

REVIEW

Criteria and methods used for the assessment of fitness for work: a systematic review

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Occup Environ Med 2007;**64**:304–312. doi: 10.1136/oem.2006.029397

The main findings from reports published in scientific journals on the criteria and methods used to assess fitness for work were reviewed. Systematic searches were made using internet engine searches (1966–2005) with related keywords. 39 reports were identified, mostly from the US and western Europe. Assessment of fitness for work is defined by most as the evaluation of a worker's capacity to work without risk to their own or others' health and safety. It is mainly assessed at recruitment (pre-offer or post-offer), and when changes of work or health conditions occur. Five main criteria used by occupational doctors to evaluate fitness for work were identified: the determination of worker's capacity and worker's risk in relation to his or her workplace, as well as ethical, economic and legal criteria. Most authors agreed that assessment tools used need to be specific and cost-effective, and probably none gives unequivocal answers. Outcomes from fitness for work assessments range from "fit" to "unfit", with other possible intermediate categories such as "fit subject to work modifications", "fit with restrictions" or "conditionally fit (temporarily, permanently)". Workplace modifications to improve or adjust working conditions must always be considered. There is confusion about the decision-making process to be used to judge about fitness for work. There is very scarce scientific evidence based on empirical data, probably because there are no standard or valid methodologies for all professions and circumstances.

the practice of occupational medicine. Detailed knowledge of both working and health conditions is required. Because of the changing nature of these two variables, fitness for work is a dynamic concept. Its assessment may be required at the beginning of the work relationship, after transfer of positions within employment, after the emergence of a health problem or periodically, especially for hazardous, physically demanding or safety-sensitive jobs. The assessment of fitness for work is regulated by specific and general legislation in many countries,^{3,4} although ambiguity often exists. Our hypothesis was that, despite being a cardinal activity of occupational health services, there are few or no validated criteria or recommendations on how to assess fitness for work. If confirmed, this could have important ethical (and possibly legal) implications due to inconsistent practice patterns, a sparse scientific basis and poorly articulated outcomes. The objective of this paper is to systematically review the available scientific literature on the criteria and methods used to assess and determine fitness for work.

METHODS

An electronic search of PubMed English or Spanish studies was conducted for the period May 1966–May 2005, including reports analysing and/or describing how to assess fitness for work in the context of occupational medicine practice, either centred on specific cases or by providing more general recommendations, from which data could be extrapolated on the criteria or decision-making processes. Types of reports included original papers, quantitative and narrative syntheses, guidelines or descriptions of programmes, opinion articles and editorials. Studies focusing on sickness absence certification or evaluation of the degree of permanent disability for compensation, and those dealing with fitness for work in relation to consumption of illegal drugs, were not within the scope of this review and were excluded. For a recent comprehensive review of the former, readers are referred to Wahsltröm and Alexanderson.⁵

The keywords initially identified for the search were "fitness for work" and "fitness for duty", which retrieved the highest number of related articles. However, there are no MeSH terms for these concepts. To overcome this, the list of terms included in the PubMed index was exhaustively reviewed, and the final search strategy included a

Occupational health aims to promote and maintain the highest degree of physical; mental and social well-being of workers in all occupations; to prevent decline in health caused by their working conditions; to protect workers in their employment from risks resulting from factors adverse to health; and to place and maintain workers in an occupational environment adapted to their physiological and psychological capabilities. In summary, it aims to adapt work to the workers and each worker to his or her job.¹ Within this frame, a critical function of the occupational health doctor is to assess whether such adaptation occurs spontaneously or if modifications or accommodations are necessary.

The assessment of fitness for work is defined as the determination of whether an individual is fit to perform his or her tasks without risk to self or others,² and is contextualised in this review within

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Accepted 20 October 2006
Published Online First
9 November 2006

combination of the following terms: fitness for work, fitness for duty, fitness to work, occupational fitness, fitness for employment, fitness for task, job fitness, pre-employment medical examination, pre-employment examination, periodical medical examination, assessment, evaluation, decision.

RESULTS

A total of 110 references were retrieved, none of them in Spanish. Of those, 60 did not meet the inclusion criteria. Eleven other publications were excluded because they were published before 1980, electronic copies were not available, access to paper copies was difficult and expensive or the requested copies were not received by the time the review was completed; furthermore, for all of them, the abstract suggested reasonable doubt of meeting the inclusion criteria or of adding new relevant information. This review is based on 39 reports.

Table 1 summarises the characteristics of the included articles. Publication dates were from 1984 to 2005: 5 studies were published before 1990, 11 between 1990 and 1995, 13 between 1996 and 2000 and 10 after 2000. Most were from the US ($n = 21$), seven from the UK, three each from Canada and The Netherlands, and one each from Australia, Hong Kong, Singapore, Israel and South Africa.

