Safety critical work, ageing and cognitive decline

Fitness for work assessment is inherent to occupational medicine practice, whether at the pre-employment stage, or when a person is an established employee. Many occupational health practitioners are involved in the assessment of fitness of workers to undertake safety critical work, for example, driving a heavy goods vehicle or a train or working in health care. But, how do we define safety critical work and what constitutes a safety critical task? Furthermore, how do we assess fitness to carry out safety critical work? There is no generic definition of safety critical work within the literature that can be applied to all industries, although specific tasks or duties have been cited.

In relation to the construction industry, the Health and Safety Executive (HSE) has stated that some safety critical jobs involve activities that can place safety-critical workers at risk, unless the workers have full, unimpaired control of their physical and mental capabilities [1]. The HSE guidance advises that safety critical jobs should be defined by analysing duties or tasks that are inherent to the job. Similarly, The Railways and Other Guided Transport Systems (safety) Regulations 2006 do not contain a definition for safety critical work and again concentrate on a task-based system (providing specified safety critical tasks within the regulations) by which to identify safety critical workers [2]. However, as industries evolve and as technology and techniques advance, tasks may change, and it is important to have a system to assess fitness to work that can account for this. In the aviation industry, there is an established and systematic approach for assessing an individual’s fitness to work, which is used for air traffic control officers as well as commercial pilots. Each of these occupations contains tasks that are safety critical; therefore, workers are assessed according to established medical standards for risk of incapacitation due to medical causes in relation to carrying out these tasks.

However, applying a task-driven approach to identifying safety critical workers may not identify all those who should be assessed for medical fitness. For instance, there are certain occupations, such as flight engineers who do not undergo medical assessment for possible causes of incapacitation. It could be argued that assessment of flight engineers is necessary because they too have the potential to cause a significant adverse outcome if errors or omissions are not recognized by quality assurance systems that are already in place. Therefore, employees such as flight engineers are potentially indirectly safety critical workers, and medical causes of incapacitation are relevant in terms of their effect on safety, because an undetected error made by such a person could result in an adverse outcome.

In the health care sector, many groups of employees are responsible for making decisions in high-risk situations, and individuals are required to function at a level that delivers safe patient care at any time during the day or night. The introduction of re-validation for physicians [3] aims to address performance review, but this process does not comprise an on-going, regular assessment of medical risk of incapacitation and its potential effect on patient safety. As an employee, an assessment of medical fitness to work may be prompted by an episode of ill health, a period of absence from work, or substandard performance. Guidance from the General Medical Council relies on the individual doctor or colleague identifying impairment of a physician’s judgement or performance and acting upon this [4]. One might therefore question whether it is appropriate to rely on an individual doctor or colleague to report a problem, and whether doctors should be routinely assessed for incapacitation as they age. Beyond the remit of the General Medical Council, there are many other health care workers, who undertake tasks that are safety critical, for instance nursing staff that are responsible for the safe administration of prescribed drugs.

The issue of assessing fitness for safety critical work is likely to become more challenging and important as the retirement age increases. Recent changes, such as phasing out a default retirement age in the UK and age being defined as a protected characteristic in the Equality Act (2010) [5] means it is becoming increasingly important to consider an individual worker’s fitness to undertake duties, rather than to apply a set of rules to all. This requirement is particularly important for those engaged in safety critical work because of their responsibility for the safety of themselves, other workers and members of the general public. As the workforce ages, there is likely to be an increased demand on occupational health specialists to be able to assess older workers with potential cognitive impairment, and this deserves the same rigorous approach as any other aspect of medical assessment [6].

Cognitive function declines with age, in terms of information processing, memory and attention [7,8]. There is potential for this decline to be undetected, particularly in those performing a well-learned task, as experience and expertise can have a positive impact on individuals’ skilled cognitive performance [9,10]. There has been recent debate [11] surrounding the results of the Whitehall II study, which has found a significant...
decline in cognitive function over a 10 year period in a cohort of 7390 individuals, aged 45–70 years at the start of the 10 year follow-up [12]. This decline was recognized even in the youngest participants of the study and it has been suggested that these results are important for early detection and prevention of dementia [13], particularly in light of the findings of a meta-analysis of 47 studies, done in 2005, which concluded that deficits in multiple cognitive domains are characteristic of Alzheimer’s disease several years before clinical diagnosis [14]. It has also been shown that diseases such as diabetes and chronic bronchitis exacerbate cognitive decline [15], which is important as these common conditions will exist in safety critical workers, just as in the general population. Such evidence supports the need to implement systems to individually assess risk and degree of cognitive decline in safety critical workers as they age but more importantly to assess how this translates to their level of functioning, performance and potential adverse risk to safety.

