



The Association of Chartered Physiotherapists in
Occupational Health and Ergonomics

**Guidelines for Occupational Health
Physiotherapists on the use of Functional Capacity
Evaluation and Functional Measurement for the
Assessment of Fitness for Work**

Configuration management

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Summary

This ACPOHE guidance document on functional capacity evaluation and functional measurement is provided for physiotherapists in the field of Occupational Health and Ergonomics who provide a specialised level of assessment of fitness for work. This guidance has been developed to support physiotherapists in both clinical and management positions to understand their responsibilities when contracting, delivering or reporting such assessments.

This document is guidance. Guidance is information which a physiotherapist has a duty to consider and is expected to take into account as part of their decision making process.

Disclaimer

Research into functional capacity evaluation and functional measurement is rapidly expanding; therefore, the listing of papers and instruments in this document is illustrative and not exhaustive.

ACPOHE is not recommending all of the functional capacity evaluation systems and functional measures included in this document, nor is their inclusion on this document to be considered as their validation for use in your professional practice. ACPOHE members are responsible for appraising any instrument prior to its use to ensure its suitability for purpose.

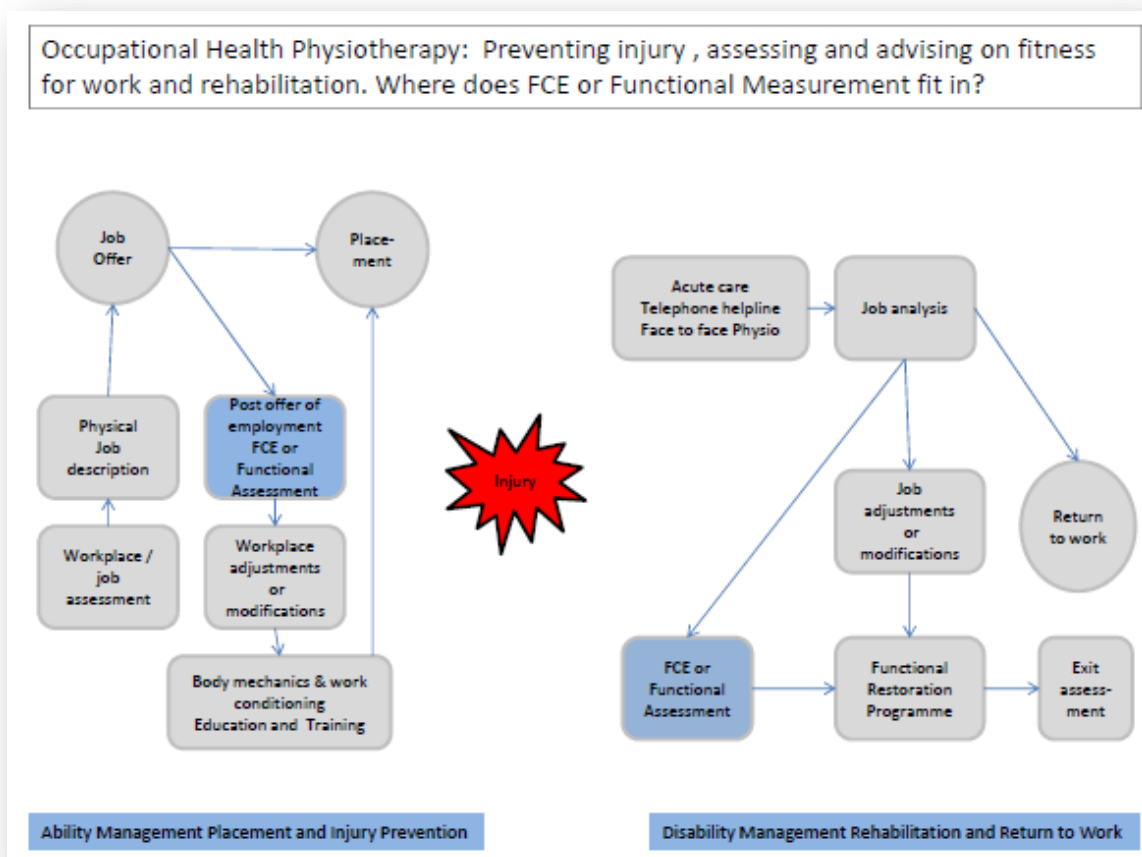
ACPOHE endeavours to keep this guidance as up to date as possible and reviews it at regular intervals. If you wish to suggest resources or content to this document then please e-mail ACPOHE@buryphysio.co.uk



1 Introduction

An important role of the occupational health (OH) physiotherapist is to give advice on a person's physical fitness for work. In order to do this the OH physiotherapist uses tools to measure the physical and functional ability of a person to perform a related series of work relevant tasks. Many physiotherapists use functional measurements and functional capacity evaluation (FCE) for this purpose. Figure 1 shows how functional measurement and FCE fits into the scope of work of an occupational health physiotherapist.

Figure 1: Functional measurement/ FCE & the scope of OH Physiotherapist's work



A draft document 'Functional Capacity Evaluation Guidance' (Smith 2008) has been available to ACPOHE members via the ACPOHE website. This document has been revised in view of the increased level of research being undertaken around FCE. While the term FCE will be used throughout the document, many of the principles within this guidance are applicable to physiotherapists using functional measurements to give advice on fitness for work.

FCEs are used by physiotherapists, occupational therapists, doctors, occupational health physicians, occupational health advisors, and insurance companies to obtain information on a person's functional work capability.

FCE is intended to provide the referrer and customer with:

- objective analysis of functional performance, including the potential to sustain work tasks over a defined time frame, in the context of work ability. It encompasses analysis of work demands and comparison with assessed performance, identifying discrepancies between the two
- the identification of psychosocial and other relevant factors such as pain and fatigue, that may influence functional performance, rehabilitation and return to work outcomes
- baseline measurements and progress reports for a goal centred and work focused rehabilitation plan (where work is not an immediate option)
- advice on work-based interventions aimed to facilitate sustained return to work including phased return, organisational changes and / or ergonomics interventions
- information to support the need for referral to other professionals for further medical investigations / treatment, for education, counselling etc.

FCE is typically undertaken in the following circumstances:

- to identify the need for and to monitor progress through a work focused rehabilitation programme
- to advise on work readiness and return to work following long term sickness absence where a person may be de-conditioned or have lost confidence in their abilities
- where there is a discrepancy between the person's work ability, or their perceived work ability, with medical opinion relating to return to work
- to provide objective information in complex cases to inform the completion of the Allied Health Professional's Advisory Fitness for Work Report (AHP Fitness Report)
- to reassure an employer and / or employee that the employee is fit for their full range of duties following injury or illness
- to reassure an employer and / or employee that the employee with a long term condition is fit for their full range of duties
- to determine whether an employee is fit / unfit for their former work / any work in respect of income protection insurance
- to determine whether a person is fit / unfit for their former work / any work in respect of personal injury litigation

Guidance: Physiotherapists offering FCEs must be quite clear of the referrer's objectives of the assessment and should only accept the referral if they believe they are able to answer the questions posed by the referrer.



In some cases there is an expectation by referrers that FCE can identify that a client is malingering or is less disabled than they present themselves to be (see Section 11). However there is no evidence-base for such a conclusion on the basis of the FCE alone and ACPOHE advice is that assessments should not be offered or accepted for this purpose.

Physiotherapists should use FCE measures to obtain objective data for completion of the AHP Fitness Report where they are reporting a discrepancy between the person's physical capability and their job demands.

FCEs may be requested by lawyers, usually in relation to personal injury litigation, and the physiotherapist may be relied upon as an expert witness.

Where a functional capability assessment is used by a physiotherapist to provide a medical legal report as an expert witness, we recommend that in addition to following this guidance, they should seek guidance from the Medico-Legal Association of Chartered Physiotherapists www.mlacp.org.uk with regards to providing reports and evidence to a court.

All physiotherapists should be aware that in undertaking an assessment and providing a report on fitness for work they may be requested to provide evidence to a tribunal or court. They must ensure they are competent to do this.

2 Purpose of this document

The purpose of this document is to provide guidelines for the contracting, delivery and reporting of FCEs in the UK in occupational health, and to define the competencies required by UK based physiotherapists who carry them out as part of their professional practice.

Chartered physiotherapists should interpret the guidelines within the broader scope of professional duties detailed in:

- Chartered Society of Physiotherapy (CSP) Quality Assurance Standards 2012 <http://www.csp.org.uk/professional-union/professionalism/csp-expectations-members/quality-assurance-standards>
- CSP Code of Professional Values and Behaviours 2011 <http://www.csp.org.uk/publications/code-members-professional-values-behaviour>
- Health Care Professions Council (HCPC) Standards of Proficiency 2012 <http://www.hpc-uk.org/publications/standards/index.asp?id=49>
- HCPC Standards of Conduct, Performance and Ethics 2006 <http://www.hpc-uk.org/aboutregistration/standards/standardsofconductperformanceandethics/index.asp>
- ACPOHE Behaviours, knowledge & skills framework required for working in Occupational Health 2012



These guidelines are also intended for use as an information / research resource by:

- Allied Health Professionals who provide advice on fitness for work using the AHP Fitness Report <http://www.csp.org.uk/professional-union/practice/ahp-advisory-fitness-work-report>
- referral sources such as occupational health professionals, employers, insurers, claims review organisations, solicitors and case managers
- individuals going through the FCE process
- researchers, educators, other professionals interested / involved in the FCE / assessment of fitness for work process

3 What is FCE?

In current practice, interchangeable terms for FCE include work capacity evaluation (WCE) and physical capacity evaluation (PCE). FCE is normally a standardised battery of tests. An assessment of fitness for work may be a non standardised assessment of a person's functional capability to undertake work activities, where the tests and measures to be used are selected by the physiotherapist for their relevance to the person's condition and job demands. This type of test is frequently also referred to as a FCE.

3.1 FCE Definitions

In a Delphi study undertaken by Soer (2008) the following definitions of FCE were agreed by the panel of experts:

Definition 1 achieved 38% agreement

FCE is an evaluation designed to document and to describe a person's current safe work ability from a physical ability and motivational perspective with consideration given to any existing medical impairment and or pain syndromes.

Definition 2 achieved 68% agreement

FCE is an evaluation of capacity of activities that is used to make recommendations for participation in work, while considering the person's body functions and structures, environmental factors, personal factors and health status.