Most ($n = 16$) were non-systematic reviews of the literature, covering partial aspects of the assessment of fitness for work. Ten reports described guidelines ($n = 8$) or programmes ($n = 2$) and two were opinion articles or editorials. Eight were original research papers: four observational designs (cross-sectional or surveys),^{10 13-15} three laboratory experimental studies^{6 24 42} and one recent randomised controlled trial.⁴⁴ Three additional articles were case reports.

Twelve articles referred to the evaluation of fitness for work for specific occupational groups, mostly safety-sensitive or with

Table 1 Characteristics of the 39 articles on the assessment of fitness for work included in the review, by chronological order

Article	Country	Type of publication	Group	Occupations
Harber <i>et al</i> , 1984 ⁶	USA	Original	Occupational group	Miners
Floyd and Espir, 1986 ⁷	UK	Opinion	General	Any
Cowell, 1986 ⁸	Canada	Guidelines	General	Any
Robbins, 1988 ⁹	USA	Review	Disease	Any
Hessel and Zeiss, 1988 ¹⁰	South Africa	Original	Occupational group	Miners
Favata <i>et al</i> , 1990 ¹¹	USA	Review	Occupational group	Toxic waste
Shephard 1990 ¹²	Canada	Review	General	Any
de Kort <i>et al</i> , 1991 ¹³	The Netherlands	Original	General	Civil servants
Murphy 1992 ¹⁴	USA	Original	Disease	Any
de Kort <i>et al</i> , 1992 ¹⁵	The Netherlands	Original	General	Civil servants
Shepherd, 1992 ¹⁶	USA	Review	General	Any
Nethercott, 1994 ¹⁷	USA	Review	Disease	Any
Johns <i>et al</i> , 1994 ¹⁸	USA	Guidelines	Disease	Manual handlers
Hainer, 1994 ¹⁹	USA	Review	General	Any
Hoffman and Guidotti, 1994 ²⁰	Canada	Review	General	Any
Gerkin, 1995 ²¹	USA	Guidelines	Occupational group	Firemen
McCunney, 1996 ²²	USA	Review	General	Any
Davies, 1996 ²³	UK	Guidelines	General	Any
Stevens and Sykes, 1996 ²⁴	UK	Original	General	Any
Popper, 1997 ²⁵	USA	Review	Occupational group	Army
Colledge <i>et al</i> , 1999 ²⁶	USA	Guidelines	General	Any
Mohr <i>et al</i> , 1999 ²⁷	USA	Review	Disease	Any
Poole, 1999 ²⁸	UK	Guidelines	General	Any
Merkel <i>et al</i> , 2000 ²⁹	Israel	Case report	Occupational group	Army
Szeinuk <i>et al</i> , 2000 ³⁰	USA	Review	Occupational group	Respiratory protection users
Townsend, 2000 ³¹	USA	Guidelines	Disease	Any
Fletcher <i>et al</i> , 2000 ³²	USA	Review	General	Any
Rayson, 2000 ³³	UK	Editorial	General	Any
Chan <i>et al</i> , 2000 ³⁴	Singapore	Review	General	Any
Rigaud, 2001 ³⁵	USA	Review	Disease	Psiquiatric patients
Donoghue, 2001 ³⁶	Australia	Case report	Disease	Any
Sood and Redlich, 2001 ³⁷	USA	Review	Disease	Any
Wong and Lieh-Mak, 2001 ³⁸	Hong Kong	Case report	Disease	Firemen, customs officers
Glazier, 2002 ³⁹	UK	Review	Disease	Any
McGregor, 2003 ⁴⁰	UK	Programme	Occupational group	Airlines
Kashima, 2003 ⁴¹	USA	Programme	Occupational group	Truck drivers
McGorry <i>et al</i> , 2004 ⁴²	USA	Original	Occupational group	Meat industry
Anfang <i>et al</i> , 2005 ⁴³	USA	Guidelines	Occupational group	doctors
de Raad and Redekop, 2005 ⁴⁴	The Netherlands	Original	Occupational group	Army

special risks (soldiers, doctors, hazardous waste workers, airline personnel and meat industry workers). Eleven described methods to assess fitness for work for specific diseases or health conditions (eg, psychiatric, cardiovascular, respiratory, musculoskeletal disorders, skin diseases and so on). The remaining 16 were general reviews of fitness for work, including descriptions of authors' practices and programmes.

The information collected from the 39 articles included in this review was organised and summarised into six categories that reflect the process of assessing fitness for work: definition of fitness for work; criteria used to assess fitness for work; assessment tools used; decision-making process; and outcomes and circumstances that require the assessment of fitness for work (appendix A).

Definition

Half of the reports included a definition of assessment of fitness for work (table 2). The definition proposed by Cox *et al*² was cited by several authors, and, with slight variations, "the assessment of the individual's capacity to work without risk to their own or others' health and safety" would be the most-cited definition.

