Journal of Occupational Rehabilitation (2020) 30:475–479
https://doi.org/10.1007/s10926-020-09876-0

Functional Capacity Evaluation Research: Report from the Fourth International Functional Capacity Evaluation Research Meeting

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Published online: 7 February 2020

Abstract

Purpose To summarize progress of functional capacity evaluation (FCE) research based on the proceedings of the Fourth International FCE Research Conference held in Switzerland on September 21 and 22, 2018. *Methods* A scientific committee identified key issues in FCE research and developed the program including key note presentations, a call for abstracts, and round table discussions over 2 days. Highlights of the presentations and discussions are summarized in this article. *Results* Seventy-nine participants from 11 countries attended the conference where 10 keynote lectures and 21 abstracts were presented. There was also an open discussion regarding the need for an International FCE clinical practice guideline (CPG), methods for developing such a guideline, and practical next steps. Full program details and abstracts from this Fourth International FCE Research Conference are available from https://www.sar-reha.ch/interessengemeinschaften/ig-ergonomie.html. *Conclusions* Researchers and clinicians continue to increase the body of knowledge in the FCE field. A major finding of this conference is the diversity across the different FCE protocols and research groups as well as of the different uses of FCE across cultural and social economic systems. Next steps will include exploring the development of an international, interdisciplinary, evidence-based FCE clinical practice guideline by a committee formed at the conference.

Keywords Functional capacity evaluation · Work assessment · Disability evaluation · Return-to-work · Insurance medicine

Background

Functional Capacity Evaluations (FCE) are performance-based assessments designed to determine current capacity to perform activities while considering the person's body structures and functions, environmental and personal factors, and health status [1]. Researchers, clinicians, and other professionals use Functional Capacity Evaluation (FCE) as part of their clinical practice to inform work ability recommendations for people with work-related disabilities. Since 2012, a growing international group of FCE researchers meet biannually to discuss key issues in the field, share new research findings, and possibilities for collaboration [2, 3]

The aim of the 4th FCE research conference was to provide an opportunity to present and discuss recent FCE research, provide a forum for discourse related to FCE use, and create an international working group for developing an international FCE Clinical Practice Guideline. Conference presentations covered aspects of: (1) the use of FCE in work-related rehabilitation and Insurance Medicine in Germany and Switzerland; (2) practical issues in administration and interpretation; (3) protocol reliability and validity; and (4) an update on research evidence regarding FCE. The purpose of this article is to summarize the discussions and highlights of the meeting.

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Meeting Report

The 4th International FCE Research Conference was held in Valens, Switzerland on 21st and 22nd September, 2018. A scientific committee identified key issues in FCE research and developed the program including a call for abstracts. Invitations to the conference were sent to previous attendees from earlier conferences, researchers who have published studies related to FCE, practicing FCE clinicians, health care professionals working in occupational or vocational rehabilitation, and FCE protocol developer networks. Seventy-nine participants from 11 countries (Australia, Austria, Belgium, Canada, France, Germany, The Netherlands, New Zealand, United Kingdom, South Africa, Switzerland) attended the conference. The FCE research conference final scientific program consisted of 10 keynote lectures and 21 abstract presentations.

Summary of Individual Presentations

Day One

An update in FCE research since the 3rd International FCE Research Conference [4] was presented by Jone Ansuategui Echeita from Bilbao, Spain and Groningen, The Netherlands. Since that meeting, 29 studies from 7 countries have been published in 14 journals. In 50% of these studies the participants had a health disorder potentially limiting work ability, 27% enrolled healthy persons, 8% enrolled both patients and healthy persons, while 15% enrolled therapists. Research included a range of study types: reliability (6), validity (6), observational (5), review articles (5) and cohort (7).

Despite their common use and far reaching consequences for workers claiming disabling injury or illness, research on the reliability of medical evaluations of disability for work is limited. A systematic review of reproducibility studies of inter-rater agreement in evaluation of disability, as derived from insurance medicine physicians, was next presented by Regina Kunz. This review of 23 studies from 12 countries highlighted a lack of good quality data applicable to the real world of disability assessment. Current assessments have demonstrated low reliability, however, reliability of structured functional assessments is more promising. Standardizing the evaluation process could improve reliability. Development and testing of instruments and structured approaches to improve reliability in disability evaluation is urgently needed [5].