4 History of FCE

During the last 30 years, standardised approaches to functional assessment have been developed in North America / Canada by individual therapists. Each FCE system comprised a cohort of functional and physical tests some already widely used in physiological / functional / sports science / physiotherapy assessments. Many standardised FCE systems used the identification of symptom magnification (said to be the conscious or sub-conscious tendency of an individual to underestimate



capacity and overstate limitations), measurement and interpretation of effort, inconsistencies in performance between tasks, assessment through distraction, and the identification of behavioural signs to draw conclusions about the person's work capability. Certification in the field of FCE has been available since the 1980s.

In 2009 the American Medical Association published a 'Guide to the Evaluation of Functional Ability: How to Request Interpret and Apply Functional Capacity Evaluation' by E Genovese and J Galper. A book review by Barron (2010) states that the 'The guide is a comprehensive and evidence-based state-of-the-art book that will assist practitioners in knowing when to order FCEs and how to critically assess, interpret, and apply the outcomes of FCEs in a variety of situations. Although functional capacity tests are scientifically-driven, the guide clarifies their clinical, analytical, and legal limitations'. Physiotherapists offering FCE may find this a useful reference book on the topic of FCE.

5 FCE systems

There are a number of commercially available FCE systems available and in use, which differ in their content and approach, degree of standardisation, concepts, validity and predictive validity. Some of these systems have been extensively researched and for others there appears to be little or no published research.

A list of FCE systems which includes those found in FCE searches on the internet and cited in published research is in Appendix 1. It is not exhaustive and readers aware of other systems and their supporting research are invited to provide this information to ACPOHE for inclusion in these guidelines.

Physiotherapists frequently refer to a non standardised assessment of a person's functional capability to undertake work activities, where the tests and measures to be used are selected by the physiotherapist for their relevance to the person's condition and job demands, as FCE.

ACPOHE recommends that physiotherapists make it clear in information documents whether the service they offer is a commercially available standardised FCE or non standardised assessment, where the tests and measures to be used are selected by the physiotherapist for their relevance to the person's condition and job demands.

The term FCE will be used in this document for both types of test.

6 The benefit and use of FCE

6.1 How is FCE data of benefit to referrers?

There is now evidence showing that while FCE is just one element of 'work ability' (Tengland 2011), it is a very important part of the picture. A study by Brouwer (2005) showed that where patients and clinicians estimate physical capability; the results are lower than actual measured capability. Both Reneman (2007) and Asante (2007) report patients under estimate their capability by between 15 and 30%.



Objective information provided by FCE regarding a person's functional capability has been shown as a minimum to reinforce a physician's opinion and in some cases to change a physician's opinion on work capability. Once a physician has used FCE information to provide advice on capability, over 50% reported they would use this information in the future (Wind 2009a).

Oesch (2006) investigated the influence of functional testing on decision making in medical fitness assessments for work. A randomized clinical trial compared function-centred treatment versus pain-centred treatment in patients with chronic low back pain. Physicians issued Fitness for Work Certificates on completion of the treatment. In the function centred treatment group, physicians had the results of FCE while this was not the case in the pain centred treatment group. Three experts assessed the quality of the work information provided on the fitness for work certificates and found this differed significantly between the two groups with a trend towards a higher work capacity in the function centred treatment group. Oesch concluded that FCE positively influences quality of information regarding working capacity on medical Fitness for Work Certificates in patients with chronic low back pain.

Wind et al performed three studies in 2006 and 2009 to look at the utility of FCE to case managers and physicians. The first study explored how Dutch experts perceive the utility of FCE for return to work (RTW) and disability claim (DC) assessment purposes. Twenty-one RTW case managers and 29 DC experts were interviewed by telephone using a semi-structured interview schedule. The RTW case managers valued the utility of FCE as 6.5 on a scale of 0–10 and the average valuation by DC experts was 4.8 (SD 2.2). Respondents reported that FCE helped confirm their own opinions and they liked the objectivity of its measurement method. They were more likely to use FCE for subjects with musculoskeletal disorders (MSDs), a positive self-perception of ability to work and the presence of an actual job. They did not use FCE where there were medically unexplained disorders, a negative patient self-perception of ability to work and the existence of disputes and legal procedures. RTW case managers perceived FCE to be more useful than the responding DC experts.

Wind et al (2009a) looked at the value of information from FCE for insurance physicians who assess the physical work ability of claimants with long-term MSDs. Consented claimants underwent FCE in addition to the regular disability claim assessment. A self-formulated questionnaire was presented to the insurance physicians after they viewed the FCE report. Insurance physicians were asked whether they perceived FCE information to be of complementary value to their judgement of the claimant's physical work ability. Of 28 insurance physicians, 19 (nearly 68%), reported FCE information to be of complementary value for their assessment of claimants with MSDs. Half of the insurance physicians stated that FCE information reinforced their judgement. All but four insurance physicians changed their assessment after reading the FCE report. 16 insurance physicians intended to involve FCE information in future DC assessments.

The third study by Wind et al (2009b) tested whether FCE information led insurance physicians to change their judgement about the physical work ability of claimants with MSDs. They found that insurance physicians change their judgement of the physical work ability of claimants with MSDs in the context of DC procedures more often when FCE information is provided.



6.2 How do physiotherapists use FCE systems?

James and McKenzie (2009b) conducted a survey of FCE practice. They found 11 different FCE methods were being utilised in NSW Australia. Health professionals were often using more than one system and the most commonly used FCE (56%) was non- standardised. The health professionals' perceptions suggested that accreditation, training and the characteristics of the FCE system were important factors in FCE selection. Overall it seemed that professionals used parts of an FCE rather than the whole and that adaptation was common due to client injury and specific job requirements. Currently there is no published information about how FCE is used in the UK.

7 What do FCEs comprise?

FCEs vary greatly in content and duration with a range between 2 hours and 2 days. Some FCE assessment protocols include clinical history and a clinical evaluation of impairment with measurement tools such as inclinometry, goniometry or dynamometry to measure impairments in mobility and strength, while others do not. The main emphasis of a FCE is to measure function. Physical demands in relation to job demands commonly assessed following the Dictionary of Occupational Titles (DOT) descriptions.

(http://www.occupationalinfo.org/appendxc_1.html#STRENGTH). This is linked to the DOT job demands and interpreted in terms of the United States Department of Labor (USDOL) physical demand level chart (Table 1) http://www.occupationalinfo.org/front_148.html.

Many physiotherapists also use an employee's physical job description obtained during a workplace assessment. The job description is interpreted in terms of USDOL as this is a simple way to communicate job demands to an employer or to other stakeholders

Table 1: Job demand classification (USDOL)

Job Demand Classification (USDOL)					
Lifting / Activity	Sedentary	Light	Medium	Heavy	Very heavy
Occasional 1-33% of day	5kg	9kg	23kg	45kg	Over 45kg
Frequent 34 -66%	Negligible	4.5kg	11kg	23kg	Over 23kg
Constant 67 -100%	Nil	Negligible	5kg	9kg	Over 9kg
Activity	Sit	Stand/ Walk	Stand/ Walk	Stand/ Walk	Stand/ Walk



7.1 Postural tolerances and mobility

Postural tolerance and mobility are assessed in many FCE systems. These do not appear to be specifically outlined in the DOT and inclusion appears to be pragmatic because all jobs or activities of daily living (ADLs) have large elements of static and/or dynamic positions within the overall context of the activity. The most common postural and mobility activities are:

Standing	Kneeling
Sitting	Walking
Reaching – Overhead	Climbing
Reaching – Shoulder	Balance
Reaching	Crouching
Stooping	Step / stairs
Crawling	Squatting

Table 2 shows how commonly undertaken workplace tasks are categorised in FCE systems.

Table 2: Common task categories in FCE systems

Dynamic strength	Postural tolerance	Mobility	Other
Floor-to-waist lifting Waist-to-eye lifting Bilateral carrying Unilateral carrying Pushing Pulling	Sitting tolerance Standing tolerance Elevated work Lowered work - standing Kneeling Lowered work – sitting Squatting Reclining reach	Steps / stair climbing Repetitive squatting Walking Crawling Ladder climbing Repetitive trunk rotation – sitting Repetitive trunk rotation – standing	Power Grip Pinch Grip Key Grip Hand dexterity Balance

7.2 FCE process

Physiotherapists carrying out FCEs may be self-employed, employed as part of an occupational physiotherapy practice, or employed by commercial (not physiotherapist owned / managed) businesses offering FCE and assessment of fitness for work services.

Guidance: Physiotherapists in all circumstances must satisfy themselves that their own or company protocols in respect of carrying out and reporting on FCEs does not conflict with their professional duties and responsibilities under the CSP and HCPC (as listed in section 2). If in doubt the physiotherapist should contact the Practice and Development Function at the CSP for advice, enquiries@csp.org.uk or 020 7306 6666.



Process guidance

- a) Contract setting: This is the opportunity for the physiotherapist to ensure that the referral is appropriate, clarify what questions the FCE purchaser need answering and what, if any, employment / workplace modifications or adjustments / rehabilitation opportunities are potentially available.
- b) Pre-FCE information gathering: Where possible the physiotherapist should seek to access and review relevant medical information.
- c) The physiotherapist should obtain the name, address and phone number of the subject's GP prior to the assessment.
- d) ACPOHE advise that physiotherapists should check with the GP whether there are any contraindications to the FCE tests being carried out prior to the day of the evaluation. This should include a check on blood pressure and whether other co-morbid conditions contraindicate the assessment.
- e) If the FCE is to advise on capability for a specific job, a physical job description including task analysis should be requested and reviewed before the FCE
- f) Making arrangements: Appointments should be confirmed in writing and include a brief description of what is to take place, how long it might take, what clothing to wear, of the need to bring reading glasses, hearing aids, medication if normally taken. The subject should be advised that they may bring, or request, a chaperone.
- g) Premises: The physiotherapist must be satisfied that the premises to be used for the evaluation are adequate and safe.
- h) Equipment: The physiotherapist must ensure the equipment to be used in FCE is in working order, correctly calibrated, and that they are trained and competent in its use and can take accurate and repeatable measurements with the equipment
- i) Orientation: The physiotherapist should orientate the client in privacy by introducing themselves and explaining their role, the purpose of the assessment and what will be involved in the assessment.
- j) Physiotherapists may find it helpful to have a script to outline the process of the assessment and which covers domestic issues such that breaks can be taken if required, water is available throughout the assessment and questions can be asked during the assessment.
- k) The physiotherapist must ensure the subject knows to whom the report arising from the assessment will be sent and how they can access a copy. Physiotherapists should also make subjects aware of their right to request to see and comment on the report before it is sent.
- l) The subject must be informed of any potential consequences in relation to their employment / insurance / litigation status and be allowed to ask relevant questions.
- m) The subject should be informed of limits to confidentiality and what information is to be shared with whom. Also of their right to withdraw their consent to participate in the assessment or in any part of the assessment and for the report to be sent. They should also be informed of potential consequences of withdrawing consent. That is that the employer will be informed of their withdrawal of consent and may make fitness for work decisions without the results of the functional test.