When definitions were analysed chronologically, their differences paralleled regulatory changes, although there was no clear cut-off point, and some authors seem ahead of their times. The first concept to appear was "capacity". This was followed by "risk" or "danger" with a trend of increasing relevance to safety requirements. A third concept that appeared in the literature was that of man-work bi-directional interac-

tion. Earlier reports focused more on worker's fitness, whereas concepts such as matching or adjusting (with work changes, adjustments or redesign) were progressively introduced later.^{6 8 18 20 22 26 34} A fourth concept considers the assessment of fitness for work as a risk evaluation of the adjustment from the job to the worker as well as risk from the worker to other workers and the public.⁴⁰

Other aspects included in the definitions are efficacy,² psychological or mental fitness,^{7 8 25 34 35} standardisation as a means to make decision-making a uniform and objective process^{7 35} and employer's responsibility in the final decision,^{7 27} attributing an advisor role to the doctor. Both doctor and employer are legally required to justify any recommendation on workers' inclusion or exclusion from work.²⁶

Criteria

By criteria, we refer to main factors that occupational doctors take into account when assessing fitness for work. They were addressed in all reports to some extent. According to Davies,²³ there are basically three criteria to assess fitness for work: worker's health and safety risk third-party health and safety risk and predicted performance and absenteeism. However, other aspects also emerged from this review. The identified criteria were systematised into five categories: (a) health and safety risk (mentioned in 34 articles); (b) determination of capacity (31 articles), especially physical, although the worker's psychological capacity was addressed in 11 reports; (c) ethical considerations (29 articles); (d) legal requirements (29 articles); and (e) economical criteria (19 articles).

Table 2 Definitions of the assessment of fitness for work proposed in the literature

Article	Definition
Harber <i>et al</i> , 1984 ⁶	To determine the match between the worker's ability and the occupational requirements.
Floyd and Espir, 1986 ⁷	Information on the medical history of applicants, which is used by employers to decide if their physical and mental capacity meets the required job standards.
Cowell, 1986 ⁸	Objective assessment of the physical and mental health of employees in relation to the requirements and working conditions of specific jobs, to ensure that the workers will not be a hazard to themselves or others.
Hessel and Zeiss, 1988 ¹⁰	To evaluate the ability of workers to perform their work without risks for themselves or others.
Nethercott, 1994 ¹⁷	To determine whether workers have a disease that may render them unable to perform the essential job functions with reasonable accommodation and without placing the worker and others at material risk of injury or disease.
Johns <i>et al</i> , 1994 ¹⁸	Matching worker abilities to essential functions of the job.
Hainer, 1994 ¹⁹	To make sure that an individual is fit to perform the work task assigned without risk to his or her health or to another's well-being.
Hoffman and Guidotti, 1994 ²⁰	The assessment of abilities (capabilities) rather than the disabilities (unfitness); the intent is to assess the worker's capability to perform a particular job, not to discover a health problem to disqualify a worker from employment. The worker's health is assessed in the context of specific job requirements to estimate the worker's ability to perform without risk to himself or others.
McCunney, 1996 ²²	To ensure a proper fit between the applicant and the job, so that the person's health is not placed at risk; a major element for safety-sensitive positions is to determine whether the person has a health condition that may place others at risk; to assess the risk, the concept of "direct threat" needs to be applied.
Davies, 1996 ²³	Definition by Cox <i>et al</i> : To make sure that an individual is fit to perform the task involved effectively and without risk to their own or others' health and safety.
Popper, 1997 ²⁵	Fitness for duty: individuals meet basic medical criteria to be accepted into and continue with a job (military) where they will not be at increased risk because of their medical history or current medical condition. Physical fitness: ability to perform various tasks requiring aerobic and anaerobic capacities with appropriate neuromuscular coordination.
Colledge <i>et al</i> , 1999 ²⁶	To match safely and appropriately the worker to the workplace.
Mohr <i>et al</i> , 1999 ²⁷	Medical opinions based on careful and systematic analysis of health problems, their relationship with the capacity and risk for a given job and the knowledge of potential adaptations; conclusions need to reflect the limitations of scientific knowledge and be guided by legislation against discrimination.
Merkel <i>et al</i> , 2000 ²⁹	Definition by Cox <i>et al</i> : To make sure that an individual is fit to perform the task involved effectively and without risk to their own or others' health and safety.
Chan <i>et al</i> , 2000 ³⁴	A two-pronged process of identifying work ability (whether physical, mental or mixed) of the individual (while screening for pathological disease) and correlating it with the respective nature of the work, with reasonable job redesign.
Rigaud, 2001 ³⁵	Fitness for work: a condition in which workers are physically, physiologically and psychologically/mentally capable of performing the tasks of their assigned jobs in required standards of safety, attendance, quality, efficiency and behaviour. An individual worker's fitness for work may either become temporarily or permanently, partially or totally, impaired by medical, psychological/mental/behavioural or physical conditions or by personal problems.
Glozier, 2002 ³⁹	To assess the capacity of workers to perform the job adequately, whether they pose health and safety risks and the likelihood of future sick leave.
McGregor, 2003 ⁴⁰	To identify those individuals who have an identifiable health condition relevant to safety or who have abnormal vulnerability to harm from a work process. Risk can then be managed by work adjustment, whenever reasonable, or by exclusion, if unavoidable.
Kashima, 2003 ⁴¹	To assess whether the worker has current adequate levels of the required physical agility, strength and cardiopulmonary capacity to carry out safely the essential tasks of his or her job.