It is not necessarily the case that older workers are impaired, compared with their younger counterparts, purely on the basis of their age. Cognitive impairment has also been associated with certain chronic medical conditions such as chronic kidney disease [16] and chronic obstructive airways disease with associated hypoxia [17,18]. Identification of appropriate tools for assessment of cognitive decline may not be straightforward when applied to assessing fitness for safety critical work as this may depend on the task in question and may be affected by the individual characteristics and functioning of different cognitive domains of each worker, relative to their job. It is important to establish baseline cognitive function for workers prior to any clinically evident decline, which, as suggested by the Whitehall II study, can occur as early as the fifth decade of life. In a recent editorial, Mair and Starr [15] have recommended that the use of choice reaction time and Addenbrooke’s Cognitive Examination may provide a good basis for detecting cognitive impairment within specific mental ability domains. This can be furthered within industries by assessing which domains are most important for safe operations in specific jobs.

While cognitive function (regardless of aetiology) may be quantified within the remit of specific laboratory tests, the challenge is in translating this into a predictor of function with respect to safety critical workers. It may therefore be more appropriate to assess all safety critical workers, identified as being at risk of cognitive decline, via simulated tasks that are functional assessments specific to their job, such as bi-annual simulator checks in commercial pilots. However, such assessment may not be easily reproducible or comparable. In assessing fitness to drive motor vehicles (in relation to private licensing), it has been suggested that not all in-car driver assessments that are done to assess novice drivers, are the same and that they may be unreliable in assessing fitness in experienced drivers. Furthermore, it has been suggested that experienced drivers may have over-learned basic skills so that these are preserved; giving a potentially inaccurate assessment of competence [19]. An evidence-based driver assessment method has been developed that may allow physicians to assess fitness to drive in relation to certain medical conditions, but when this assessment involves a driver with multiple medical conditions, taking multiple medications and at risk of age related cognitive impairment, then this assessment becomes much more complex [20]. It may be possible to apply such an assessment method to assess fitness in professional drivers.

A study looking at age and flight experience in relation to crash risk in professional pilots also found that there was a significant protective effect of experience (measured by total flight time) against risk of crash involvement, but that this effect levelled off at around 10 000 flight hours [21]. The paper also acknowledged that there may be a ‘healthy worker effect’ as a result of the rigorous medical assessment process involved with obtaining and maintaining a commercial pilot’s licence. In train drivers, there has been a study, which aimed to use a train simulator to evaluate human factors in relation to cerebral blood flow, measured by functional near-infrared spectroscopy. This suggested the possibility of evaluating the train driver’s state of attention for operation and that this method can observe brain activation caused by train operation [22]. This may be applicable to future functional assessment methods.

It may also be an area for further research; to identify the individual cognitive domains that are assessed by simulated functional tests and undertake a controlled comparison with laboratory tests of the same domains. Using research such as this, it may be possible in the future to predict the functional outcomes of cognitive function testing, relative to specific safety critical jobs.

Without an evidence-based definition of what constitutes safety critical work, it would be a time-consuming task, using a subjective, and potentially unreliable (opinion-based) process to identify who should and should not be assessed in terms of incapacitation and undetected cognitive decline. A generic assessment system may have practical applications that can be applied to any occupation and also identify any element of risk to safety that is inherent to a particular job. This may also be useful in identifying occupations with greater inherent risks or identifying groups of jobs with risk common problems, which may enable us to focus health assessment in relevant groups, bearing in mind that this can be an expensive and time-consuming task.

It is understandable that there should be concern about cognitive decline and its potential effect on safety within industries that are considered to be safety critical. Assessing this risk presents a number of challenges, but first, one must ask; who are we assessing? What may appear to be a
relatively simple task in defining safety critical work is in fact a multi-faceted one, involving input from many disciplines; within health care this should involve clinical staff, managers and health and safety professionals. However, it is important to start with an evidence-based definition that can be used as a basis on which to develop a framework for assessing medical fitness to work in safety critical workers.

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