7.3 FCE consent

The CSP Consent and Physiotherapy guidance paper <http://www.csp.org.uk/publications/consent-physiotherapy-practice> requires that information is provided to enable service users to participate fully in their care. Members should obtain and document the service user's informed consent before any advice, assessment, examination, intervention, treatment or procedure. The information giving and consent process should take into account age, cognitive ability and emotional state to ensure that the service user fully understands what is to take place, and can either give their informed consent to the assessment / intervention, or decline. If the service user does not fully understand the nature of the intervention, and / or any potential consequences arising from it, the consent is not valid.

Guidance: In the case of FCE or when assessing fitness for work, ACPOHE advise that physiotherapists request a signed acknowledgement that the subject understands the nature of the assessment and has given their informed consent for the evaluation to take place.

Within the evaluation, each test that is to be performed should be explained and demonstrated and the subject's verbal consent to participate in the test should be obtained.

Where relevant, consent should specifically be obtained if the subject is to be photographed/ filmed/ videoed during the course of an assessment if that is a feature of the assessment process.

In addition to consent relating to the FCE, it should be explicit to whom any report arising from the assessment will be disclosed (i.e. medical or non-medical such as Human Resources or Health and Safety). The subject's information should only be released to sources other than those immediately involved in the plan for intervention, with permission or when there is a signed consent form to allow this process.

Consent to a FCE and any report arising from it may be an explicit requirement of an insurance policy. If that is not the case then consent to disclosure must be given.

Further information on consent is available from the Department of Health <http://www.dh.gov.uk/assetRoot/04/01/90/61/04019061.pdf>.

7.4 FCE content

Physiotherapists undertaking FCE are advised to include in the assessment the following elements:

- informed consent
- relevant medical history (including a review of any medical information provided by the subject if not previously made available)
- the subject's understanding of their health problem / disability, reported performance of activities of daily living (ADL)
- screening to identify red, yellow, orange, blue and black flags through semi-structured interview or questionnaires (see 8.5 psychosocial factors and Appendix 2)
- a detailed description / analysis of previous / future potential work activities / demands



- neuro-musculoskeletal evaluation as appropriate (to exclude red flags see 8.2 biological factors) and to understand the nature of the problem
- baseline evaluation of cardiac fitness (see 8.3 physiological safety)
- functional assessment using a range of measuring instruments which should be selected on the basis of their relevance to potential job or lifestyle demands
- observation of effort in manual handling test elements (see 8.4 biomechanical safety)
- provision of report and recommendations which answers the referrer's questions

Guidance: Physiotherapists must set out the results of the evaluation in an impartial, logical and clear way, avoiding jargon. The physiotherapist is free only to draw evidence-based conclusions. It must be clear in the report what elements are objective measures, observations or opinion.

If red or orange flags are suspected or identified, referral for further investigation must be recommended.

Where work readiness is identified the physiotherapist should make recommendations in relation to the steps required to achieve return to work: phased return, early in-work support, job modifications, ergonomics interventions as appropriate

Where psychosocial factors are identified as barriers to return to work the physiotherapist should recommend actions to support the client to overcome these obstacles (see Appendix 2).

8 Safety of FCE

The safety of FCE and functional measurement is of concern to commissioners of FCE, therapists providing FCE services and to those undergoing FCE. A subject under going FCE usually has an injury or ongoing disability and is required to exert some effort to perform physical tests. A number of issues concerning safety of FCEs have been reported by Gibson and Strong (2005).

Before the FCE, there needs to be adequate screening procedures to detect any precautions or contraindicated conditions for the FCE (Hart 1993) During the FCE there needs to be adequate procedures for monitoring the safety of the subject. Safety aspects can be classified under four main areas, biological (e.g. current or co-morbid conditions); physiological (e.g. heart rate and blood pressure), biomechanical (e.g. signs of muscle fatigue or weakness) and psychophysical (e.g. pain or fear of [re]-injury) (Gibson and Strong 2005).

8.1 Contraindications to identify prior to accepting FCE referral

There may be circumstances in which it might be considered inappropriate to accept referrals, or proceed with an FCE if identified. These would include, but may not be limited to:

- red or orange flags
- other fluctuating medical conditions - this relies on the knowledge and judgement of the physiotherapist, but might include conditions where chronic fatigue is a feature (ME, Fibromyalgia) or inflammatory disorders such as RA
- imminent medical / surgical treatment



- the subject being unable to give informed consent / fully understand instructions due to learning difficulty or mental capacity issues
- where the referral requests an opinion that cannot be provided on the basis of the FCE alone

Guidance: Physiotherapists should identify if contraindications are present at the time of referral / booking a FCE. Provision of information about the assessment and contraindications should be provided to the referrer and subject to be evaluated prior to the FCE, with a request to notify if there is a contraindication to the assessment. If a contraindication is identified during the assessment the physiotherapist should not proceed further.

8.2 Safety monitoring during FCE: Biological

Prior to any functional tests or FCE the evaluator must have a full medical history and knowledge of the presenting condition and co-morbid conditions. The evaluator must not request participation in functional tests if there is a significant risk that the test would put the person at risk of exacerbation of a pre-existing condition.

The evaluator must know of the subject's current pain level and the irritability of the pain, in particular whether there is regional pain with allodynia or hyperalgesia. Pain should not preclude participation in functional testing, but the person being evaluated must clearly understand that they are in control and able to stop a test at any point if the pain they experience is too much or if they believe that further participation will cause significant worsening of symptoms later or the next day.

There is a likelihood of increased pain levels during the FCE followed by a reduction on completion of the FCE. Gibson and Strong (2005) reported that the majority of the subjects' pain levels remain elevated from the pre-FCE levels for two to three days. In view of this it is advisable to follow-up clients in the days after the FCE to check that the pain returns to usual levels. This follow-up also provides valuable information about the cumulative effect of the evaluation in terms of the effect of physical activity on the subject's pain, which in turn is important in considering return to work recommendations.

Soer (2008b) showed that a pain response following FCE can be expected in healthy subjects and that this pain response is a normal musculoskeletal reaction. The pain response of healthy subjects was compared to those with chronic low back pain (CLBP) following FCE. The pain response of subjects with CLBP resembles the pain response of healthy subjects.

Guidance: A subjective assessment should be carried out prior to FCE to identify contraindications and understand past and current problems that may affect performance in FCE and symptom behaviour. This should be in line with CSP Code of Professional Values and Behaviours 2011 and Quality Assurance Standards 2012.

Functional testing for those who have not participated in activity for some time should be carried out with care. The test must be fully explained and demonstrated by the evaluator. The subject's consent to participate should be obtained. Tests that increase in difficulty should be graded and the subject should be asked for their consent to continue before each increment.

Subjects undergoing FCE must be told that they can stop a test or the whole evaluation at any time during the evaluation.



Subjects undergoing FCE should be advised that they may get some post FCE pain and that this may take several days to return to the pre FCE level. They can be reassured that this is normal and while this may hurt it will not cause harm.

8.3 Safety monitoring during FCE: Physiological

8.3.1 Blood pressure

Heart rate and blood pressure measurement during FCEs is recommended to monitor the effect of FCE on the cardio-vascular system (Gibson and Strong 2005).

Unmanaged hypertension is a risk factor for stroke and heart attack particularly when combined with other risk factors such as age, smoking, obesity raised cholesterol, family history of coronary heart disease (CHD) and diabetes mellitus. Subjects coming for FCE may not have taken any strenuous exercise for some time. A blood pressure check prior to the FCE is recommended. However, the risk of a clinical event during a supervised stress test is less than 1:1000. FCE subjects are very unlikely to achieve anything like their anaerobic threshold, so concerns about stroke and heart attack during FCE should be minimal and there is no indication for monitoring BP during FCE. In general, sudden significant bursts of exercise are much more hazardous than controlled aerobic activity (Thompson 2007).

Normal blood pressure is below 120/80mmHg. This varies with age. Age related normal range for blood pressure can be found at: <http://www.disabled-world.com/artman/publish/bloodpressurechart.shtml>. Hypertension is when blood pressure is 140/90 mmHg or higher. For definitions of the stages of hypertension and the identification of hypotension, see the NICE guidelines on hypertension. <http://www.nice.org.uk/nicemedia/live/13561/56015/56015.pdf>.

Guidance: ACPOHE recommend that all subjects in FCE or in functional tests requiring strenuous activity should have their blood pressure taken prior to FCE.

For guidelines on blood pressure measurement see O'Brien 2003.

http://www.bhsoc.org/files/2113/3374/7291/ESH_recommendations.pdf

The result of the check should be considered alongside other risk factors for cardiovascular event.

The National Clinical Guidance Centre Hypertension, The clinical management of primary hypertension in adults Clinical Guideline 127 August 2011

<http://www.nice.org.uk/nicemedia/live/13561/56007/56007.pdf> suggest that

- Blood pressure less than 140/90 is normotensive. ACPOHE suggest you can proceed with FCE or functional testing
- Blood pressure of 140/90 or more is hypertensive. ACPOHE recommend that you consider other risk factors in your decision as to whether you proceed or not with the FCE or functional testing. Other risk factors are being overweight, lack of regular exercise, poor diet, smoking, regular intake of alcohol, regular intake of caffeine or having a pre existing cardiovascular condition. If there are other risk factors seek clearance from the GP prior to undertaking an FCE or functional testing.



- Blood pressure of 160/100 or more is Grade 2 hypertension. ACPOHE recommend you refer the person for a medical review and seek clearance prior to commencing strenuous FCE or other functional tests.

For all subjects, if proceeding with strenuous physical tests you must monitor carefully for adverse effects such as shortness of breath, dizziness, blurred vision, headache, chest / arm pain, and to stop the test if there are any symptoms of concern.