Implementation of the Americans with Disabilities Act (ADA)³ in the US in 1992 which includes the prohibition of employment discrimination of people with disabilities, was a driving force for change in criteria to assess fitness for work. This effect carried over to other countries, as evidenced by an increasing number of articles published after 1992 addressing ethical and legal aspects, and especially health and safety risk criteria. Differences in criteria were also observed according to the article's approach. For those focused on occupations, safety is a key issue, and a high degree of physical capacity is usually required (eg, firemen), thus risk and capacity were given priority. Only half of those reports mentioned ethical or legal criteria, versus 80% of articles with other approaches, especially those disease-based. The balance between public safety concern and the protection of the individual against job discrimination must be sought.^{9 21}

Health and safety risk

The criterion of health and safety risk refers to the probability of occurrence of an adverse health effect on the worker, coworkers or the public. For several authors, it is not the doctor who has to decide which risks are acceptable or not, but rather the employer has to decide with the doctor's advice.^{18 23 26 28} According to ADA,³ the probability of substantial health damage needs to be high,¹⁹ and overprotection or paternalism of worker is not acceptable.¹⁷ The key issue is to determine which level of risk is acceptable to consider a worker fit. Interpretation of the ADA³ has led to an evolving legal standard for a level of risk that represents a "direct threat": it has to be significant, likely, imminent and severe, supported by scientific evidence and based on an individual assessment,²⁷ and not on population statistics or lifetime risks. It should be compared with other risks that are tolerated as acceptable in that particular work environment.³⁸ How this risk can be quantified is another important issue. In fact, in American case law demonstration of such a level of risk has been quite difficult. The concept of sudden incapacity or rapid loss of control has been proposed²⁹ and equations to calculate risk, allowing a significant degree of uncertainty, have been developed.³⁶ Some authors addressed the effectiveness of the assessment of fitness for work on preventing future health problems. On the basis of the observational research and case studies, Shepherd¹⁶ concluded that there is scant evidence on the effectiveness of medical pre-placement evaluations to prevent future risks. As has been noted by others, decisions on fitness appear to be often based on anecdotal evidence and unfounded assumptions about specific illnesses and risk, which can lead to unnecessary exclusion of candidates.²⁷

Physical capacity

Physical capacity is essential for highly demanding and risky occupations, especially when public safety is involved. Two aspects of fitness were proposed for soldiers: fitness for duty, which is related to risk and based on medical criteria, and physical fitness, which is based on an individual's physical condition and challenge tests.²⁵ Similarly, both medical and physical performance criteria are used for firemen, based on essential job functions.²¹ It has been recommended to include these criteria in the job description and disregard the inclusion of non-essential job functions, which could discriminate against otherwise qualified individuals.²¹ Evaluation of psychological and mental capacity was less mentioned, and mainly assessed in certain circumstances, such as known or suspected history of psychiatric disease, after a long sick leave for a psychiatric condition, when reduced performance, absenteeism or strange behaviour were present or for applicants to jobs with high psychological demands (policemen, submarine crews and astronauts).⁹

Ethics

Ethics involved in the assessment of fitness for work are complex, mainly because of the number of stakeholders (at least, doctor, worker and employer), who usually have different interests and perspectives. Several ethical aspects have been identified in this review. The right to be protected against discrimination is mentioned most often and has led to more legislation. Examples are the ADA in the US,³ the Disability Discrimination Act (DDA) in the UK⁴⁵ and the Disability Discrimination Ordinance (DDO) in Hong-Kong.⁴⁶ Some authors warn about the possibility of genetic discrimination.^{27 38} Respect for individual worker confidentiality has improved over the years, from direct access for the employer to information on the medical history of candidates⁷ to the requirement that the employer should only have access to the outcomes of the assessment,⁸ without divulging of specific medical diagnoses and limited to aspects related only to work.¹⁹ Workers also have the right to protection from unnecessary examination and testing,⁴⁰ and to receive information throughout the whole process on medical findings and the reasons for fitness restriction.^{8 19 20 43} They also have the right to appeal in case of disagreement⁴³ through specialised committees or tribunals.^{15 17 36 38}

