PROTOCOL FOR FORMULA 1 TECHNICAL SUPPORT & PIT CREW STUDY

Title: Investigation of the working hours of Formula 1 technical support crews, and the effects upon mental health and neurobehavioural performance.

Organization: Institute of Occupational Health
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Approximate Duration: 18 months

Approximate Cost: £79,100

Introduction:

There is much interest in working hours issues, as an increasing number of organizations have introduced 12-hour shift systems during the last twenty years and this has provided the opportunity for a number of “natural” experiments where the health and performance of workers has been compared before and after the changeover from standard 8-hour to 12-hour shifts. In addition, some studies have carried out follow-up observations up to 5 years after the changeover. The results suggest that 12-hour shifts are generally very popular with workers, and produce improvements in job satisfaction and overall quality of life. Other studies have shown fewer reported health complaints following the adoption of the 12-hour system. Furthermore, data on both errors and accidents also appear to favor 12-hour shifts over 8-hour shifts.

These data tend to contradict the cumulative fatigue which may be translated into adverse effects on health and performance. For example an analysis of industrial accident data in Germany over a 12 month period showed that the risk of an accident increased exponentially after the 9th hour of work, although this risk was also related to the particular time of day. This contradiction may be explicable in terms of a range of other factors which are likely to modify the relationship between the number of hours worked and the health and safety of workers. These factors include the type of work undertaken (whether this is mental or physical or more or less demanding) the safety culture of the organization, the availability of
rest breaks and, importantly, the attitudes of the workers concerned. It has been suggested, for example, that fatigue and its effects may be greater in those who perceive themselves to be working excessive hours to cope with an over demanding or stressful work schedule, than in those who perceive a 12-hour shift to be a part of their normal work schedule, complete with the expectation of a long subsequent rest period. For these reasons it is difficult to predict the effects of any particular situation. In summary therefore, there is currently insufficient information on the potential risks to mental health and performance of this particular working environment.

**Objectives:**

The objectives of the study are to identify any acute and chronic effects upon worker mental health and neurobehavioural performance due to intense and extended work schedules, in the build up to racing, and during race periods, and any differences in the mental health and neurobehavioural performance of workers operating under different schedules operated by different teams. Another objective is to identify any modifying lifestyle factors, behaviours, or working practices that may modify the mental health and neurobehavioural performance of workers.

1. To identify a suitable cohort of pit crew / technicians in as many teams as possible within the Formula 1 organization.
2. To establish baseline measurements of mental health, mood states, personality, satisfaction, stress, and neurobehavioural function of those workers out of racing season / pre race season. To then establish the same measurements during the racing season.
3. To identify those psychological characteristics and social / demographic characteristics possessed by those pit crew / technicians who perform best on the measurements.
4. To develop a working model that enables team selection of pit crews and technicians based upon those factors associated with better mental and neurobehavioural performance.
5. To assess working environments and work practices to establish factors which may contribute to beneficial behaviour and performance in addition to the health and safety culture.
Methodology:

Study Design
A cross-sectional design would be used, employing a range of outcome measures to assess both the acute and chronic neurobehavioural and psychiatric effects of technical support work. Acute psychiatric effects of work exposure would be assessed at the start and end of shifts, with chronic effects of exposure being assessed before and/or after intense working periods.

Psychological Assessment Methods

Mood State.
The Profile of Mood States (POMS) is a 65-point adjective rating scale designed to measure the subjective sensations of feeling, affect, and mood. The POMS provides a rapid method of identifying transient and fluctuating affective states, across six identified factors; tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment. The six POMS mood scales have been shown to be a sensitive measure in both psychiatric samples, and also in non-psychiatric research samples. In addition to the six mood scales, the POMS also provides a global measure of Total Mood Disturbance (TMD) based on the summation of scores across all six factors. The TMD score is presumed to be reliable because of the high inter-correlations between the six primary POMS factors. The POMS is recommended for use with normal populations over 18 years of age who have had some high school education.