8.3.2 Heart rate

A general rule is that heart rate should not exceed 85% of maximum heart rate. Maximum heart rate is calculated by taking 220 minus age, then working out the maximum required percentage. Heart rate can be monitored during tests to ensure that it stays within an age related maximum range (Trippolini 2012). A heart rate monitor provides accurate readings. For those who have not exercised regularly, limiting early functional testing activities to a maximum heart rate of 60-70% of maximum and building up to the more strenuous activities (where heart rate may reach age related maximum) is advisable.

Guidance: Heart rate should be checked before and during a FCE using a heart rate monitor and should not exceed age related maximum.

8.4 Safety monitoring during FCE: Biomechanical

Subjects being tested with FCE usually have persistent health problems, normally of musculoskeletal origin. The functional elements of FCE evaluate the subject's performance against the physical demand chart in the Dictionary of Occupational Titles. The manual handling test procedures for the subject being tested must be safe. The procedure needs to be sufficiently physically exerting, or specific enough to measure the subject's capacity for performance of the task as may be required in the workplace, while not causing a significant aggravation of the subject's injury or condition, either during or after the FCE.

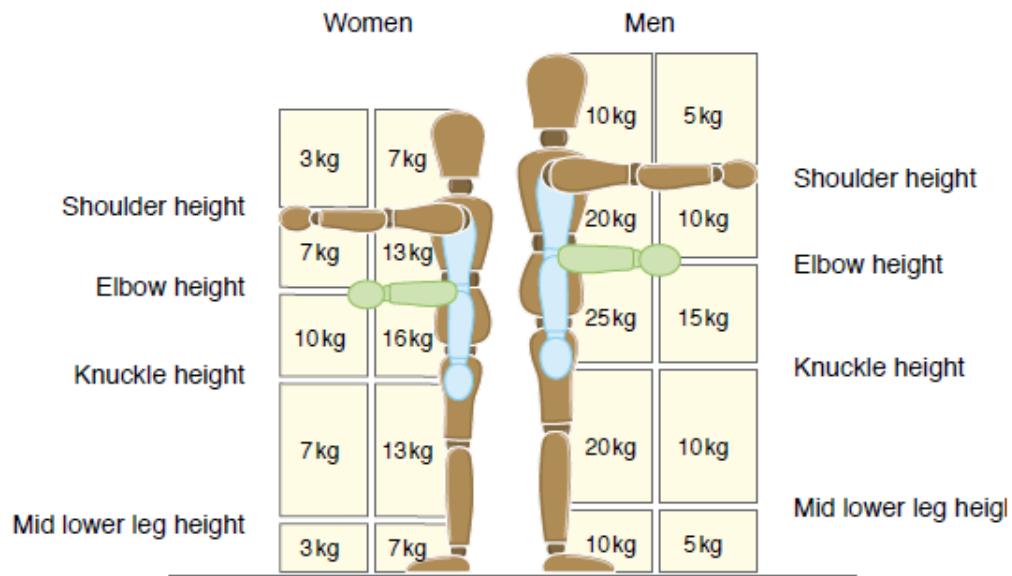
The UK Health and Safety Executive (HSE 2004) guidance for manual handling of loads gives provides guideline figures for lifting and carrying tasks based on biomechanical analysis and pragmatic considerations.

<http://www.hse.gov.uk/msd/manualhandling.htm> The guideline figures shown in the figure below are intended to set out a boundary within which the load is unlikely to create a risk of injury sufficient to warrant a detailed assessment.

Guidance: If the subject's job or lifestyle requires lifting or carrying above the guideline HSE weights then testing beyond these weights may be necessary. ACPOHE recommend that a risk assessment is performed considering the load, individual task environment and other relevant factors. This should be documented and kept in the subject's assessment records.



Figure 2: HSE lifting and lowering guidance



Lifting and lowering guide reproduced by permission of the HSE under the Open Government Licence v2.0 <http://www.nationalarchives.gov.uk/doc/open-government-licence/version/2/>

A second consideration is the load handling technique of the individual. The HSE guidelines recommend key principles should be followed for manual handling lifting tasks; plan the task, test the load, adopt a stable base, keep the load close, for lower lifting use moderate not end of range flexion of the spine, hips and knees, and lift and lower smoothly without jerking the weight.

Guidance: ACPOHE recommend that advice is given on the key principles prior to a lifting or handling test. Lifting tests should commence with an empty container and weight should be added incrementally with the consent of the subject being tested. The tester should observe the subject to ensure they do not show signs of biomechanical overload. Heart rate should be monitored to check that the heart rate remains within age related maximum while the test is performed.

These principles also apply when testing the ability of a subject to undertake manual handling tasks done with one hand only (single handed lift or carry).

Pushing and pulling of loads is also covered by the Manual Handling Operations Regulations <http://www.hse.gov.uk/msd/pushpull/risks.htm>. Our guidance is based on the assumption that pushing and pulling tests within an FCE are usually undertaken in a controlled environment with smooth floor and without inclines.

Guidance: ACPOHE recommend that advice is given on the key principles of pushing and pulling prior to a test. Pushing and pulling should commence with an empty sled or trolley, and weight should be added incrementally with the consent of the subject being tested. The tester is advised to check the person's stance prior to the push pull test and correct it if required. The tester must observe the participant during the test to ensure they do not show signs of biomechanical overload. Heart rate should be monitored to check that heart rate remains within age related maximum while the test is performed.

Risk assessments of all manual handling test protocols used in FCEs are part of an organisation's health and safety obligation. There should be a safe system of work documented for each test protocol that can be used in the organisation.

Therapists administering the physical demands elements of a FCE should be trained to ensure that they recognise the safety issues inherent in all manual handling tests; lifting, carrying, pushing and pulling. They must risk assess the subject and environment for each test in the FCE which should be documented in the assessment record. They must be able to provide advice on key principles of manual handling and must be able to demonstrate their competence to conduct lifting tests in a safe manner.

8.5 Safety monitoring during FCE: Psychosocial

The presence of psychosocial factors in response to acute pain has been found to be predictive of chronic incapacity and has a stronger influence on outcome than biomedical factors. The most important factors are distress, attitudes and beliefs, pain behaviour and pain coping strategies (Main 2002).

FCE systems were developed to assess functional limitations, but historically the assessment of psychosocial factors that impact on function was largely ignored (Geisser 2003). Psychosocial factors have also been shown to influence measures of sincerity of effort which are often obtained during FCE. The strongest evidence that psychosocial factors are related to functional performance in people with pain is based on the studies examining the association between functional activity and pain-related fear, self-efficacy, and illness behaviour (Nicholas 2011).

Van Abbema (2011) undertook a systematic review of four types of FCE. The review found few psychosocial factors to be directly associated to results of capacity tests and other functional measures. Van Abbema found that social factors such as workers compensation, involvement in litigation, influence of the test evaluator, support from the workplace or from significant others or the assessment setting have not yet been investigated in direct relation to results of functional capacity tests.

As it is people with persistent pain problems who fail to return to work that are referred for FCE must have assessment of psychosocial factors included in the FCE process. The psychosocial factors may be obstacles to recovery and return to work and need to be identified and addressed in order to achieve a sustainable return to work.

It remains unclear as to how much psychosocial factors actually contribute to FCE performance. Reneman (2007) found the proposed relation between fear-avoidance beliefs and FCE performances could not be confirmed consistently. Reneman (2008) also studied general and specific self efficacy related to FCE performance and concluded that FCE performances on the lifting test are moderately related to specific self efficacy, (measured by asking the subject being evaluated to predict their actual performance), but unrelated to general self efficacy, as measured with General Self Efficacy Scale. Both Reneman and Asante found that subjects tend to underestimate their performance on lifting tasks. Reneman reported that subjects' mean predictions were 70–85% of their mean performances. Asante (2007) reported subjects' mean predictions were 72–84% of their mean



performances, and that healthy subjects' mean predictions were 83–94% of their mean performances.

Lakke (2012) undertook a Delphi study to reach a consensus on the most important bio-psychosocial factors that influence functional capacity results in patients with chronic nonspecific musculoskeletal pain and concluded that chronic pain behaviour, motivation, and sensation of pain are the main factors that can influence functional capacity results. She recommended clinicians should consider these factors when interpreting FCE results.

Psychosocial measures appear to provide different information to a physical FCE and are complimentary to FCE and assessment for fitness for work in that they provide a wider understanding of the person and the obstacles that need to be overcome to return to work.

Guidance: ACPOHE recommend that therapists providing FCE or functional assessments of subjects with persistent pain problems should undertake a comprehensive bio-psychosocial-assessment, to gain a full understanding of the subject and the obstacles they face in recovery and return to work.

Psychosocial factors should be assessed through interview questions and questionnaires that identify obstacles to recovery and return to work. ACPOHE guidance on the use of psychosocial screening tools as part of an FCE is being written. As an interim measure we recommended an article on the identification and management of psychosocial risk factors by Nicholas (2011) in Appendix 2.

9 Reliability of FCE

A measurement is reliable if it gives consistent scores over repeat measurements with the same tester at different time points or with different testers. FCE is a battery of tests. Each individual test used within a FCE must be reliable.

There have been a number of studies undertaken concerning the reliability of FCE systems, individual tests and groups of tests. The Workwell FCE system appears to have been tested extensively. For this system, the test–retest reliability of the material-handling tests appears to be acceptable. Analyses of the ceiling and criterion tests reveal acceptable test–retest reliability of most, but not all tests (Reneman 2004). Other systems have some published research such as the Physical Work Performance Evaluations (PWPE) and WorkHab which demonstrated good reliability. The Matheson system states that it comprises measurement tools that have proven reliability and validity. Matheson claims to train 'thinking' clinicians, who select tools from the system appropriate for the subject to be evaluated. (<http://www.roymatheson.com/training/fce>) The details of the test components within the Matheson system are only available to trained evaluators. Newer test protocols are being tested for reliability as they are developed, such as the FCE for work related upper limb disorders (WRULD) and FCE for whiplash associated disorder (WAD). Other systems seem to have no published research with regards to their reliability. There is some evidence that suggests some subjects do better on a second test. It is thought that the reasons for this could be a learning effect, or due to reduced fear or due to increased self efficacy.

The table in Appendix 3 summarises the papers identified and reviewed with regards to reliability. This list is not exhaustive.



Guidance: ACPOHE recommends that physiotherapists select and use individual impairment and functional tests that have proven reliability.

Where multiple tests are used, they should be administered in the same sequence if repeated to measure progress or change in a rehabilitation programme.

In addition ACPOHE advise that:

- physiotherapists check their own intra-tester reliability to ensure they achieve consistent results on each functional test they perform
- if working in a team they should check inter-tester reliability to ensure they can achieve consistent results with other evaluators in the clinic
- evidence that this has been done should be included in CPD portfolio

<http://www.csp.org.uk/professional-union/careers-development/cpd/csp-eportfolio>

10 Validity of FCE

Validity refers to the degree to which a tool measures what it claims to measure. A valid measure should satisfy four criteria.

1. Face Validity which is an assessment of whether a measure appears, on the face of it, to measure the construct it is intended to measure.
2. Content Validity is the extent to which a measure adequately represents all facets of a construct.
3. Criterion-related validity applies to instruments than have been developed to be an indicator of a specific trait or behaviour, either now or in the future. FCE is designed to predict whether a person is safe and able to return to work now or in the future.

Does FCE have good predictive validity? That is to say, a subject's performance in a FCE should correlate well with his/her ability to return to work and stay at work. This is the gold standard test of validity. Criterion related validity is of most concern in FCE and there have been several studies looking at this. It seems FCE does not have criterion related validity; that is the result of a FCE does not predict whether someone is able to return to work now or in the future. Matheson (2002) and Gross (2004) found that one item – floor to waist lift is as good a predictor when combined with job demands as a whole FCE protocol. In 2005 Gross & Battie reported that FCE performance does not predict sustained return to work in claimants with chronic back pain. In 2009 Streibelt used the Workwell FCE system in a rehab setting and found that while there was a significant relation between FCE information and RTW the predictive efficiency was poor.

Gross, Battie and Cassidy (2004) found that the number of failed tests seemed to be of significance for patients with ambiguous return to work (RTW) prognosis. In fact there is some evidence to indicate that those who pass more tests and RTW have higher recurrence rate. Gross (2004) reported that 20% of FCE evaluatees experienced a recurrent back-related event within the year following FCE. Opposite to the initial hypothesis, a lower number of failed FCE tasks were



consistently associated with higher risk of recurrence after controlling for potential confounding variables.

Overall on criterion related validity FCE does not fare well – it is not a good tool to predict RTW and it is possible that one item may be just as good as a predictor as a whole test.

It is unlikely that criterion related validity for FCE will ever be established for FCE as functional capacity is only of a number of factors that determine a person's workability (Tengland 2011).

4. **Construct Validity.** Where there is not a gold standard available, construct validity is used. This is the extent to which a measure is related to other measures as specified by theory or previous research.

To put construct validity simply, does a measure stack up with other variables the way we expect it to? For example, does a person who is disabled with high pain levels perform less well on a FCE than a healthy person? Links have been shown between FCE results and disability measured with the Oswestry Disability Index, Quebec Back Pain Disability Index and the Pain Disability Index suggesting some construct validity for FCE. FCE performance is not independent from pain intensity as proposed by some FCE developers.

The table in Appendix 4 summarises the papers identified and reviewed. This list is not exhaustive. Please note that dynamometry testing within a FCE is currently not covered by this document. For further information on this please see

<http://www.isokinetics.net/isokinetics/isokinetic-fce-overview/fce-validity-a-reliability.html>

Guidance: FCE alone is unlikely to adequately measure all the factors that influence sustainable return to work.

FCEs and evaluations using functional measurements do not predict whether a person is able to return to work as a person's ability to perform functional activities is only one of many factors that determine work ability.

ACPOHE's position is that functional tests are extremely useful as part of the tool kit of an occupational health physiotherapist or any physiotherapist who is giving fitness for work advice. Functional measurement and FCE show the physiotherapist how a person performs in test activities that simulate real work tasks. This can provide valuable information to inform fitness for work advice and rehabilitation recommendations. There is research that shows that without objective measurement, professionals frequently underestimate a person's work capability.

Physiotherapists providing functional measurement and FCE must understand the validity of the tests and instruments they are using. They must report accurately and in line with the measurement capability of the tests / instruments they use.



11 FCE: can it detect 'not trying' or malingering?

Tests such as Waddell's non-organic signs, a comparison between rapid exchange grip and five position grip strength results and observation of inconsistent illness behaviour are suggested to indicate inconsistent effort and malingering. Lechner et al (1998) reviewed the evidence for:

- reliability and validity of scores for Waddell's non-organic signs
- descriptions of pain behaviour and symptom magnification
- coefficients of variation
- correlations between musculoskeletal evaluation and function
- grip measurements
- relationship between heart rate and pain intensity

Following a critical review of the literature addressing these methods for identification of inconsistent effort and malingering, Lechner recommended that until there is evidence in peer-reviewed literature to support these methods, clinicians should avoid basing evaluation of sincerity of effort on these tests. Instead they should use a bio-behavioural approach to better understand and address the complex factors underlying delayed recovery.

Waddell's non-organic signs were developed as a simple screen to identify those where a more detailed psychosocial assessment is indicated. They are associated with poor treatment outcomes but cannot discriminate organic from non-organic causes and should not be used for anything other than this purpose.

Reneman (2002) investigated whether an evaluator could determine a subject's level of effort in lifting tests within a FCE through a standardised observation method; i.e. whether a subject is giving maximal or sub-maximal effort. A small study involving four healthy participants performing lifting and carrying tests indicated that standardised observation in healthy subjects had reasonable inter-rater and intra-rater reliability. The study suggests that therapists using these methods can reliably determine a subject's effort level during lifting and carrying tests in healthy subjects.

Gross (2004) reported that all measures involving human effort or performance on motor tasks give variable results. Measures of disability behaviour are influenced by a complex array of biological, psychological, and social factors and are amenable to rehabilitation.

Oesch et al (2012a) investigated 'non-organic somatic components' in Functional Capacity Evaluations in patients with chronic non-specific low back pain undergoing fitness for work evaluation and concluded that they account for between 42 and 58% of the variation in the results and are consistent independent predictors in FCE testing. As such they should be considered for interpretation of test results.

Oesch et al (2012b) then studied the concurrent validity of Waddell's signs and sub-maximal effort to consider whether they contribute independently to lifting performance. Waddell's eight non-organic physical signs are thought to assess illness behaviour and psychological factors, whereas observation of physical effort indices seeks to differentiate between sub-maximal and maximal effort. Despite their different theoretical background, the Waddell signs have been used as a means to determine effort during FCE. This study found that Waddell's signs have a low sensitivity for sub-



maximal effort. Waddell's signs and sub-maximal effort were independent contributors to lifting performance during FCEs.

Guidance: Where Waddell's non organic signs are assessed they should only be used to identify the need for more detailed psychological assessment. Clinicians should not use Waddell's signs in any other way.

Clinicians using standardised observation techniques that have been shown to be reliable in determining whether a subject is giving maximal or sub-maximal effort in FCE should only report on the level of effort given in a test.

Clinicians are advised not to give a reason why a subject gave sub-maximal effort as this cannot be determined through the observational method. Nor can it be deduced from the results of other tests such as Waddell's non-organic signs, coefficients of variation, correlations between musculoskeletal evaluation and function or grip measurements or the relationship between heart rate and pain intensity.

Reneman and Gross (2011) in a joint statement on whether FCE should be used to detect malingering said:

'As FCE or rehabilitation professionals, we have an ethical responsibility to care for our patients' health and well being in a conscientious and diligent manner. It is doubtful that this ethical obligation can be met when we place ourselves in a situation whereby we are asked by a third party payer to judge the sincerity and legitimacy of our patients' presenting problems for purposes of claims management decision making. Ultimately, for patients, employers and insurers, it is much more constructive to conduct FCE with a neutral or therapeutic as opposed to litigious perspective, because it may then be used to assist with facilitating work participation. Thus, based on theoretical considerations, absence of quality validity evidence, and the broader ethical dilemma, we believe the answer to whether FCEs should be used in this way is clearly no.'

Guidance: ACPOHE supports the joint statement by Reneman and Gross.

12 Does one FCE system give the same result as another?

Reneman (2006) performed a study where standardised FCEs were performed on three cohorts of patients with chronic low back pain, from three different countries. The performance of patients in the Canadian and Swiss samples was consistently lower on all FCE items compared to the Dutch sample. This association remained statistically significant after controlling for potential confounders. Possible variables that were not examined in the study were variability in evaluator judgements across settings, the evaluator-patient interaction and patients' expectations of the influence of FCE results on disability compensation. Further research is needed to find how reliable a whole FCE is between settings.

Guidance: Organisations stating they provide a consistent FCE service between centres should measure intra and inter tester reliability of each of the tests or instruments they use in the FCE to ensure consistency of test results within their organisation.



13 Can tests within FCEs be interchanged?

Within each FCE system there are functional tests that measure the same construct. In some cases the measurement tool itself comes with a standardised protocol for use and normative data for results comparison. Examples of standardised tools for measurement of function are:

- Perdue Pegboard
http://www.lafayetteevaluation.com/product_detail.asp?ItemID=159
- Minnesota dexterity test (Lafayette instruments)
http://www.lafayetteevaluation.com/product_detail.asp?ItemID=164
- Progressive Isoinertial Lifting Test (Mayer)
http://www.fcesoftware.com/images/7_Dynamic_Lifting.pdf
- Jamar Grip 5 position strength test (Lafayette instruments)
<https://www.chponline.com/store/pdfs/j-20.pdf>
- FitHaNSA test (MacDermid)
http://www.srs-mcmaster.ca/Portals/20/pdf/research_resources/FIT-HaNSAProtocol_April2007.pdf
- Valpar work samples

As many FCE systems have been developed by individual practitioners, many use tests that are not in the public domain. As a result different tests have been designed to measure the same construct. Take as an example a test to find the maximum a person is capable of lifting from the floor occasionally (i.e. three to four times an hour). This can be tested using different occasional lifting test protocols. The Workwell occasional lift test requires the participant to perform five lifts of one weight within 90 seconds. The weight is then increased. The Snook and Cirello occasional lift test protocol only requires one lift of each weight increment before the weight is increased. These tests are both designed to indicate the maximum a person can safely lift on an occasional basis, based on the US Department of Labor physical demand level chart, but the different test methods could give different results.

Soer (2006a) compared the results of the Progressive Isoinertial Lifting Evaluation (PILE) and the lifting test of the WorkWell Systems FCE (WWS) to find if they can be used interchangeably in patients with CLBP and to explore whether psychosocial variables can explain possible differences. Lifting performance on the WWS was a mean of 6.0 kg higher compared to the PILE ($p < 0.01$). The difference between the PILE and the WWS was unrelated to psychological variables. The PILE and the WWS therefore cannot be used interchangeably.