Another ethical concern is the doctor's loyalty. For some authors, loyalty should always be to the patient.¹⁹ For others, it is also to the employer and the State.^{9 20 23} A general opinion is that the doctor has to find the balance between the legitimate concern of the employer to offer a safe workplace and the people's civil rights, especially if disabled. Some believe that the doctor who merely assesses fitness for work has no duty of care to the candidate and that adequate information and referral suffice.²⁸ Others believe that the assessing doctor has the duty to treat or refer the patient for adequate treatment if a health problem is identified.¹⁹ Finally, to avoid possible discrimination, equity needs to be guaranteed by performing similar assessment of fitness for work on all candidates applying for a similar job.^{19 21}

Employment and earning capacity

Decisions that affect worker's employment and earning capacity carry heavy legal and ethical responsibilities.¹⁸ Employers respond to economic arguments and legislation,³⁹ thus legislation links ethical requirements and economical aspects. Existing legislation on fitness for work varies across countries and is mainly focused on preserving people's rights, as explained above. There is specific legislation for high-risk occupations, such as professional drivers, pilots and nuclear power workers in the US.²⁷ Recognised professional guidelines at national level also exist, such as those for teachers, food handlers or healthcare workers in the UK,²³ and policemen, emergencies personnel or firemen in the US.²¹ In Canada, the Individual's Rights Protection Act (RSA 1980)⁴⁷ stimulated the design of formal assessments of occupational fitness, and occupational health and safety acts were passed by the different provinces.^{8 12} The ADA requires determination of the conditions under which individuals can work, encouraging a combined effort between the impaired employee, the healthcare provider and the employer to arrange reasonable accommodations.^{26 27} Both the ADA and the DDA give a legal definition of disability. Candidates with health problems but not considered disabled by law are not protected, and may potentially be discriminated against. This is criticised by most authors but supported by others for whom the employer has the right to expect employees to attend work regularly, justifying discrimination against non-disabled candidates with a history or condition supposedly associated with increased sickness absence (ie, obesity, smoking, asthma, heart disease, diabetes, etc).²⁸ However, for others, the identification of such workers would

only be ethical to assess the possibility of individual support and workplace adjustments.³⁹ Another important legal aspect in countries under the European Union frame directive on health and safety at work, is the employer's liability to protect workers against occupational injuries and diseases, both physical and mental,³³⁻³⁹ which would justify the final decision on fitness for work by the employer.

Economics

By economic criteria, we include the assessment of fitness for work to predict company's future financial losses because of potential health-related problems of the candidates. Examples are sickness absence, early retirement or permanent disability and compensation or claims for occupational injuries and diseases, and assessment of worker's productivity, performance or efficacy in his or her job tasks. A Dutch survey showed that the aim of the pre-employment medical examination differed widely among doctors, ranging from the applicant's assessment of health risks to the assessment of employer's economical risks.¹³ In some countries, the certificate of fitness for work is equivalent to the candidate's acceptance in a pension plan or a company's private medical insurance. A survey in the US showed that 68% of occupational doctors reported certifying candidates with hypertension as unfit, probably because their inclusion in the workplace would increase the company's health insurance annual premium.¹⁴ However, cut-off values of blood pressure used were arbitrary, variable and unrelated to the type of work tasks, and the survey highlighted confusion among professionals and the need for guidelines to prevent inappropriate job exclusion.¹⁴

Whether economic criteria have to be taken into account and evaluated by occupational doctors has been a matter of intense debate, with great discrepancies among authors, and some recent reports stating that this function is not within the purview of the doctor.²¹⁻⁴⁰ The existing scarce evidence, based primarily on observational research and case studies, suggests that pre-employment examinations are not cost-effective in preventing a company's potential financial loss,¹⁶ and the validity of methods to predict worker's future health is also a matter of concern.⁴⁰

Assessment tools

Most reported assessment tools applied to individuals were diagnostic tests (30 articles), especially basic tests, although more sophisticated ones are selected in specific situations⁶⁻²¹⁻²⁵⁻³⁰; clinical interview and physical examination (23); occupational history (13); health questionnaires (12) and other types of questionnaires (6), such as the Work Ability Index³⁴ or other standardised questionnaires.³⁹⁻⁴² Health questionnaires are used in some occasions as the only mean or first step to assess fitness for work.¹⁹⁻³⁹⁻⁴⁰ Adjustment skills simulations⁹ have also been used to assess individuals' fitness to work, and even a polygraph had been used in the past to protect companies' property rights.⁹

It has been well acknowledged, however, that health evaluation alone is not enough. The doctor's awareness of the requirements of a particular job is another key aspect when assessing fitness for work.⁸ Regarding tools applied to work, the majority of reports (n = 27) agree that detailed and clear information is needed on work conditions, such as job tasks,¹⁹ exposures and organisation, which may include site visits to obtain first-hand information. The importance of essential tasks and risk assessment is stressed in 10 and 15 reports, respectively, although this information is often scarce and unspecific, when not lacking, and too often provided solely by the worker. According to Rayson,³³ any assessment should be tailored to the functional requirements and risks of the job, and the functional capacity (ie, the worker's ability to carry out the

essential tasks of the job), and be assessed through a job analysis on the basis of the quantification of the physical demands. Some tools have been evaluated to determine functional job requirements⁶ and physical capacity.²⁴⁻⁴² Several authors emphasise the importance of determining the essential job functions, which should be made by the employer, the occupational doctor and/or other experts.¹⁷⁻³⁸ For example, a committee of occupational doctors, assessed by members of the fire service, developed an authorised guideline based on the essential job functions to assess fitness of firemen in the US.²¹

Twelve reports addressed the need to rationalise the use of assessment tools. It has been noted that programmes should be cost-effective⁴⁰ and determined by the specific risks in the workplace,¹⁰ including information on job requirements, targeted occupational and health histories, selective physical examination and laboratory and specialised testing.¹⁹

Four articles commented on the role of nurses in the assessment of fitness for work,¹⁰⁻¹⁹⁻³⁰⁻⁴⁰ which might entail obtaining the medical history, performing selective clinical examination and diagnostic tests, and referring selected individuals to the doctor.

Decision-making process

One quarter of the articles do not address the decision-making process at all. Another 25% just mention that the doctor "forms an opinion, or arrives at a clinical judgment", and only the other half describe, however briefly, how to reach this decision. For most such reports, the decision-making process is based on disease diagnosis, either on a case-by-case basis and according to the clinical judgement of the individual doctor, or by applying standardised criteria for disease groups. Sometimes, medical and physical standards are used, which are based on safety risks and essential functions, and ideally should be validated for each post.²¹ For some specific occupations, the establishment of absolute physical capacity standards, independent of age, sex, race, disability and so on, can be justified.²⁵

However, functional capacity varies widely among patients with the same diagnosis. An alternative method would be to assess the worker's functional capacity (described in 14 reports), either visual, auditory, physical strength and balance, mental and social capacity and so on, considering also the safety and the possibility of workplace accommodation.³⁴ Task simulation or validated tests can be used to assess functional capacity.⁴¹ A more comprehensive proposed method would involve first the analysis of work conditions and required health standards for the job, then meeting this information with medical findings, and finally, the joint assessment of all factors.⁸

Outcomes

Outcomes referred to the worker are usually given as fit, not fit or fit with conditions/restrictions, either temporary or permanent.⁸ Poole²⁸ adds a category of "fit but at increased risk of above-average sickness absence".

One study found a low degree of agreement (31–37% of discordant pairs) on medical fitness for a job between experienced occupational doctors, even when pre-defined criteria were established.¹⁵ According to Mohr *et al*,²⁷ and given the weakness of the evidence in most cases, the concept of "medical clearance" is less useful than direct communication of the range of possible risks and associated uncertainties. For minor or highly improbable risks, the worker should decide after receiving full information from the doctor, whereas more significant risks, close to the threshold of direct threat, warrant discussion with the employer. The ideal outcome would be to reduce the work-related component of risk through accommodation, engineering control of hazards or alternative placement. The occupational doctor should have a central role in

facilitating this process. In some specific situations, however, worker rejection will be unavoidable.²⁷

In all, 65% of articles emphasised the importance of evaluating work conditions over worker capabilities, followed by workplace adjustments or modifications, redesign or adoption of preventive measures, which may benefit all exposed workers or enable an individual worker with special characteristics into work. If reasonable, accommodations should be made by the employer.²⁶

Declaring a worker unfit should be the last resort. A survey on Dutch civil servant candidates reported an overall rejection percentage of 0.6%, which was higher for occupations with a public safety component and high physical demands, but never exceeding 4%.¹³ "Enabling options", such as allowing progressive return to work, temporary reduction of duties or changes in functions or schedule; risk prevention and control; or implementing previously unexplored medical treatments, should always be considered when assessing fitness for work.²³

Circumstances that require fitness for work examinations

This was addressed in the majority of reports. The most frequent scenario is at pre-employment or pre-placement. About half of all workers are evaluated at employment in the US.²⁷ Also, 300 000 pre-employment health examinations were carried out in 1998 in The Netherlands.¹³ For some occupations entailing high physical demands or safety risks, screening may be justified to select individuals able to perform their duties without risk for themselves or others.¹⁹ A key issue, because of potential discrimination, is whether the evaluation is timed at pre-employment (before the employment offer) or at pre-placement (after the employment offer). In some countries, such as in the UK, pre-employment examinations are permitted,³⁹ whereas they are illegal in the US^{16 17} after implementing the ADA in 1992.³ The identified literature illustrates this because pre-employment evaluations were described in 60% of reports published before 1992 and only in 25% reports after 1993, whereas the proportion of reports mentioning pre-placement evaluations increased from 40% to 69% before and after 1992, respectively.

Seventeen reports also mention that evaluations are also carried out at return to work after a period of sick leave to identify health changes, impairments and possible disabilities that may need work adjustments.

Eleven articles reported on periodic assessments on fitness to work, mainly for safety-sensitive occupations (firemen, soldiers, professional drivers, workers of toxic waste plants) that are often regulated by mandatory legislation. For other occupations, the responsibility is shifted onto workers to report changes in health conditions or use of medication that may have an impact on safety.^{30 40}

Other reported circumstances are at redeployment, modifications of working conditions or when a health problem appears,¹⁹ at the request of the worker, employer, supervisor³⁰ or from the public administration⁴³ and, in general, when new problems appear.^{31 32 37}

DISCUSSION

The assessment of fitness for work is a function in occupational medicine that has important implications, especially prevailing job opportunities. We sought to systematically review the research, views and experiences on the criteria and methods used to assess fitness for work published in the scientific literature, internationally and from the occupational medicine perspective. We found that the assessment of fitness for work is defined as the evaluation of the individual's capacity to work without risk to their own or others' health and safety. It is carried out to prevent future health and safety risk for the

worker or candidate, coworkers and the public. A good balance is needed between job opportunities and health and safety risks. There is some evidence that efforts to increase the adjustment of work to the worker reduce the likelihood of injuries in highly demanding and safety-risk jobs. For such occupations, determining the physical and psychological capacities for essential job functions is needed and their inclusion in the job description is recommended. However, the establishment of a threshold risk or an acceptable level of risk is difficult and often needs a multipart, expert-based consensus. Companies' potential financial loss due to possible future health outcomes is a further criterion that is sometimes used to assess fitness for work. However, no evidence suggests that it is cost-effective to examine all candidates and preclude those considered unfit on the basis of medical diagnosis, susceptibility or previous sickness absences. Because of potential imbalance between workers, and employers' expectations, there are important ethical and legal implications in the assessment of fitness for work: the right to confidentiality and information, and against discrimination and unnecessary testing, as well as the right of appeal in case of disagreement. There is a general belief that the occupational doctor should find the balance between loyalty to the patient and the duty of employers to offer safe and non-risky jobs. Both medical diagnostic tools and indepth direct description of essential tasks and job analysis are needed to assess fitness for work. Obtaining all this information is a desirable process to reach well-sustained outcomes on fitness. These outcomes usually include fit, fit with conditions/restrictions, either temporary or permanent, and not fit. The latter should be the exception and enabling options should always be considered. There is evidence of inconsistencies and low validity of judgements, so standardised criteria are needed.

Our review is based mainly on narrative, non-systematic reviews covering partial aspects of the assessment of fitness for work, and descriptions of guidelines and programmes. Only eight original research papers were identified, although one old review on research of the benefits of fitness for work examinations added a further 13 research articles published before 1989,¹⁶ which we were not able to locate. Only publications in English were included, thus the results obtained in this review represent the views and practice mainly from English-speaking countries and The Netherlands. This frame may not be similar to that in other southern and eastern European countries, and it is possible that articles not included in the review because of language barriers report different perspectives, as the assessment of fitness for work is not a universal or static concept. Despite this, we think it brings sufficient common elements to raise conclusions that may be used in many different environments.

IMPLICATIONS FOR PRACTICE AND RESEARCH

The available scientific evidence raises some interesting issues for practice: (1) fitness for work is mainly determined by job safety and physical demands rather than on medical conditions of candidates, with psychiatric conditions and age being possible exceptions^{10 13}; (2) the assessments of fitness for work focused on job requirements appear to be better predictors of future health outcomes and costs than those focused solely on medical diagnoses⁴⁴; (3) despite being common occupational medicine practice, the available research indicates that the validity and effectiveness of judgements on unfitness for work are doubtful^{15 48}; (4) even for common medical conditions, such as hypertension, no standardised criteria were used to measure and interpret blood pressure nor for excluding workers, either temporarily or permanently¹⁴; (5) candidate's rejection should be the exception: <1% for most and >4% for highly demanding

Main messages

- Assessment of fitness for work is commonly defined as the evaluation of a worker's capacity to work without risk to self or others. It has important implications, especially prevailing job opportunities.
- The criteria used to evaluate fitness for work include: determination of the worker's capacity and the worker's risk in relation to his or her workplace, together with ethical, economic and legal considerations.
- Assessment tools should be specific and cost-effective; workplace modifications to improve or adjust working conditions must always be considered. There is confusion about the decision-making process involved in determining fitness for work.
- Evaluation of the effectiveness of fitness for work examinations and criteria used for that purpose is scarce.

