HEALTH ASSESSMENT and COMPUTERISED METHODS FOR ASSISTING DETERMINATION OF FITNESS FOR WORK

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ABSTRACT

Occupational Health Surveillance is a well accepted means of risk assessment. Tried and tested practices, procedures and processes have been developed, and guidelines for health surveillance using standard medical principals are available.

Fatigue, sleep deprivation, illness, and drug and other substance use in the workplace is perceived to be posing a significant threat to safety in the workplace. Employers attempting to discharge their duty of care are faced with implementing identification and control measures to counteract these problems. Unfortunately in a number of situations basic principles regarding health screening have, for one means or another, not been applied to this situation, and for example a number of drug and alcohol policies appear to rely on urinary drug screening as a means of risk identification and assessment.

This paper examines issues effecting fitness for work and some computer based applications, which may assist in the management of this problem.

INTRODUCTION

There is considerable concern over impairment in the workforce and the effect this impairment has on safety and productivity. Every day factors such as illness, sleep depravation, psychological stress, the effect of drugs, (both legal and illegal), as well as varying job demands may influence both productivity and safety. Clearly for optimum loss control risks associated with these must be managed.

Determination of an individuals fitness for work requires the identification and evaluation of risks associated with the working environment, workstation, work process, workpractices and individual worker. While this presentation will focus on mainly evaluation of risk of the individual, those identification and evaluation processes which take into consideration the working environment, are likely to produce a more comprehensive and accurate evaluation.

With modern computer technology interactive displays can be used as an assessment tool as well as providing information processing, and data base management. These tools are now becoming increasingly used to assist in this evaluation by the medical profession and health and safety professionals. Computerized means of undertaking these evaluations are being found in a number of workplaces, of varying degrees of complexity. The most sophisticated examples of these can be seen in the assessment of pilots by the commercial airlines and armed forces as well as, more locally, Queensland Rail's driver training simulators.

FITNESS FOR WORK ASSESSMENT

Traditional evaluation of fitness for work status has relied in the past on clinical medical examination however, as most would be aware, this type of evaluation contains serious practical limitations because of the dynamic nature of an individuals health, limitations in clinical measurement, and medical observation and assessment. For this reason, many occupational physicians see the benefits of a medical examination more as part of a pre-placement evaluation rather than pre-employment determination of fitness to work. It allows the recording baseline information and evaluation of health status, as well as providing some assessment of health and safety risk, and an indication of how this can best be managed.

This form of assessment now often incorporates a number of computerized assessments, particularly of hearing, respiratory, and other measurable physiological parameters such as strength, blood pressure,

heart rate and visual acuity. It is likely that in time a measurement of these parameters will be expanded, and developed on a more functional basis, providing a more useful database for the management of health and safety issues for both individuals, and populations.

Types Of Fitness For Duty Testing

Several human factors can be considered in determination of fitness for duty testing and the computerization makes measurement and evaluation a more practical management tool. Measures of biochemical values, neurological reflexes and performance tests are now becoming common. The three approaches are probably complementary, with perhaps some measures more appropriate for some occupations, due to their job or task relevance. Performance testing tends to measure more immediate job relevant issues where as biochemical and neurological measures may be more appropriate for the assessment of life style issues.

Table 1
TYPES OF FITNESS FOR DUTY TESTING

Biochemical

Direct (i.e. brain - not used)
Indirect (e.g. blood, expired air, urine, hair)

Behavioral
Neurological -
Subjective (e.g., DOT Standardized Field Sobriety Test, or SFST)
Objective (e.g., EEG evoked response, pupillometry

Performance
Motor -
Abstract (e.g., finger tapping).
Industrial (e.g. simulated driving)

Perceptual –
Abstract (e.g., pattern comparison)
Industrial

Higher cognitive -
Abstract (e.g., code substitution)
Industrial

Mixed –
Abstract
Industrial

This paper does not attempt to provide a critique, nor comprehensive list of tests. Those mentioned do however provide some indication of the variety of available systems.

BIOCHEMICAL

Direct biological testing of neurotransmitters is at present not yet available. Urine testing is one such counter measure increasingly implemented for the detection of exposure to drugs. The collection and laboratory testing of bodily fluids however is costly and time consuming and for this reason is typically used on a random basis. This considerably reduces the reliability of this assessment as a means of managing safety by relying on the fear factor which is directly proportional to the chances of detection. Additionally the turn around time is too slow to provide a true fitness screening method and accurate

interpretation of the data reduces the reliability of accurate decision making. . These and other concerns make this a rather unscientific means of control with significant practical limitations

BEHAVIORAL

Behavioral tests of a neuro physiological nature are available in Australia in the form of the *Fit 2000* test which measures pupil response to light, as well as scanning delay and velocity. This is a reflex test measuring involuntary responses and is not influenced by training or skill. It is quick to administer, has individual baselines. It relies on the findings that these responses are influenced by exposure to a number of factors such as sleep depravation, psychological stress, as well as a number of pharmacological substances, both legal and illegal.

PERFORMANCE TESTS

These may be characterised into areas of measurement of motor, perception and higher cognitive (thinking) areas. Motor tests require functioning neuro-muscular networks. They usually involve tests of strength and endurance, or reaction time. Perceptual tests require accurate recognition of stimuli testing higher neurological processing often involving tasks such as pattern or color recognition. Cognitive testing usually requires information processing, such as simple mathematical processing, code substitution or short term memory tasks. With developments in computerization, this testing is becoming more reliable. The possibility of integrating or combining some or all of the above tests in a complete package is now available.