Mental Health.
The General Health Questionnaire (GHQ-28) would be used to assess the prevalence of psychiatric symptoms in workers. The GHQ was developed as a screening tool to detect those likely to have, or to be at risk of developing psychiatric disorder. The likelihood of “psychiatric caseness” is determined by a threshold score value. The abridged 28-item version of the questionnaire would be selected in preference to any other version (30-item, or 60-item) because of time considerations. The GHQ-28, as well as providing a global mental health score also provides four sub-scales; somatic symptoms, anxiety and insomnia, social dysfunction, and severe depression.

The Worry and Annoyance Questionnaire (WAQ).
The WAQ is a questionnaire that would be specifically tailored to the concerns of the workers in the study, as no other readily available questionnaire may be able to deal with the organization-specific issues that concerned the workers in the current study.

Occupational Satisfaction Index (OSI) satisfaction sub-scale.
The workers’ attitude to their job, and the subsequent satisfaction derived from the work-organization, would be measured using the 12 item satisfaction sub-scale of the OSI.
The Life Events Inventory (LEI).

The LEI is a checklist of recent stressful events, adapted from the original Schedule of Recent Experiences Checklist\textsuperscript{13} and its subsequent modification and re-naming as the Life Events Inventory\textsuperscript{14}. Workers would be asked to read the checklist of 55 life events and to indicate which they had experienced in the last six months. Workers then received a stressful event rating, based on the sum of the weights attached to each of those events that had been identified in the respondent’s life.

Neurobehavioural Evaluation System (NES).

Neurobehavioural (neuropsychological) testing allows for a detailed collection of quantitative data concerning cognitive functioning to be made. Such data takes the form of stimulus-response latencies, correct responses, and errors made (true errors or omissions) during test completion. Analysis of these data can indicate neurobehavioural effects in seemingly asymptomatic workers. Tests selected for the current study would be taken from the Neurobehavioural Evaluation System\textsuperscript{15}, version 4.2, which is a widely used testing software package developed for use in occupational health and environmental investigation. Specific tests would therefore selected to assess performance over a range of cognitive process, including sustained attention, short term memory, learning, mental manipulation, arithmetic ability, as well neurobehavioural functions of perceptual motor speed, reaction time, vigilance, and visual memory.

Data Collection Procedure

The data collection procedure would involve workers being tested in their place of work, using laptop computers to collect all data.

Statistical Analysis

Multivariate statistical analyses will be conducted:

(i) to compare mental health and neurobehavioural performance between technicians of differing work schedules.

(ii) to compare mental health and neurobehavioural performance in individual technicians at the beginning and end of their own work schedules.

(iii) to establish any identifiable factors within technicians that effect mental health and neurobehavioural performance (regardless of any working schedules’ effects) either positively or negatively.

(iv) to identify the effects of other environmental and chemical factors upon technicians’ performance.

(v) To develop a statistically reliable working model that enables team selection of pit crews and technicians based upon those factors associated with better mental and neurobehavioural performance.
Approximate Total Costs:

Details can be discussed further with participating teams, with the intention of splitting the overall costs between the participating teams. The following figures are based on costs of previous similar research projects with an estimated duration of 18 months:

**Staff costs:**
- Research Fellow, 18 months: approx. £30,000
- Research Associate, 6 months: approx. £9,000
- Secretarial assistance, 6 months: approx. £5,000
- Overheads and salary costs at 40%: approx. £17,600

**Consumable costs:**
- 10 Portable laptop computers: approx. £10,000
- Neurobehavioural testing software: approx. £500
- Software development: approx. £500
- Travel and subsistence during data collection: approx. £6,000
- Biological monitoring: approx. £500

**APPROXIMATE TOTAL £79,100**

Approximate Time Frame:

The study would be suited around the working practices of individual team and Formula 1 organization commitments, and is aimed to be as unobtrusive and non-invasive as possible.

Relevant experience:

The Institute of Occupational Health has extensive experience in carrying out large scale epidemiological studies related to working hours and hazard exposure. Researchers in the department have carried out previous neurobehavioural investigations associated with other occupational factors, and are currently investigating other neurobehavioural effects. Previous neurobehavioural and neurological studies have been funded by the HSE, international bodies, and industry.

Confidentiality:

The Institute of Occupational Health understands the sensitive nature of the research and safeguards the security and confidentiality of individual team data and procedures that it may be privy to. All data obtained by the Institute of Occupational Health is stored securely and analyzed entirely on site.
References:


