

IDENTIFYING THE IMPACT OF PSYCHOLOGICAL ILL-HEALTH ON SAFETY PERFORMANCE

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This paper describes a project initiated by BP to gain a deeper understanding of how safety performance is affected when personnel experience psychological ill-health at work. A great deal is already known about the effects of psychological ill-health on the individual, but this knowledge tends to focus on distress caused to the individual who is suffering from a clinical form of psychological ill-health and likely to be absent from work. There is less attention to the possible effects of pre-clinical or non-clinical forms of psychological ill-health on performance at work and safety. The impact on the organisation is usually calculated on the basis of absence from work and related lost productivity, however the impact on performance and safety is equally important, particularly in hazardous industries. This paper focuses on 'the walking wounded': those who are experiencing psychological health problems such as stress, depression, or anxiety but who are still working.

A review of previous studies into the forms of psychological ill-health found to be most common in the UK working population (e.g. anxiety, depression) was conducted to identify the effects that these conditions can have on human performance and accident occurrence. A number of practical implications for safety in the workplace are presented relating to the effects on human performance of common neuroses and commonly prescribed medication for psychological ill-health.

KEYWORDS: Human factors; safety, stress, anxiety, depression, human error, human performance

INTRODUCTION

In the UK, there has been a recent increase in attention to psychological ill-health at work, and work-related stress in particular. In correspondence with publication of *Securing Health Together* in 2000 the UK Health and Safety Executive (HSE) has funded extensive research and published guidance for employers in this area (see Smith et al, 2000). The research has been directed primarily at understanding the extent and the causes of psychological ill-health in the UK working population, resulting in a good level of understanding on the main 'risk factors' that can cause stress at work.

The last few years have also seen, both in the UK and elsewhere, a growing consideration of the impact of human performance on accidents and safety-related behaviours. On the one hand, research has focussed on the impact of factors external to the individual on their safety performance (e.g. safety culture, quality of the procedures available, equipment available and used etc). On the other hand there have been attempts at focusing on individuals themselves and the way certain personality traits or attitudes may impact on their safety. Overall, the first field of enquiry has arguably proved more fruitful.

What is missing, however, is a comprehensive understanding of the links between psychological wellbeing, human performance and safety. This should address two separate issues. First, whether suffering from psychological ill-health at work can impact on individuals' safety behaviour, and secondly, how the presence of sources of work-related stress may affect safety performance.

DEFINING PSYCHOLOGICAL ILL-HEALTH

The term psychological ill-health can cover a broad range of symptoms and experiences, from minor symptoms such as poor mood or tension, to longer-term major difficulties such as clinically diagnosable mental disorders.

In a clinical setting, the Diagnostic & Statistical Manual of Mental Disorders (DSM-4) is the most commonly used diagnostic aid for psychological ill-health in the UK. However, even the DSM-4 refers to the lack of an adequate consistent operational definition of 'mental disorder'. It presents the following as a definition:

"a clinically significant behavioural or psychological syndrome or pattern that occurs in an individual and that is associated with present distress or disability or with a significantly increased risk of suffering death, pain, disability or an important loss of freedom."

In a workplace setting, tools more sensitive to less severe forms of psychological ill-health have been designed. One of the most commonly-used scales is the General Health Questionnaire (GHQ) which is used for the detection of minor psychiatric disorders in the general population. The GHQ measures the frequency of the experience of symptoms common to minor mental disorder. The classification of experiencing a 'minor psychiatric disorder' is therefore made on the basis of the number of symptoms experienced by the individual over a given period of time. Example symptoms include not being able to concentrate, losing sleep over worry and losing confidence in own abilities.

Psychological ill-health in the workplace is commonly referred to as 'stress'. Stress is a very generic term defined by the Health and Safety Executive as: 'the adverse reaction people have to excessive pressures and other types of demand placed on them'. A variety of symptoms are commonly associated with the experience of stress; physical symptoms include heart disease, back pain and gastrointestinal disturbances. Psychological symptoms include anxiety and depression. Recently, some researchers have argued that the term 'stress' is not useful in research terms due to its generic nature. Therefore, the current research will focus on an analysis of the effects of anxiety and depression more specifically.

RESEARCH OBJECTIVES

In order to develop a comprehensive understanding of the links between psychological wellbeing, human performance and safety, the following research objectives were set:

- Determine the extent of psychological ill-health in the UK workplace

- Determine how specific forms of psychological ill-health impact on performance at work
- Produce recommendations about how to minimise the impact of psychological ill-health on safety in the safety-critical industries

PREVALENCE OF PSYCHOLOGICAL ILL-HEALTH

There is some variation in the different estimates of the extent of psychological ill health in the UK population. However, a recent report from the Mental Health Foundation (Bird, 1999) aimed to assemble and analyse research in this field and concluded that:

- One in four people will experience some kind of mental health problem in the course of a year;
- Between 10 and 25% of the general population present with mental health problems every year and of these 2-4% will suffer from a severe mental illness;
- Estimates of the number of people with severe and enduring mental health problems vary from 0.3 to 1.5% of the adult population. It is unlikely that people who fall into this category would be attending work.
- One in six people suffer from depression and 1 in 10 people suffer from anxiety in the UK;

These figures represent the UK population as a whole, but we know that 85% of people with serious mental health problems are economically inactive, therefore not currently in employment. The remaining 15% will be at work, or currently employed, and are more likely to suffer from common neuroses: depressive and anxiety disorders

Estimates of the prevalence of psychological ill-health at work vary greatly according to how this is measured. Common measurements include: sickness absence, clinical diagnosis in the working population and/ or access to treatment, questionnaire measures such as the General Health Questionnaire (GHQ) or measures of stress at work. A summary of evidence of this kind indicates that:

- Approximately 26% of the UK working population exhibit symptoms that might lead to a classification of minor psychiatric disorder;
- Approximately 20% consider their work to be very or extremely stressful and are likely to suffer from negative impact on their health;
- Approximately 16% of managers report having taken time off work in the last year due to stress;
- An average of 0.5 day's absence a year, based on current data from the HSE, is caused by stress;

The most common forms of psychological ill-health are depression and anxiety;

These figures indicate that psychological ill-health is a significant problem in the UK working population and that it is likely that the majority of people experiencing symptoms are still at work.

PSYCHOLOGICAL ILL-HEALTH AND PERFORMANCE

From the investigation of the prevalence of psychological ill-health in the working population, it was apparent that the most common reported conditions are anxiety and depressive disorders. The research into psychological ill-health and performance therefore focussed on these conditions.

ANXIETY

The human body is designed to react when we perceive a real or potential threat. Imagine the situation where a person is walking along a quiet street when there is a sudden loud noise nearby. One might expect the heart rate to increase, the muscles might tense, and the rate of breathing might increase. Changes such as these are designed to help us either fight the threat or flee from it, what is commonly known as the 'fight or flight' response.

When symptoms such as these occur in response to a valid stimulus (such as a loud noise), this is healthy and can be helpful. When they occur in the absence of a valid stimulus or when the individual experiences difficulty returning to a 'normal' state, they can be unhelpful. The experience of high arousal combined with feelings of worry (e.g. fear of failure), tend to be classed as anxiety.

Typically, anxiety can affect performance in a number of ways (Eysenck, 1983, Eysenck, 2000, Hanin, 1980):

- Change in focus of attention – attentional selectivity:
 - Increase in focus on the stimulus perceived to be the source of threat
 - Decreased ability to divide attention between multiple tasks or sources of information;
 - Decreased ability to integrate information from more than one source; leading to poor judgements
- Decrease in attentional capacity (e.g. Sephton et al, 2003):
 - Decrease in the amount of information that can be held in short-term memory;
 - Reduction in the ability to recall information from long-term memory;
- Increased perception of events as threats:
 - Increased reactivity to real threats but also more 'false alarms',
 - Increased conservative judgements and greater expressions of aggression towards others;
 - Increased the number of errors made whilst performing a task
 - Increased the number of irrelevant thoughts that can distract from the task in hand;
- Decreased efficiency in task performance
 - Increasing feelings of fatigue

There is also some evidence which suggests that anxiety can increase the likelihood of suffering from musculoskeletal disorders (MSDs), which could indirectly affect performance (Devereux et al, 2004).

These effects have all been documented in a non-clinical population – for example in people who are experiencing momentary anxiety. In a clinical population, clinicians would expect these effects to be debilitating and significantly disruptive of the individual's routine. The DSM-4 diagnosis also concentrates on the extent to which the individual feels able to control the worrying thoughts.

The effects of anxiety and high arousal vary from task to task, dependent on the specific skills required for accurate performance, and complexity of the task. For example, a highly complex task requiring integration of information from multiple sources would be more severely affected than a simple task.

DEPRESSION

When diagnosing an individual with depression, clinicians would usually be looking out for the experience of the majority of the following symptoms on a regular basis:

- Fatigue or loss of energy;
- Feelings of worthlessness or excessive guilt;
- Depressed mood most of the day;
- Diminished interest or pleasure;
- Significant weight loss or gain with no particular attempt to do so;
- Insomnia or, to a lesser extent, hypersomnia;
- Psychomotor agitation or retardation;
- Diminished ability to think or concentrate or indecisiveness;
- Recurrent thoughts of death.

Sufferers of depression often shy away from social contact and avoid these situations more than they may have done in the past. Common implications of this difficulty with social interaction are: difficulty communicating with others, avoiding non essential communication and interaction, difficulty remaining calm under pressure, difficulty getting on with others.

The effects of depression on performance tend to include:

- Negative cognitive focus:
 - Tendency for biased recall of information
 - Greater recall of negative (mood-congruent) information;
- Decreased general cognitive resource
 - Difficulty sustaining attention on one thing, frequent attention shifts;
 - Greater number of errors (both of omissions and commission);
 - Decreased ability to recall information;
- Decrease in energy/ general resources
 - Significant decrease in motivation
 - Significant increase in fatigue
 - Decrease in sense of reward from achieving positive performance – i.e. less motivation to perform a tasks well;

Evidence suggests that both simple tasks (for example needing fast reaction time) and complex tasks (requiring co-ordination of effort or decision making) would be affected by the depressed worker (Martin et al, 1996; Wang et al, 2004).

EFFECTS OF MEDICATION FOR COMMON PSYCHOLOGICAL DISORDERS ON PERFORMANCE

The use of prescribed medication to treat the symptoms of common psychological problems is on the increase. In particular, the use of some of the more modern anti-depressant medication has increased by around 460% over the last 5 years, due to the belief in it resulting in fewer side-effects. Despite this level of increase, there has been little research into the effects of such widespread use of medication on performance at work.

A recent study, however, found that workers taking medication for anxiety and depression who were still at work initially reported that it exacerbated the existing symptoms of the disorder (e.g. confusion, dizziness, nausea, lack of motivation and a general lack of engagement with activities), leading to a further decrement in work performance. Over time, patients seemed to have difficulty distinguishing between the effects of the ill health and the side-effects of the medication, reporting changes in their behaviour and various negative effects on performance at work. The experience of these effects led some patients discontinued their own medication – a dangerous situation that would decrease chances of successful, timely treatment and could result in further, more severe side effects.

A further study addressed work performance effects in more detail. It found that around 9% of the working population was using psychotropic medication, particularly antidepressants. The most interesting finding is that the most common class of antidepressant used, selective serotonin reuptake inhibitors (SSRIs), thought to have very few negative side-effects, actually did have a detrimental effect on cognitive performance in two ways:

- It increases reaction time;
- It impairs memory

The researchers found that people using SSRIs were also more likely to report losses of concentration and mistakes than a control group.

However, the study reported that there was no association between taking medication and minor injuries at work. The authors argue this could be explained by the low occurrence rates in the study; a conclusion that is supported by the fact that they did find association with increased work-related road traffic accidents and an association between use of older classes of anti-depressant and accidents and associations between use of SSRIs and accidents outside work. However, the authors note that, in some instances, taking medication was not the most important predictor of accidents. This means this may increase the likelihood of an accident only when other 'accident-prone' conditions are also present.

In summary, there is evidence to suggest a relationship between medication for depression and anxiety, and performance and safety at work. It is not yet clear how strong this relationship is or how much more medication can impact on accidents than other known factors. In patients reporting their own experiences, common effects are:

- Lack of concentration;
- Dizziness;
- Impaired judgement and decision-making;
- Impaired memory;
- Increased reaction time.

However, it is likely that some confusion exists in their own minds between the effects of the medication and the effects of the ill health itself.

PSYCHOLOGICAL ILL-HEALTH AND ACCIDENTS

The previous sections of this paper have reported that there is evidence to suggest that psychological ill-health and the prescription medication for the more common complaints can have an affect on performance. The question remains – is the effect on performance sufficient to influence the occurrence of accidents?

Human error theory states that humans are strongly influenced by the conditions in which they operate, and that there are certain conditions which are known to have an affect on human performance. These are known as Performance Shaping Factors (PSFs) and they cover aspects of the task, communications, procedures and documentation, ambient environment, training and experience, design of equipment, personal factors, and social and team factors.

It is possible that the likelihood that these PSFs could negatively influence performance could be exacerbated if the person is experiencing symptoms of psychological ill-health, and hence the likelihood of an error occurring could be increased. For example:

- Inability to concentrate is a common effect of some forms of psychological ill-health. This could affect division of attention and the ability to concentrate attention on a specific task. When PSFs such as multiple tasks, complex tasks, noise and distraction, communications quality, complex procedures, the design of the human-machine interface or co-ordination of efforts within a team are present, the strength of their influence on performance can be increased.
- Negative effects of psychological ill-health on memory can mean that the negative impacts of PSFs such as recency of training, level of experience, number and complexity of procedures and human-machine interaction can mean that performance is more negatively affected.
- Low levels of motivation can work in conjunction with social and team factors and task factors to negatively affect performance.
- Symptoms such as dizziness, nausea, headaches and lack of sleep can interact with environmental factors such as air quality, temperature and lighting to affect performance to a greater extent than the performance shaping factors alone.

So, this describes how performance could be further impaired under certain conditions, theoretically. But is there any evidence that psychological ill-health actually results in accidents?

There is little publicly available accident data for the process industries that can help to reveal information on the influence of psychological ill-health on accidents. Initial indications suggest that proprietary accident databases within the process industries could contain a wealth of information on this subject and project may be expanded to investigate this at a later date.

However, more is available for the transport sector. The evidence gathered to date from the freely-accessible accident data from the aviation industry suggests psychological ill-health or the influence of medication for commonly occurring conditions is a relatively common cause of accidents. The sources of data reviewed only related to accidents, so it is also probable that psychological ill-health contributes to a number of near-misses and incidents as well.

The USA National Transportation Safety Board database of airline accidents and incidents was consulted for accidents since 2000 where anxiety or depression, and taking of related medication, were significant factors. A total of 44 accident reports were found in the database. Of these, about 50% of the investigations concluded that psychological illness¹ was seen as either causal or contributory to the accident itself. Of these, 30% were suspected suicides. Excluding these suicides, 64% of the accidents where psychological ill health was reported as a significant factor resulted in fatalities.

Of these investigations, 50% mentioned there being some knowledge that the pilot or co-pilot suffered from depression (usually family), though the presence in the body of anti-depressant medication was found in nearly 60% of cases. There was a small number of cases that mentioned individuals suffering from depression but that did not find the presence of any anti-depressant medication; in all of these other forms of mood-altering substances were found: e.g. amphetamines or alcohol. This could suggest the pilots were attempting to self-medicate in some manner.

In 17% of the analysed investigations, anxiety was mentioned as a significant factor; of these, nearly 60% referred to an occurrence of panic in either the pilot or the passengers, rather than to longer-term suffering of anxiety. These occurrences tended to be those with less severe consequences. Nearly 18% of investigations found presence of medication to reduce anxiety in the body of the pilot or co-pilot. All of these accidents were fatalities and the anxiety and related medication was found to be either a cause or a contributory factor in over 40% of investigations where these were reported.

A major finding in this database is also that people are under-reporting their use of anti-depressants and other medication. Of all the cases where medication was found in the body (75% of the total):

- 6% of people had reported this in their compulsory medical examination;
- 63% had actively withheld this information when asked;

¹ Defined for the purpose of these analyses as either: knowledge that the individuals involved suffered from depression or anxiety; or presence of related medication in their body.

The rest fell mostly into categories where there was no compulsory medical examination: e.g. student pilots.

This was a particularly worrying find as the effects of medication were found to be a causal factor in a significant number of these accidents. In just under 40% of these investigations this was reported as likely to have been either the main cause or contributory factor. If we exclude all the suicides from the above, the amount of investigations where medication was found that reported this as a significant factor is closer to 30%. In the other cases, the presence of medication was found as part of the routine post-accident investigations and would otherwise have gone undetected.

Overall, the following comments can be made based on the accidents reported in this database:

- Accident reporting for psychological ill-health does not fit with the accident triangle – all accidents seem to be very serious, suggesting under-reporting of minor accidents;
- There is significant under-reporting of known psychological illnesses and of related prescribed medication;

When assessing the impact of psychological ill health on accidents, it is also worth research into work-related stress. A large-scale, longitudinal study carried out in the early 2000s indicated that people reporting high levels of stress did report a higher occurrence of accidents at work than those reporting low stress scores. This difference was significant for accidents at work but not in the home, though the authors urge caution due to low number of responses (Smith et al, 2000). There was no difference between high and low stress groups for minor injuries sustained.

There is clearly a need to perform a similar analysis to the one described above with data from the process industries. To date this has not been possible, but this is planned for a later phase in the research.

DISCUSSION AND CONCLUSIONS

The results of the research to date suggests that psychological ill-health definitely has an influence performance, and that this influence can be sufficiently powerful as to result in accidents. This has a number of implications for safety managers, line managers and individuals working in safety-related roles within the process industries.

IMPLICATIONS FOR SAFETY OF ANXIETY

For simple tasks where reaction time is important, arousal levels should not be allowed to become too low. Use of stimulating tasks to maintain arousal levels during critical periods can help reduce the likelihood of human failure leading to an incident.

Sustained exposure to high arousal conditions, such as periods of intense high workload, can be harmful even when there are no outward signs of a stress response.

For complex decision-making tasks, it will be important to be aware of the impact on thinking styles and decrease the experience of anxiety, by changing the physical symptoms or by supportively challenging anxious thoughts.

For tasks performed in circumstances of high anxiety or high arousal, deliberate slowing down or checking of responses is needed to ensure no errors are made.

Signal detection tasks can be impaired during high workload conditions. Consider either temporarily using additional personnel in parallel when detection tasks are critical, or employing automation.

IMPLICATIONS FOR SAFETY OF DEPRESSION

For simple tasks where reaction time is the most important elements, the biggest risk is a delay in the response to information, this can be both due to heightened potential for distraction and also due to falling interest in the task.

For complex tasks, the greatest risk will be from the negative thinking style and decreased interest in social interaction. This could lead to a lack of motivation and a belief in the inevitability of negative outcomes. A decrease in social interaction is also likely to worsen any bias in the individual's thinking.

The negative bias in thinking may actually prove to be useful in certain tasks, such as risk assessments. It could be that the depressed person will be more able to visualise some of the risks as real and therefore make a significant contribution to this. The main challenge will be how to move on from this perspective to one that is more constructive.

A key challenge for managing people who may be experiencing depression is to find ways in which to reward performance and keep motivation high. Simple performance feedback techniques that ensure praise is accurate, timely and person-specific will help as will explicitly asking the individual what they would find rewarding. Setting short-term objectives and breaking down longer-term goals into smaller chunks will also help.

IMPLICATIONS FOR SAFETY OF PRESCRIBED MEDICATION

From the evidence discussed, it is likely that the implications for safety of taking prescribed medication will be quite similar to those associated with the psychological ill-health for which it is taken.

The most at-risk areas reported in the available literature are:

- Driving;
- Operating machinery;
- Having responsibility for the care of others;
- Handling hazardous materials.

The added difficulty is that it may be difficult for the organisation to know whether staff are taking prescribed medication. Because the evidence about its impact on performance is not strong, organisations would not automatically be entitled to be made aware of the

medication's use. The case would be stronger for specific activities where there is stronger evidence of an impact, such as driving.

CONCLUSIONS

Psychological ill-health can influence the occurrence of accidents by affecting the ability of the individual to perform effectively and timeously and their ability to think and interpret information accurately. Psychological ill health may also interact with other task factors to increase the likelihood that the person could make an error. The effects of psychological ill health can also affect non-clinical populations (i.e. people from the general population who have not been clinically diagnosed with a form of psychological ill-health).

The organisation needs to be aware when personnel are experiencing symptoms of psychological ill-health, in order to be able to monitor the work of the individual. In addition, the individual should be assisted in developing greater understanding of common psychological states that are more likely to lead to errors or accidents.

The culture within the organisation needs to encourage personnel to report when they are experiencing such psychological states so that a judgement can be made on the types of tasks that the person should be asked to undertake. In the case of lone workers, their self awareness will be key in making this judgement about their own ability to conduct a task effectively.

The characteristics of tasks more likely to be negatively affected by psychological ill-health are:

- Having to complete multiple tasks or divide attention;
- Having to concentrate for long periods of time;
- Having to complete a very complex task;
- Working under high levels of noise or distraction;
- Having to use complex procedures;
- Having to co-ordinate work with other team members;
- Not having had initial or refresher training for critical aspects of the task for a long period of time;
- Tasks for which the individual is inexperienced;
- Tasks where existing environmental factors are already known to influence performance (e.g. high noise, extremes of temperature, poor lighting, etc.)

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