Policy implications

- Further research should focus on the evaluation of benefits, consequences and validity of tools, and judgements used to assess fitness for work.
- Evidence-based guidelines are needed to assess fitness for work.

and public safety-risk jobs¹⁰⁻¹³; (6) reliable evidence-based tools should be prioritised and correctly used when evaluating fitness for work⁴²; and (7) except for jobs with high physical demands, the available evidence suggests no beneficial impact of pre-employment medical examinations, either on health risks or company costs.¹⁶⁻⁴⁹ The assessment of fitness for work should not be confused with health surveillance, as the former focuses on the prevention of future health effects,⁸⁻¹³⁻¹⁶⁻⁴⁰ the main objectives of health surveillance are to evaluate prevention and identify new risks.

Although there seems to be a growing interest in research on prevention⁴⁸⁻⁴⁹ and cost-effectiveness of the assessment of fitness for work,⁵⁰ the scientific evidence is still very scarce and rarely based on experimental designs. This could probably be owing to the complexities of the assessment of fitness for work with regard to its conceptual constraints, ethical implications and probably difficulties related to methodological aspects. Despite these difficulties, there is a clear need for future research to evaluate the effectiveness and impact of interventions to assess fitness for work. For example, the uncertainty of the risk of occupational injuries associated with diseases that may cause sudden impairment, such as epilepsy, diabetes and ischaemic heart disease, has been evaluated for traffic injuries.³⁶ There is a lack of consensus on ethical issues and of uniform or explicit criteria regarding the methodological aspects of evaluating the effectiveness of judgements on fitness for work.¹⁶ Evidence for its validity does not exist,²⁵ partly due to difficulties in conducting randomised controlled trials, or studies on the agreement in interpreting health tests, a prerequisite for valid judgements. When scientific basis is lacking, consensus is a desirable goal that is often lacking too.¹⁵ In conclusion, more research is clearly needed to evaluate the benefits, consequences and validity of tools and judgements. Guidelines and recommendations also need to be developed either based on good scientific evidence or consensus when evidence is not available.

ACKNOWLEDGEMENTS

This review was carried out as part of Cátedra MC MUTUAL UPF de Medicina del Trabajo, the joint research and training programme on occupational medicine established in 2004 between MC MUTUAL and the University Pompeu Fabra, both in Barcelona, Spain. Also, this review was partially financed by the RCESP CO3/09 /Spanish Network for Cooperative Research in Epidemiology and Public Health.

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Competing interests: None.

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APPENDIX A

Table AI gives the summary of the information obtained from the 39 articles on the assessment of fitness for work (AFW), classified by their content.

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Definition	Criteria		Assessment tools							Decision-making process							Outcomes							Circumstances requiring afw						
	Health and safety		Capacity	Ethical	Legal	Economic	Applied worker	Applied to work	Rationalisation	Nurses involvement	Disease-based	Functional capacity	Other	To the worker	To work	Pre-employment	Pre-placement	Return to work	Periodic	Other										
	34	31																			29	29	19	36	31	12	4	20	14	7
Number of reports	19																													
Anfang 2005 ⁴³	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Chan 2000 ³⁴	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Collidge 1999 ³⁶	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Cowell 1986 ⁸	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Davies 1996 ²³	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
De Kort 1991 ¹³	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
De Kort 1992 ¹⁵	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
De Raad 2005 ⁴⁴	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Donoghue 2001 ³⁶	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Favata 1990 ¹¹	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Fletcher 2000 ³²	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Floyd 1986 ⁷	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Gerkin 1995 ²¹	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Glozier 2002 ³⁹	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Hainer 1994 ¹⁹	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Harber 1984 ⁶	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Hessel 1988 ¹⁰	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Hoffman 1994 ²⁰	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Johns 1994 ¹⁸	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Kashima 2003 ⁴¹	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
McCunney 1996 ²²	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
McCunney 1996 ²²	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
McGarry 2004 ⁴²	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
McGregor 2003 ⁴⁰	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Merkel 2000 ³⁹	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Mohr 1999 ²⁷	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Murphy 1992 ¹⁴	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Nelhercot 1994 ¹⁷	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Poole 1999 ²⁸	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Pepper 1997 ³⁵	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Rayson 2000 ³³	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Rigaud 2001 ³⁵	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Robbins 1988 ⁹	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Shepherd 1990 ¹²	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Shepherd 1992 ¹⁶	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Sood 2001 ³⁷	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Stevens 1996 ²⁴	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Szeinuk 2000 ³⁰	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Townsend 2000 ³¹	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
Wong 2001 ³⁸	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										