Motor Performance

Established forms of computerized physical assessments such as *Cybex*, and more recently, the *Blenkinship* evaluation system, have been available for assessment of functional capabilities. These traditionally have been used in association with occupational rehabilitation for monitoring treatment progress, and more recently use in assessment of maximum effort, particularly with respect to medico-legal evaluations and the detection of less than optimum physical performance.

Other tests of motor function, often take the form of measures of reaction time such as the *Psychomotor Vigilance Task* used in various scientific investigations, as well as the United States for studies of reaction time in air crew, and commercial road transport drivers.

Perceptual Tests

Perceptual Tests of both an abstract, and practical nature are frequently performed in pre-employment, pre-placement and worksite assessments for factors relying on sensory input particularly for factors such as vision, hearing.

Higher Cognitive Tests

Higher Cognitive Tests usually incorporate both perceptual requirements as well as decision making, with responses and measurements often requiring some motor performance.

Critical tracking task testing such as *Factor 1000*, and *Ospat* have both been available in Australia. These tests rely on the tracking of a moving target as opposed to discrete reaction time testing. In these tests the complexity of decision making testing is determined by the variability and complexity of the tracking tasks. Testing results are rapidly available and testing time reduced. These tests also rely on a moving individual base line.

More complex higher cognitive tests involving divided attention testing, require an individual test of the ability of an individual to switch from one skill to another. With the exception of some driver simulation tests, this form of testing is not yet readily available in Australia, although development is currently well

underway. *Nova Scan* is a test available in North America and covers skills such as logical reasoning, decision making, numerical manipulation, short term memory, situation awareness, and tracking tasks.

The *Personal Safety Analyzer* is a matrix of tests developed in North America assesses the employees performance in a number of cognitive tasks measuring of speed of information extraction, processing, and speed and accuracy of information abstraction, decision making, and processing from the computer database. These tests include acquisition of information (in code) working memory, long term memory, decision making, and response selection and execution.

LIMITATIONS

Performance tests may be abstract, or not similar to workplace tasks or alternately may be drawn directly from the workplace i.e. (industrial). This may significantly effect the validity of the test. For example a color discrimination and interpretation task may use colours taken from a pallet designed on a computer screen for color blindness testing during a medical examination, or it may use colored indicator lamps from a control panel in the workplace. Clearly the more job specific the task and the closer its relationship to a real life situation, and the more valid the information.

Performance tests may use an absolute or relative pass / fail criteria or a mixture of both. Absolute criteria use a distribution of data collected from a representative sample of the population of interest. An individual's performance on a given test is then compared with expectations derived from that sample and assumes that the individual is a member of that population forming the bulk of the population. In the relative approach of the criteria is based on the distribution of scores provided by the individual, and therefore relates to that individual and is not influenced by population variability. In the mixed approach, one uses a moving window of recent performance by an employee to calculate that employees base line. The pass level is then set at a standard position within the individuals performance distribution, such as two standard deviations form the mean. Most of the commercial computerized tests use this approach. This procedure avoids some problems associated with use of population data, including inappropriate discrimination on the basis of age, sex, computer literacy, intelligence, education, dexterity, and even test anxiety. It also allows for improved performance arising out of familiarity with the test and practice. Using the individual as his or her own control also gives one greater sensitivity and specificity than do comparisons to a population norm.

Daily performance testing increases the sensitivity and specificity by increasing the number of tests performed, and allowing for test and retest comparison. If undertaken before work commencement, it is also useful in detecting psychomotor impairment in those not ready to commence work. In interpreting these results however, the reliability of the testing should be considered, i.e. how closely the measurements relate to the job demands. Failure identified by testing will only indicate that a test performance is impaired and the employee may not be able to perform safely. Passing the test however, indicates that the functions tested are working adequately. It gives no indication of other functions not tested, and therefore cannot be expected to guarantee that the job will be performed safely. It is difficult to identify, much less to test for, all of the cognitive and neuro physiological functions required to perform a job well. It therefore has limitations in identifying potentially unsafe situations where an impaired employer is allowed to work.

INTERPRETATION

One must remember that there is a wide range of normal values that humans are individuals, with considerable individual variability with gradual progression from health to ill health and fitness to unfitness, as well as other factors associated with genetic makeup, sex, and age. All of these make it difficult to find a "normal" values for individual workers even if it is confined soley to that group capable of working, as there will be fluctuating levels even for an individual, depending on their state of health, state of nutrition, as well as levels of fatigue, boredom, etc.

All of these factors make reliable, functional, and quantitative testing of fitness for work difficult as confounding factors may influence these evaluations considerably. For this reason, the interpretation of

this information for the individual workers requires skills and knowledge, not just of interpretation of the individual test, but also an awareness of confounding factors which may be contributing or influencing that test, especially if some intervention or useful management of reduced performance is to be undertaken.

CONCLUSION

As with any parameters associated with the measurement of human performance, norms for the population should be viewed with considerable skepticism. As mentioned previously, groups within a population may produce a wide variety of normal performance for a number of reasons, making interpretation of data against a normal population often meaningless. Systems using a continuum of performance for an individual over a period of time, should be considered more useful in both identifying, assessing and managing risks associated with an individuals ability to undertake any specific tasks.

The determination of fitness for work requires assessment of multiple factors. As yet there is no comprehensive technological means of determining this with any precision or certainty. At best, current technology can identify risk factors and quantify these risks. The management of these risks however, still requires appropriate interpretation and decision making by human input.

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