Ijmker (2003) looked at upper lifting tasks (waist up) of the Ergo-Kit FCE and the Isernhagen Work Systems (IWS) FCE. Seventy-one healthy young adults performed five upper lifting tests with at least five minutes of rest in between. The lifting tests included three standard protocols and two modified protocols. The results showed that none of the criteria were met for the standard test protocols. Individual differences larger than 10 kg were found. Ijmker concluded that the upper lifting tasks of the Ergo-Kit FCE and the IWS FCE do not meet the criteria for concurrent validity and therefore cannot be used interchangeably. No other papers were identified. Currently it is unknown which test protocols are best.



Guidance: Therapists using functional tests should select tests that have face validity, i.e. that appears to test the construct to be measured and that have clear instructions as to how to undertake the test consistently to maximise its reliability. Currently it is unknown which test protocols are best.

Individual therapists and organisations employing multiple therapists must select one standardised test for each construct to be measured and use this consistently with patients as tests cannot be interchanged.

14 FCE developments

As more research is undertaken into FCE, a wider range of protocols are becoming available in the published research. Normative values for FCE have been collected. Short form FCEs have been developed which are shown to be just as good at predicting return to work as longer protocols and several short protocols have been developed (Gross and Battie 2007). Specific FCE protocols for neck and upper limb disorders have been developed based on risk factors for health problems (Reesink 2007, Soer 2006b, and Reneman 2007). There are job specific protocols where the FCE tests are closely linked to job demands. This work has been undertaken by Dutch researchers. In addition, a procedure has been proposed for selection of tests from longer FCE protocols (Gouttebauge 2010).

14.1 FCE and normative values

Soer (2009) collected normative FCE values for healthy workers for four DOT physical demand categories. He reports that these enable comparison of subjects' performances to these values. If a subject's performance exceeds the lowest scores in his/her corresponding job demand category, then the subject's capacity is very likely to be sufficient to meet the workload. This method also allows clinicians can make more precise return to work recommendations and set goals for rehabilitation programmes. However, further research is needed to test the validity of the normative values with respect to workplace assessments and return to work recommendations. The reference for the paper by Soer with normative tables is in Appendix 5.

14.2 Short form FCE

FCE contributes to clinical decisions regarding fitness for work and may improve return to work outcomes but is a burdensome clinical tool in terms of time and cost. Gross et al (2007) evaluated a short form FCE protocol. Twenty-three clinicians who were trained and experienced with FCE were randomized to either an intervention or control group. The intervention group was trained to conduct short-form FCE and used this protocol through the trial's duration, while the control group continued standard FCE procedures. Clinicians logged time taken to complete assessments. Administrative recovery outcomes were similar between groups as were claimant satisfaction ratings and a 43% reduction in functional assessment time was seen. The short form FCE was able to predict time to recovery. Like longer FCEs it was not able to identify those who would have a further recurrence of their problem (Branton 2010).



The WRULD FCE was designed to determine functional capacity of WRULD patients (Reneman 2005a). The content validity of the WRULD FCE was based on a literature search regarding the relationship of physical risk factors and the development of WRULD due to VDU work. The WRULD FCE consists of eight different tests including 26 items measuring repetitive movements, duration, working in awkward positions, forceful movements and static postures. Reliability was confirmed by Soer et al (2006b) in tests on healthy adults. 14 of 26 items (54%) had excellent reliability, 9 of 26 items (35%) had good reliability and 3 of 26 items (11%) had moderate reliability based on ICC values. Significant learning effects were present in the Purdue Pegboard Task and in the Complete Minnesota Dexterity Test.

14.3 FCE protocols based on physical risk factors

Reesink (2007) designed a FCE based on physical risk factors for injury to the neck shoulder region which included repetitive movements, forceful movements, awkward positions and static contractions of the neck or the neck/shoulder region. Eight tests were selected to cover all risk factors: repetitive side reaching, repetitive reaching overhead, static overhead work, front carry, forward static bend, overhead lift and the neck strength test. Content validity of this FCE was established by providing the rationale, specific objectives and operational definitions of the FCE. Further research is needed with regards to other types of validity.

14.4 Job specific FCE

Bos et al (2002) set out to find a universal strategy for the identification of specific demands of a job or task, focusing on occupations in which there may be an increased risk for health complaints owing to these specific demands. There was insufficient information in the literature to achieve this. Bos recommended that more attention should be paid to (1) the definition of specific occupational demands; (2) the assessment of specific occupational demands; and (3) the quality of tests for specific occupational demands.

A few job specific protocols have been developed: For example, there has been the development of a job specific FCE protocol for the work demands of hospital nurses (Frings–Dresen 2003), for construction workers (Gouttebauge 2009) and for fire fighters (Plat 2010).

14.5 Three stage procedure for selection of FCE tests

Gouttebauge (2010) proposed a three-step procedure to enhance the efficiency and practicality of FCEs. The procedure is to be used in the selection of functional tests from any full FCE method in order to assess efficiently physical work-ability in workers with MSDs and related functional limitations. The study was based on existing literature and the authors own expertise of FCE methods. The three step process is:

- Step 1 to establish the worker's medical condition and to assign it to one or more defined MSD categories (upper extremity, back, lower extremity).
- Step 2 to identify activities that are restricted by the medical condition (e.g., lifting and bending for MSD of the back).



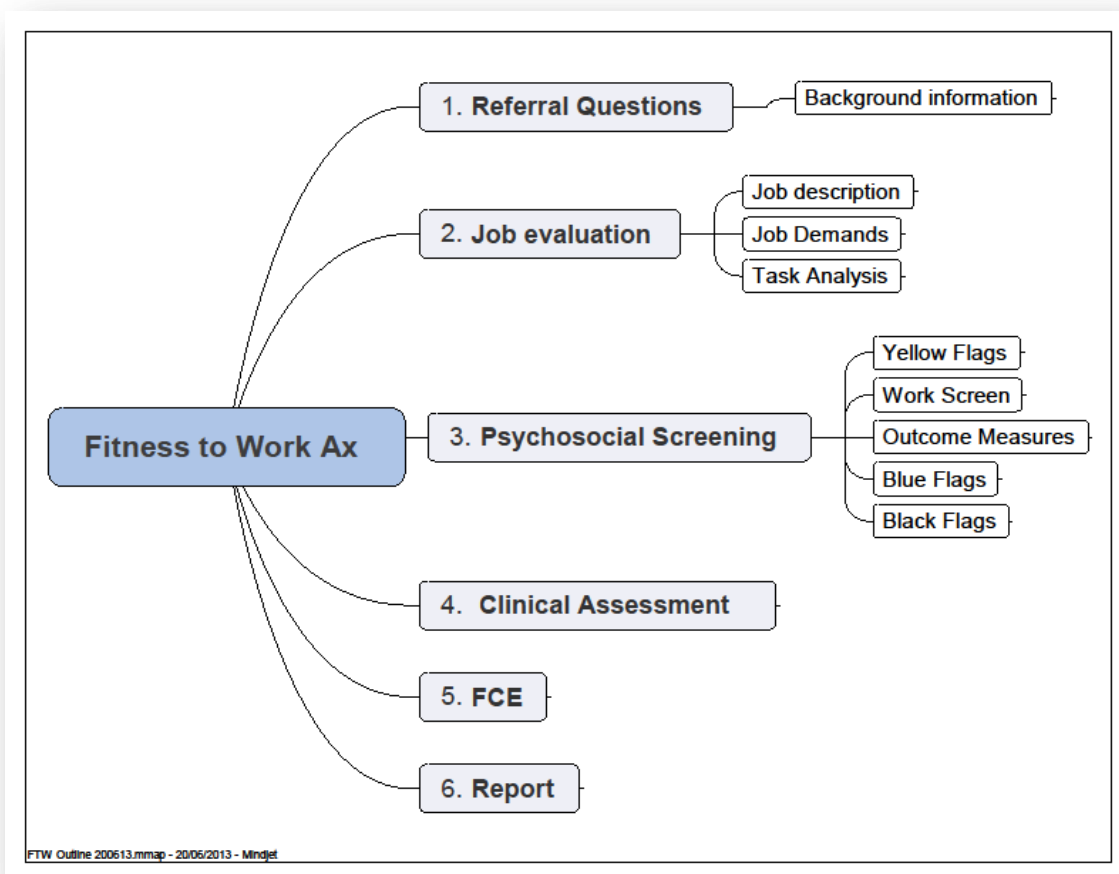
- Step 3 to select functional tests from a full FCE tests battery to permit measurement of the restricted activities identified in Step 2, striving to avoid redundancy by selecting a limited number of tests for each activity under investigation.

ACPOHE recommend that physiotherapists offering functional measurement and FCE should familiarise themselves with recent developments in FCE practice. Where possible they should use FCE protocols that have been developed and tested for reliability and validity and have test methods and results published in peer reviewed journals.

15 Physiotherapists' competency and duty of care when providing FCE

Figure 3 summarises the range of knowledge and skills needed to provide advice on fitness for work and how FCE or functional measurement fits in.

Figure 3: Components of fitness for work assessment



All physiotherapists have a duty of care to their patients/clients <http://www.csp.org.uk/publications/duty-care>. This duty of care exists even if the cost of an assessment and/or intervention is paid for by a third party such as an employer, insurance company or lawyer. Given the nature of the potential outcomes arising from fitness for work assessments that include functional measurement or FCEs (work loss, loss of benefits etc) the physiotherapist

evaluator must adopt an impartial approach to the assessments and reports regardless of who is paying for them.

Evidence-based practice is the process of systematically finding, appraising and using contemporaneous research findings as a basis for clinical decisions. This has developed out of concerns about health care interventions not being evaluated and proven, including in physiotherapy, and it has become a crucial and topical issue in modern health and social care.

Guidance: In order to safely carry out functional capacity evaluations, interpret the results and make useful and impartial recommendations the physiotherapist must have developed knowledge at a level B on the ACPOHE behaviour skills and knowledge framework in the following areas:

www.acpohe.org.uk/memberszone/competencyframework/

- Domain 2 - Knowledge 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14
- Domain 5 - Psycho-motor skills 5.1, 5.2, 5.3, 5.4, 5.6
- Domain 6 - Communication skills 6.1, 6.2, 6.3, 6.4, 6.6
- Domain 10 - Customer focus 10.1, 10.2, 10.3, 10.4
- Domain 11 - Respect and promote diversity 11.1, 11.2, 11.3
- Domain 15 - Practice decision making 15.1, 15.2, 15.3
- Domain 17 - using evidence to lead practice 17.1, 17.2

16 Future research recommendations

ACPOHE has identified the following areas where research is needed to assist physiotherapists to use functional measurement effectively to advise on fitness for work:

- 1 A study to identify reliable and valid tools that relate to the determinants of disability and measure function and evaluate their (a) usability in occupational settings and (b) usefulness in making decisions on workability and fitness for work.
- 2 A study to develop normative values for FCE in UK.



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19 Appendices

Appendix 1: FCE systems list

- Arcon <http://www.fcesoftware.com/>
- GAPP Functional Capacity Evaluations (Gibson and Strong) no website
- Hanoun Medical and BTE <http://www.btetech.com/about.htm>
- Physical Work Performance Evaluations
<http://wwrc.virginia.gov/PhysicalWorkPerformanceEvaluation.htm>
- Jobfit <http://esvc000876.wic057u.server-web.com/about.html>
- Jtech Medical <http://www.jtechmedical.com/>
- Key <http://www.keymethod.com/index.htm>
- Matheson <https://www.roymatheson.com/>
- Saunders <http://www.amazon.co.uk/Functional-Capacity-Evaluation-Saunders-Method/dp/1879190109>
- West –EPIC (Len Matheson) <http://epicrehab.com/>
- Workhab <http://www.workhab.com/>
- Workwell (formerly Isernhagen) <http://www.workwell.com/>
- Ergoscience <http://www.ergoscience.com/>



Appendix 2: Further recommended materials

Identification of psychosocial factors that predict long term disability

To support these FCE guidelines, additional ACPOHE guidance on Functional Capacity Evaluations and Psychosocial Screening Tools has been prepared.

We recommend the following article by Nicholas, M. K., Linton, S. J., Watson, P. J., & Main, C. J. (2011).

Early identification and management of psychological risk factors (“yellow flags”) in patients with low back pain: a reappraisal.

Physical Therapy, 91(5), 737–53. doi:10.2522/ptj.20100224

Abstract

Originally the term “yellow flags” was used to describe psychosocial prognostic factors for the development of disability following the onset of musculoskeletal pain. The identification of yellow flags through early screening was expected to prompt the application of intervention guidelines to achieve secondary prevention. In recent conceptualizations of yellow flags, it has been suggested that their range of applicability should be confined primarily to psychological risk factors to differentiate them from other risk factors, such as social and environmental variables.

This article addresses 2 specific questions that arise from this development:

- (1) Can yellow flags influence outcomes in people with acute or subacute low back pain?
- (2) Can yellow flags be targeted in interventions to produce better outcomes?

Consistent evidence has been found to support the role of various psychological factors in prognosis, although questions remain about which factors are the most important, both individually and in combination, and how they affect outcomes. Published early interventions have reported mixed results, but, overall, the evidence suggests that targeting yellow flags, particularly when they are at high levels, does seem to lead to more consistently positive results than either ignoring them or providing omnibus interventions to people regardless of psychological risk factors.

Psychological risk factors for poor prognosis can be identified clinically and addressed within interventions, but questions remain in relation to issues such as timing, necessary skills, content of treatments, and context. In addition, there is still a need to elucidate mechanisms of change and better integrate this understanding into the broader context of secondary prevention of chronic pain and disability.



Appendix 3: Reliability of FCE - summary of research identified to date

System	Reliability	Findings	References
Workwell 1988.	To look at the difference in the variability of submaximal and maximal forces generated by patients with chronic pain while performing standing static arm lifts.	Good reliability for maximal effort was demonstrated in push pull tests, but not for submaximal effort.	Hart DL (1988). Test-retest reliability of the static push/pull tests for functional capacity evaluations (Physical Therapy, 68, 824).
28 FCE systems available in 1999.	This study examined available literature and sources in order to review the extent to which reliability has been established for 28 work-related assessments.	Only a limited number of assessments had adequate evidence on which to judge their reliability. Most of these demonstrate moderate to good reliability. Few assessments, have demonstrated levels of reliability sufficient for clinical (and legal) purposes.	Innes E, Straker L (1999a) Reliability of work-related assessments .Work 13:107–124.
Workwell (formerly IWS) 1999	Reliability of independent observer judgements in FCE	Both interrater and intrarater reliability were high when three levels of lift were used (.68 and .81). When light and heavy categories were isolated, there were no errors in the judges' ratings (1.0).	Isernhagen SJ, Hart DL, and Matheson LM (1999). Reliability of independent observer judgments of level of lift effort in a kinesio-physical functional capacity evaluation (Work 12, 145-150).
Workwell (formerly IWS) 2002.	Determining effort through standardized observations of lifting and carrying	Inter-rater reliability ranged 87–96%, intra-rater reliability ranged 93–97%.	Reneman MF, Jaegers S M J, Westmaas M, & Göeken LNH (2002). The reliability of determining effort level of lifting and carrying in a functional capacity evaluation. <i>Work (Reading, Mass.)</i> , 18(1), 23–7.
Workwell 2003.	Test –retest reliability of Workwell system in CLBP	Tests of the IWS FCE were divided into tests with and tests without acceptable test-retest reliability on the basis of the kappa values, the	Brouwer, S, Reneman MF, Dijkstra PU, Groothoff JW, Schellekens JMH, Göeken LNH (2003). Test-retest reliability of the Isernhagen work Systems functional

System	Reliability	Findings	References
		percentage of absolute agreement and ICC values. Fifteen tests (79%) showed acceptable test-retest reliability based on Kappa values and percentage of absolute agreement. Eleven tests (61%) showed acceptable test-retest reliability based on ICC values.	capacity evaluation in patients with chronic low back pain. (<i>Journal of Occupational Rehabilitation</i> , Vol 13, No 4, December).
Workwell (formerly IWS) 2004.	Test-retest reliability of Workwell system.	Test-retest reliability of material-handling group is acceptable. Crude analyses of the ceiling and criterion tests reveal acceptable test-retest reliability of most, but not all, tests.	Reneman, M. F., Brouwer, S., Meinema, a, Dijkstra, P. U., Geertzen, J. H. B., & Groothoff, J. W. (2004). Test-retest reliability of the Isernhagen Work Systems Functional Capacity Evaluation in healthy adults. <i>Journal of occupational rehabilitation</i> , 14(4), 295–305.
Physical Work Performance Evaluation PWPE 2004.	Interrater reliability of the dynamic strength, position tolerance, and mobility tasks of the Physical Work Performance Evaluation (PWPE).	In general, the reliability was “substantial” ($0.61 \leq \kappa \leq 0.80$) to “almost perfect” ($0.81 \leq \kappa \leq 1.00$) for most of the 21 tasks and three sections of the PWPE evaluated with the exception of three tasks in the mobility section (ladder climbing ($\kappa = 0.47$), repetitive trunk rotation—standing ($\kappa = 0.54$), and repetitive trunk rotation—sitting ($\kappa = 0.37$)) task and the mobility section itself ($\kappa = 0.54$).	Durand, M.-J., Loisel, P., Poitras, S., Mercier, R., Stock, S. R., & Lemaire, J. (2004). The interrater reliability of a functional capacity evaluation: the physical work performance evaluation. <i>Journal of occupational rehabilitation</i> , 14(2), 119–29. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15074364
4 FCE systems through a literature review	Functional capacity evaluation methods: a systematic review with reference to	The interrater reliability and predictive validity of the IWS were	Gouttebauge, V., Wind, H., Kuijjer, P. P. F. M., & Frings-Dresen, M. H. W. (2004).

System	Reliability	Findings	References
Blankenship system, Ergos work simulator, Ergo-Kit and Isernhagen work system 2004.	Blankenship system, Ergos work simulator, Ergo-Kit and Isernhagen work system.	evaluated as good while the procedure used in the intrarater reliability (test-retest) studies was not rigorous enough to allow any conclusion. The concurrent validity of the <u>EWS</u> and EK was not demonstrated while no study was found on their reliability. No study was found on the reliability and validity of the BS.	Reliability and validity of Functional Capacity Evaluation methods: a systematic review with reference to Blankenship system, Ergos work simulator, Ergo-Kit and Isernhagen work system. <i>International archives of occupational and environmental health</i> , 77(8), 527–37. doi:10.1007/s00420-004-0549-7
Workwell 2002.	Test retest of lifting and carrying in FCE.	Interrater reliability of kinesio-physical lifting and carrying determinations performed on a sample of low back-injured WCB claimants was excellent <ul style="list-style-type: none"> • Test-retest reliability was slightly lower but acceptable when subjects willing to participate in both sessions were analyzed. WS.	Reneman MF, Dijkstra PU, Westmaas M, Göeken LNH (2002). Test-retest reliability of lifting and carrying in a 2-day functional capacity evaluation (<i>Journal of Occupational Rehabilitation</i> , Vol 12, No 4, December, pp. 269-275) .
Workwell 2004.	Doctoral thesis considering reliability and validity of FCE in CLBP.		Reneman, MF (2004). Functional capacity evaluation in patients with chronic low back pain: Reliability and validity (Doctoral Thesis, June.)
Non-specific Work Related Upper Limb Disorders WRULDFCE 2006.	The WRULDFCE consisted of 8 different tests including 26 items measuring repetitive movements, duration, working in awkward positions, forceful movements and static postures.	14 of 26 items (54%) had excellent reliability, 9 of 26 items (35%) had good reliability and 3 of 26 items (11%) had moderate reliability based on ICC values.	Soer, R., Gerrits, E. H. J., & Reneman, M. F. (2006). Test-retest reliability of a WRULD functional capacity evaluation in healthy adults. <i>Work (Reading, Mass.)</i> , 26(3), 273–80.



