exposure to both general physical stressors (e.g. noise, vibration, cold, and chemical hazards) and specific stressors (e.g. physical workload, working at heights) was significantly higher on rigs than on FPSO's. This difference could be largely attributed to the intensity of drilling activities which are a major source of physical environment stressors on rigs in contrast to the absence of such activities on FPSO's.

Psychosocial work environment measures. In contrast to the findings for physical stressors, for psychosocial work environment measures, FPSO's differed more markedly from production platforms than from drilling rigs. Thus, personnel on FPSO's reported significantly lower levels

of workload, but also lower levels of job variety/skill utilisation and co-worker support than those on platforms; for each of these measures, scores on FPSO installations were comparable to those on drilling rigs.

FPSO's also tended to have lower scores on the measure of job clarity than either platforms or drilling rigs. Further analyses suggested that job clarity played a role in satisfaction with safety; when differences in job clarity were taken into account, differences among types of installations in satisfaction with safety were much reduced. The implication of this finding is that increasing job clarity (e.g. by making task instructions more explicit, encouraging supervisor involvement in the planning of work activities, and ensuring that personnel know what is expected of them and what they can expect from others) should have a favourable effect on perceptions of, and satisfaction with, safety onboard.

Reported work hours and overtime. Consistent with the lower levels of workload reported by FPSO personnel as compared with those on production platforms, day-workers on FPSO's were less likely to report total work hours in excess of 94 hours per week (20.1%) than those on drilling rigs (36.3%). Day-workers on production platforms (42.4%) were the most likely to report working hours of 94+ hours. The constraints inherent in designing offshore shift patterns are such that the hours worked during a standard week (84 hours) are more than double a normal week onshore. In the light of evidence presented by Proctor *et al.* (1996), working a standard pattern of 12 hour shifts over the course of a two-week (or, in some cases, a three-week) offshore tour gives rise to concerns about cumulative fatigue and its impact on performance. Work significantly in excess of these hours (often worked by management personnel) must be inevitably a cause of even greater concern.

10.3.2 Work satisfaction

Each of the three work satisfaction measures differed significantly across types of installations. The most marked differences were between platforms and FPSO's; job satisfaction and satisfaction with safety were both significantly higher on platforms than on FPSO's; in each case, also, drilling rigs showed intermediate levels. Production platforms are larger and more stable than FPSO's, and usually have more spacious living and recreational facilities. They also have more favourable psychosocial work characteristics.

All these factors could contribute to the higher levels of job satisfaction and satisfaction with safety observed on platforms as compared with FPSO's. However, it should also be noted that evidence from the follow-up study suggested some overall reduction in satisfaction with safety between 1995 and 2000; this general change could partially account for the observed difference in satisfaction with safety between FPSO's (data collected in 2002) and platforms and drilling rigs (data collected in 1995).

In contrast to the other aspects of work satisfaction, for the measure of job security, personnel on production platforms had significantly lower scores than those on either FPSO's or rigs. This finding is probably attributable, at least in part, to the tendency for down-manning to occur on fixed platforms when oil and gas reserves become depleted and production costs increase. In contrast, as noted above, both drilling rigs and FPSO's are potentially mobile and can move to new fields when necessary.

10.3.3 Health complaints and health behaviours

Personnel working on FPSO's reported higher frequencies of headaches, sleep problems and musculo-skeletal complaints than those working on other types of installations, even when differences in age and in negative responses biases were taken into account. This result may reflect the relatively cramped conditions of work and recreation on FPSO installations, and their greater vulnerability to wind and sea conditions, as compared with other types of installations.

Rates of smoking were relatively low on FPSO's; thus, the higher rates of health problems on FPSO's as compared with other types of installations could not be attributed to differential rates of smoking. Among FPSO personnel, 72% were non-smokers, in contrast to 55% of those on drilling rigs, and 67% of those on platforms. However, FPSO personnel had higher levels of body mass index (BMI) than those on drilling rigs and platforms. This difference was partially accounted for by their lower rate of smoking and their greater average age, but even after these factors had been taken into account, the finding remained significant. The relatively small size and the restricted living space of FPSO installations may result in less energy being used in day-to-day work and living activities than on other types of installations.

10.4 REVIEW OF FINDINGS: FOLLOW-UP STUDY, 1995 - 2000

Longitudinal research in the North Sea oil and gas industry is rare, not least because of the difficulty of tracing individuals in a highly mobile workforce over a period of years. Thus, the only previous study that evaluated change over time among offshore workers (Rundmo, 1995) was based on two separate cohorts, rather than on repeated assessments of the same individuals as in the present study. Moreover, Rundmo's study was specifically concerned with the experience of risk and safety, rather than with more general issues of psychosocial factors and health. Thus, in spite of its limitations (in particular, it was only possible to obtain follow-up data from approximately one third of the potential sample), the follow-up study described in Chapter 9 adds a new dimension to the existing literature on offshore work.

In analysing the longitudinal data set, it was clear that whether or not individuals had changed jobs between 1995 and 2000 was a major factor determining the extent of change in psychosocial measures. Among personnel who did not change jobs, measures of work perceptions, job satisfaction, and health were largely stable across the five-year period. However, some significant changes were found. Both the absence of change in most measures, and the nature of the significant changes in a few measures, are of interest.

The lack of change in most of the measures analysed suggests that, from a psychosocial perspective, the North Sea work environment was relatively stable over the years concerned in spite of continuing exploration and operational development in the industry as a whole. Moreover, among those who did not change jobs, there was little evidence of significant differences across job groups in the nature and/or extent of change in psychosocial measures over the five-year period. These findings have implications for the comparison of different types of installations, as it suggests that the effects observed were primarily attributable to real structural and psychosocial differences, particularly between FPSO's and platforms, rather than solely to generalised changes over time.

However, some important measures did show significant changes; in particular, job clarity and satisfaction with safety both decreased while anxiety increased. The link between job clarity and satisfaction with safety parallels the similar finding noted in the cross-sectional analysis comparing different types of installations. One factor that may have served to reduce job clarity

over the five-year period of the follow-up study is the increase in multi-skilling and the consequent blurring of job boundaries and widening of responsibilities. Whilst flexibility in work tasks and roles is a desirable aim, reduction in job clarity was found to be directly related to reduction in satisfaction with safety, which in turn predicted increased anxiety.

Effects of job change. Whilst the discussion above is based on findings for personnel who did not change jobs during the five-year follow-up period, the effects of job change were also of interest. In particular, the group that moved from non-management jobs to management roles showed the most marked changes in measures of the physical and psychosocial environment. The nature of these changes was such that the individuals concerned showed a profile of responses in 2000 which differed from their responses in 1995, and closely resembled those of 'continuing managers' (ie. those who had already been in management positions in 1995).

The changes in work perceptions resulting from promotion to management jobs were largely favourable, for example, less exposure to physical environment stressors, greater task variety/skill, increased responsibility, and greater job satisfaction. However, less favourable aspects of moving to management posts were increased workload, lower subjective health ratings, and a tendency for body mass index to increase, this latter effect being most probably due to the more sedentary nature of management roles (Parkes, 2002). Some of these changes were also apparent among those who moved from one non-management post to another, although these were less marked..

10.5 FURTHER WORK

The findings of the present work generate a number of further questions and research issues that merit attention.

- The present findings suggest that wider use of survey measures such as those reported here to identify problems experienced by particular job groups offshore would be beneficial. More generally, this approach would allow 'benchmarks' to be established against which work conditions, job satisfaction, and health could be assessed, with the aim of bringing all installations to the level of the most favourable.

- The link between job clarity, safety perceptions and anxiety, and the possible role of multi-skilling requirements in this association, would merit further attention in view of the importance of safety in the offshore environment.

- Long work hours are an inherent aspect of offshore work, but the extent of overtime worked in excess of the normal 84-hour offshore week (particularly by day work personnel who do not have a back-to-back to take over at the end of a shift) is a cause for concern; there is a need to assess the extent of cumulative fatigue, impaired performance, and sleep loss associated with these long hours.

- The present results relate only to male offshore personnel; the number of women who took part in the survey work was too small to allow reliable analysis. Given the increasing numbers of women working in the North Sea, there is a need to increase understanding of the demands and constraints experienced by female offshore personnel, particularly as many of them are employed in catering, a job group known to be exposed to particularly difficult offshore work conditions. Moreover, it is possible that women working offshore experience greater difficulties in managing parental and domestic roles than their male counterparts.

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