System	Reliability	Findings	References
WorkHab 2010.		The ratings for the lifting components identified substantial levels of test–retest reliability for the lifting components of the WorkHab FCE in healthy adults.	James, C., Mackenzie, L., & Capra, M. (2010). Test-retest reliability of the manual handling component of the WorkHab functional capacity evaluation in healthy adults. <i>Disability and rehabilitation</i> , 32(22), 1863–9. doi:10.3109/09638281003734466
Functional capacity evaluation in patients with whiplash associated disorders 2012.	The FCE consisted of 12 tests, including material handling, hand grip strength, repetitive arm movements, static arm activities, walking speed, and a 3 min step test.	The reliability of the WAD FCE was moderate in two tests, good in five tests and excellent in five tests.	Trippolini, M. a, Reneman, M. F., Jansen, B., Dijkstra, P. U., & Geertzen, J. H. B. (2012). Reliability and safety of functional capacity evaluation in patients with whiplash associated disorders. <i>Journal of occupational rehabilitation</i> . doi:10.1007/s10926-012-9403-z



Appendix 4: Validity of FCE - summary of research identified to date

System	Validity	Findings	Reference
This study examined available literature and sources in order to review the extent to which validity has been established for 28 work-related assessments.	The levels of evidence and validity are presented for each assessment within the paper.	Most work-related assessments have limited evidence of validity. Of those that had adequate evidence, validity ranged from poor to good. There was no instrument that demonstrated moderate to good validity in all areas. Very few work-related assessments were able to demonstrate adequate validity in more than one area, or with more than one study, even when contributory evidence was included.	Innes, E., & Straker, L. (1999). Validity of work-related assessments. <i>Work (Reading, Mass.)</i> , 13(2), 125–152. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12441557
Workwell system (formerly Isernhagen Work System IWS).	Construct validity of IWS.	The sample consisted of 321 subjects with work-related, medically stable low back pain of median duration of 307 days. FCE performance was moderately correlated with the PDI ($r = -0.44$ – 0.52) and with the pain VAS ($r = 0.34$ – 0.45). Pain intensity was correlated highly with the PDI ($r = 0.79$). The moderate relationship between FCE and the PDI supports the construct validity of FCE as a functional measure. However, kinesio-physical FCE performance was not unrelated to pain severity ratings as purported.	Gross, D. P., & Batti, M. C. (2003). Construct validity of a kinesio-physical functional capacity evaluation administered within a worker's compensation environment, 13(4).



System	Validity	Findings	Reference
Blankenship System, Ergos work simulator, Ergo-Kit and Isernhagen work system.	Literature review to look at predictive validity The search resulted in 77 potential relevant references but only 12 papers were identified for inclusion and assessed for their methodological quality.	The interrater reliability and predictive validity of the IWS were evaluated as good while the procedure used in the intrarater reliability (test-retest) studies was not rigorous enough to allow any conclusion. The concurrent validity of the EWS and EK was not demonstrated while no study was found on their reliability. No study was found on the reliability and validity of the BS.	Gouttebarga, V., Wind, H., Kuijer, P. P. F. M., & Frings-Dresen, M. H. W. (2004). Reliability and validity of Functional Capacity Evaluation methods: a systematic review with reference to Blankenship system, Ergos work simulator, Ergo-Kit and Isernhagen work system. <i>International archives of occupational and environmental health</i> , 77(8), 527–37. doi:10.1007/s00420-004-0549-7
GAPP FCE Item validity.	This study used an expert review to analyse the item validity of 15 of the physical demands of the DOT, as evaluated in the GAPP FCE, in terms of item objective congruence, relevance and difficulty. This process of item validation contributed to the evidence for aspects of the GAPP FCEs content validity.	The authors selected the experts used for the study. The majority of the therapists agreed that most of the items were congruent with the objectives based on the definition of the physical demands from the DOT. The items evaluating Balancing and Pushing and Pulling had the lowest item-objective congruence. The evaluation of Balancing and the Lifting, Carrying and Pushing and Pulling of loads greater than light-medium weight (10–16 kg) were not considered significantly relevant.	Kersnovske, S., Gibson, L., & Strong, J. (2005). Item validity of the physical demands from the Dictionary of Occupational Titles for functional capacity evaluation of clients with chronic back pain. <i>Work (Reading, Mass.)</i> , 24(2), 157–69. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15860905
FCE for Patients With Work-Related Upper Limb Disorders.	The design of a FCE for WRULD patients working with Visual Display Units (VDU) and provide evidence for content validity.	Content validity of this FCE was established by providing the rationale, specific objectives and operational definitions of the FCE.	Reneman, M. F., Soer, R., & Gerrits, E. H. J. (2005). Basis for an FCE Methodology for Patients With Work-Related Upper Limb Disorders. <i>Journal of Occupational</i>

System	Validity	Findings	Reference
		Further research is needed to establish reliability and other aspects of validity of the WRULD FCE.	<i>Rehabilitation</i> , 15(3), 353–363. doi:10.1007/s10926-005-5942-x
Workwell system (formerly IWS).	Predictive validity of the Isernhagen Work Systems' FCE to predict sustained return-to-work and future pain and disability in workers' compensation claimants with chronic back pain.	Fewer failed tasks (HRR 0.94 (0.91–0.98) and higher floor-to-waist lift (HRR 1.38 (1.17–1.62)) were associated with faster return-to-work. FCE was not associated with future recurrence, or reported pain intensity, or disability in subjects reached for follow-up. Conclusions: Better FCE performance was mildly associated with indicators of faster return-to-work. However, FCE is not related to recurrent back problems, future pain intensity, or self-reported disability.	Gross, D. P., & Battié, M. C. (2005). Functional Capacity Evaluation Performance Does Not Predict Sustained Return to Work in Claimants With Chronic Back Pain. <i>Journal of Occupational Rehabilitation</i> , 15(3), 285–294. doi:10.1007/s10926-005-5937-7
Dort form FCE based on Workwell system.	Comparison of effectiveness of short form and Workwell system.	A short-form FCE appears to reduce time of assessment while not affecting recovery outcomes when compared to routine FCE administration. Results of this trial show only minimal differences on workers' compensation administrative outcomes between claimants undergoing the short-form and standard FCE.	Gross, D. P., Battié, M. C., & Asante, A. (2006). Development and validation of a short-form functional capacity evaluation for use in claimants with low back disorders. <i>Journal of occupational rehabilitation</i> , 16(1), 53–62. doi:10.1007/s10926-005-9008-x
FCE for work related neck disorders.	An FCE was designed based on the risk factors identified for work related neck	Content validity of this FCE was established by providing the	Reesink, D. D., Jorritsma, W., & Reneman, M. F. (2007). Basis for a

System	Validity	Findings	Reference
	disorders.	rationale, specific objectives and operational definitions of the FCE. Further research is needed to establish reliability and other aspects of validity of the neck-FCE.	functional capacity evaluation methodology for patients with work-related neck disorders. <i>Journal of occupational rehabilitation</i> , 17(3), 436–49. doi:10.1007/s10926-007-9086-z
Predictive Validity of PWPE system	The predictive validity of a functional capacity evaluation, the Physical Work Performance Evaluation (PWPE) was examined in 30 workers compensation patients with musculoskeletal dysfunction who participated in an industrial rehabilitation program in 1993 and 1994.	Authors state that the study provides preliminary evidence in support of the predictive validity of the PWPE for making return-to-work recommendations at the conclusion of an industrial rehabilitation program. Reneman (2009) questions this in an editorial as the data is gathered in 1993 and 1994, but no efforts were made to discuss whether this seemingly old data might still be valid in the current times.	Lechner, D. E., Page, J. J., & Sheffield, G. (2008). Predictive validity of a functional capacity evaluation: the physical work performance evaluation. <i>Work (Reading, Mass.)</i> , 31(1), 21–5. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18820417
Ergokit FCE	To assess the construct (discriminative and convergent) validity of 5 Ergo-Kit (EK) functional capacity evaluation (FCE) lifting tests in construction workers on sick leave as a result of musculoskeletal disorders (MSDs).	Poor construct validity of the 5 EK lifting tests was found: discriminative validity was not statistically established, and convergent validity with self-reported pain intensity and disability was poor.	Gouttebauge, V., Wind, H., Kuijer, P. P., Sluiter, J. K., & Frings-Dresen, M. H. (2009). Construct validity of functional capacity evaluation lifting tests in construction workers on sick leave as a result of musculoskeletal disorders. <i>Archives of physical medicine and rehabilitation</i> , 90(2), 302–8. doi:10.1016/j.apmr.2008.07.020



System	Validity	Findings	Reference
To evaluate the quality of functional capacity evaluation (FCE) information in predicting return to work (RTW).	FCE was used as a measure for people entering medical rehabilitation. As predictive FCE information, the physical capacity (DOT Titles categories 1-5), the number of test results not meeting work demands (0-25), and the testers' recommendation of full time work ability in the actual job were analyzed.	There was a significant relation between FCE information and RTW with and without concurrent predictors, but the predictive efficiency is poor. Primarily, the number of failed tests seemed to be of significance for patients with ambiguous RTW prognosis.	Streibelt, M., Blume, C., Thren, K., Reneman, M. F., & Mueller-Fahrnow, W. (2009). Value of functional capacity evaluation information in a clinical setting for predicting return to work. <i>Archives of physical medicine and rehabilitation, 90</i> (3), 429–34. doi:10.1016/j.apmr.2008.08.218
To evaluate the ability of a short-form FCE to predict future timely and sustained return-to-work.	Subject performance on the items in the short-form FCE was compared to administrative recovery outcomes from a workers' compensation database.	A short-form FCE appears to provide useful information for predicting time to recovery as measured through administrative outcomes, but not injury recurrence. The short-form FCE may be an efficient option for clinicians using FCE in the management of injured workers. Faculty of Rehabilitation Medicine, University of Alberta, Canada.	Branton, E. N., Arnold, K. M., Appelt, S. R., Hodges, M. M., Battié, M. C., & Gross, D. P. (2010). A short-form functional capacity evaluation predicts time to recovery but not sustained return-to-work. <i>Journal of occupational rehabilitation, 20</i> (3), 387–93. doi:10.1007/s10926-010-9233-9



Appendix 5: Normative values for FCE

Soer et al 2009 undertook a study to establish normative values for a functional capacity evaluation (FCE) of healthy working subjects using 12 tests. The values enable comparison of patient's performance to these values. If a patient's performance exceeds the lowest score in his/ her corresponding demand category then it is very likely to be sufficient to meet the work load. Please note that the normative value tables are for a Dutch population, so translation to a UK population should be undertaken with caution. The reference for the full text paper that gives the values is:

Soer, R., Van der Schans, C. P., Geertzen, J. H., Groothoff, J. W., Brouwer, S., Dijkstra, P. U., & Reneman, M. F. (2009). Normative values for a functional capacity evaluation. *Archives of physical medicine and rehabilitation*, *90*(10), 1785–94. doi:10.1016/j.apmr.2009.05.008