An update of the evidence on FCE was then presented by Stijn De Baets. The objective of this presentation is to present an overview of the results out of the systematic review of nine databases. The aim of this review was to synthesize the recent evidence on the clinimetric properties of FCE. The search resulted in 20 eligible studies covering 9 different FCE protocols published between May 2004 and October 2018. Overall, the clinimetric properties varied between and within methods. Well-known FCEs such as the WorkWell and EPIC FCE systems have been rigorously studied, but research also indicates some weaknesses in their reliability and validity. Future research should address how these weaknesses can be overcome [6].

The benefits for employers and employees for a safe return to work were presented with the Resource Oriented Inclusion Profile (REP) by Regina Knöpfel [7].The REP has been developed in Switzerland as a tool to enhance and support communication between employer, employee and physicians. It is a web-based solution to improve the ability to work by knowing demands and external conditions of the workplace. It facilitates discussion between involved stakeholders on available resources and barriers to return to work.

The use of FCE in work related rehabilitation (WMR) in the German pension model was next presented by Marco Streibelt. This intensified WMR model focuses on the individual's work conditions, work performance with work-related diagnostics (FCE is a core component of this), psychosocial counselling, education groups, and functional capacity training. The target group in this study were people with high risk of not returning to work (i.e., long term sick leave, unemployment, negative subjective return to work (RTW) prognosis. Findings indicate individual short FCE protocols may be useful within this context, when performance is compared to actual work demands [8–10].

A multicenter prospective cohort study of 198 patients undergoing a short-form FCE (customized FCE less tests, selection of tests depending on job demands) to predict sustainable return to work was presented by Torsten Alles and David Bühne from Germany, again within the WMR model. Information taken from FCE appears useful for the prediction of future occupational participation as the study found good predictive validity of crude and adjusted FCE-information within this setting [11].

Cyrille Burrus presented the predictive value of the Fear-avoidance Model (FAM) and the influence of activity patterns on FCE. In a prospective cohort study, 298 patients were tested to determine whether the FAM predicts lifting capacity performance. After adjusting with numerous confounding variables, results across several lifting tests indicate that there is a cumulative impact of the multidimensional FAM on lifting performances during FCE. In another analysis, task-contingence persistence was positively associated with physical performance during FCE unlike other activity patterns, suggesting that

strategies like goal setting, used for task-contingence persistence, should be promoted in occupational rehabilitation [12].

Reliability and agreement of Neck FCE tests were evaluated in patients with chronic multifactorial neck pain [13]. The limits of agreement were substantial in all 6 tests. Three tests (overhead lift, two handed carry, static overhead work) demonstrated excellent reliability and 3 tests (repeated bending, side reaching left and right) demonstrated a poor reliability. The study also explored safety of the Neck FCE tests, which appeared adequate.

The concurrent validity of the WorkWell observation criteria for determination of workload during lifting was evaluated in healthy subjects by Remko Soer. The objectives in this study were to examine the association between of the WorkWell observation checklist and motion analyses, electromyography, and electrocardiography tests. Primary and secondary musculature became more active with progressive loads. A linear increase of base of support (distance between feet) was observed with progressive loads. No change in starting velocity between the medium and heavy weight lifting condition or linear increase in spine extension were found. Concurrent validity was partially confirmed as a linear increase in heartrate was observed with increasing weights.

Reliability and validity of a short form upper extremity FCE (with fewer trials per test than directed by original FCE protocols) was evaluated in patients with complaints of the arm or hand by Redmar Berduszek. Shortened upper extremity FCE protocols have been found reliable and efficient compared to regular protocols in healthy subjects, but had not yet been assessed in patients with complaints of the arm or hand [14]. In patients, test–retest reliability appears adequate for the majority of short form upper extremity FCE tests, and construct validity appeared sufficient [15, 16]. Findings indicated evidence of the reliability and validity of the short form upper extremity FCE in patients with complaints of the arm or hand and its use in clinical practice may save time, money, and effort.

Douglas Gross presented procedures to develop a computerized adaptive test to assess patient reported physical functioning [17]. The study evaluated efficiency and measurement precision of various Computerized Adaptive Testing designs using computer simulations. It demonstrated feasibility and efficiency of using Computerized Adaptive Testing for measuring reported physical functioning. The procedures are straightforward, and can be applied to other patient-reported outcome measures. The Computerized Adaptive Testing of reported physical functioning is ready for clinical implementation and further testing, but the concept has not been applied to performance based testing yet.

Day Two

Charissa Roossien presented the development and testing of new technology to measure workload. This included the development and testing of sensor technologies for physical, mechanical (sensor chair, -sensor suit, exoskeletal) and energetic workload (wearable breathing gases analyzer, wearable core thermometer) to support sustainable employability. Several innovative sensor and intervention systems are available, while others are nearly ready for implementation in the work field. Roossien concluded that new test sensor technologies hold promise and may make important contributions to sustainable employability [18].

Carole James evaluated changes in biomechanics between safe minimum and safe maximum lifts during the WorkHab FCE. The study used video from 28 participants completing the bench to shoulder lift alongside two-dimensional joint angles measured with joint markers at the wrist, elbow, shoulder, hip, knee, ankle and lumbar and thoracic spine. The sample for the Workably testing was healthy participants: staff and students from the University of Newcastle. Students or staff members with no reported musculoskeletal injuries were invited to participate. Participants were excluded if they had medical conditions which would preclude them from completing manual handling tasks. Dartfish prosuite software was used to evaluate biomechanical differences between minimum and maximum lifts. This study provides insight into the biomechanical changes during a bench to shoulder lift and supports observations and clinical reasoning used in determining the safe maximal lift [19–21].

Robert Sellars evaluated the relationship between upper limb injury, muscle bulk, beliefs and FCE performance in 220 patients with chronic upper limb injuries and persisting chronic pain syndrome and disability. In this observational study, 79% of patients with upper limb pain and disability were observed to have normal muscle bulk regardless of the site of injury. Patients perceptions of pain and/or disability were described by VAS scale of pain, Dallas Questionnaire, MSPQ and McGill [22].

Muscle atrophy did not appear to be a factor in ongoing upper limb disability, but beliefs appeared to have a much greater influence on ongoing disability. Demonstrated disability was not related to measured impairment. The more heightened the patient's beliefs about pain and disability, the worse the overall FCE performance.

The influence of a two-day FCE protocol on self reported work capacity was examined in post-trauma patients by Martin Schindl. A diagnostic before-after study was conducted in 161 consecutively recruited patients with trauma who were referred for FCE at the end of an interdisciplinary inpatient rehabilitation program [23]. Patients completed the Spinal Function Sort to assess patient-reported functional ability both prior to, and after completing the FCE. The

performance of the FCE in patients with trauma was associated with an improvement of patient-reported functional ability [24]. The performance of an FCE in trauma rehabilitation may possibly have a direct therapeutic effect on the patient by allowing a more realistic appraisal of the ability to perform relevant work activities.

Limitations of traditional FCE are related to their length, that they are time consuming and expensive. But questions remain regarding whether brief assessments are as valid as long FCE protocols. Factors associated with performance on a short-form FCE (with less tests) was evaluated in workers' compensation claimants in Alberta, Canada. In this study presented by Douglas Gross, 316 claimants were assessed with short-form FCE to examine construct validity of short-form FCE by examining factors associated with FCE performance. Uni- and multivariable correlation/regression were performed and demonstrated that better performance on short-form FCE was consistently and moderately associated with lower self-reported disability as measured using the Pain Disability Index. Results support the construct validity of this short-form FCE protocol, but further research is needed to evaluate validity in other contexts.

Does completion of a negative or positive questionnaire have an effect on performance and pain perception in people with functional musculoskeletal complaints? To answer this question Ulrike Schwarzer and colleagues studied the influence of priming due to patient-reported questionnaires on physical performance and pain perception in patients with whiplash associated symptoms. They performed an RCT with 75 participants with whiplash associated disorder grades I and II. Patients were randomized to one of three groups: (1) positive priming with the Reliance Scale 13, (2) negative priming with the Fear-Avoidance Beliefs Questionnaire, and (3) neutral priming. No main effects due to positive or negative priming on FCE performance or pain perception were found, possibly due to the high variance of results within groups. The small sample size may also have reduced the ability to detect an effect due to priming.

It is unknown whether central sensitization (i.e., increased responsiveness of nociceptive neurons in the central nervous system to their normal or subthreshold afferent input) is associated with functioning in patients with chronic low back pain. In a cross-sectional study by Ansuategui Echeita, the association between central sensitization, FCE lifting performance, and aerobic capacity were evaluated in patients with chronic low back pain. No significant association was found indicating no effect due to central sensitization in this preliminary evaluation with a small sample [25].

In the final conference session, Douglas Gross led a discussion of the International Working Group around 3 questions: (1) Do we need an international FCE clinical practice guideline?; (2) What methods should be used for developing an international clinical practice guideline?; and (3) What are the next steps towards developing a guideline? The discussion highlighted limitations of current guidelines, which included their limited local (i.e., single nation only) and contextual (i.e., single discipline) applicability, an inconsistent use of evidence to inform development of the guideline, reliance on expert panels without other stakeholder input, and variable quality as indicated by scores on the Appraisal of Guidelines for Research & Evaluation II instrument. Due to these limitations, there was consensus that an international, interdisciplinary evidence-based clinical practice guideline should be developed to provide recommendations for clinicians and consumers about optimal and appropriate use of FCE in specific clinical situations. Several potential benefits of such a clinical practice guideline were identified including: (1) more consistent and evidence-informed clinical use of FCE; (2) better informed funding decisions by insurers and health care funding organizations; and (3) optimal clinical outcomes for patients. Development of a guideline would include starting with broad clinical questions focused on the relevant FCE issues, identifying and appraising the research evidence, incorporating stakeholder preferences/values, and providing specific recommendations using a transparent, systematic process. Since clinical practice guidelines can be appraised like any other source of information or evidence, development should follow a rigorous process that follows a strict methodology. An outcome of the discussion was the development of an international working group to explore development of an FCE clinical practice guideline.

Discussion and Future Directions

Presentations and discussion at the 4th International FCE Research Conference highlighted the differences in FCE use across cultural and social economic system contexts in which clinicians operate. A need for further research was identified specifically to further investigate reliability and validity of existing protocols in diverse contexts and populations, to better understand the biopsychosocial nature of patient performance during FCE, develop decision support tools related to work-ability decisions informed by FCE, and develop a widely-applicable evidence-based FCE clinical practice guideline. Next steps will include exploring the development of an international, interdisciplinary evidence-based FCE clinical practice guideline by a committee formed at the conference. It was also agreed that a fifth international FCE meeting will be planned in the United States of America within the next 2 years. Details of this meeting will be distributed as they become available to the international network of researchers, clinicians, and other professionals in the area.

Full details and abstracts from this Fourth International FCE Research Conference are available (as of December 11,

2019) from https://www.sar-reha.ch/interessengemeinschaften/ig-ergonomie.html.

Acknowledgements The following FCE researchers and clinicians have actively contributed to the discussion on research needs, reviewed this brief report, and agreed to be acknowledged for their contributions: T. Hornung, I.Herzog-Zwitter, A. Klipstein, R. Kunz, S. De Baets, D. van de Velde, J. Ansuategui Echeita, R. Knöpfel, M. Steibelt, T. Alles, C. Burrus, R. Berduszek, H. Huwiler, B. Tissi, C. Roossien, R Soer, R. Sellars, M.Schindl, U. Schwarzer.

Compliance with Ethical Standards

Conflict of interest Edelaar, Oesch, Gross, James and Reneman declare they have no conflict of interest.

Ethical Approval The scientific conference included no data collection, so ethics approval was not pursued. However, each of the studies presented at the conference had received appropriate ethical approval as required.

References

1. Soer R, van der Schans CP, Groothoff JW, Geertzen JH, Reneman MF. Towards consensus in operational definitions in functional capacity evaluation: a Delphi survey. J Occup Rehabil. 2008;18(4):389–400.
2. Reneman MF, Soer R, Gross DP. Developing research on performance- based functional work assessment: report on the first international functional capacity evaluation research meeting. J Occup Rehabil. 2013;23(4):513–515.
3. James CL, Reneman MF, Gross DP. Functional capacity evaluation research: report from the second international functional capacity evaluation research meeting. J Occup Rehabil. 2016;26(1):80–83.
4. Edelaar MJA, Gross DP, James CL, Reneman MF. Functional capacity evaluation research: report from the third international functional capacity evaluation research meeting. J Occup Rehabil. 2017;28(1):130–134.
5. Barth J, de Boer WE, Busse JW, Hoving JL, Kedzia S, Couban R, Fischer K, von Allmen DY, Spanjer J, Kunz R. Inter-rater agreement in evaluation of disability: systematic review of reproducibility studies. BMJ. 2017;356:j14. https://doi.org/10.1136/bmj.j14.
6. De Baets S, Calders P, Schalley N, Vermeulen K, Vertriest S, Van Peteghem L, Coussens M, Malfait F, Vanderstraeten G, Van Hove G, Van de Velde D. Updating the evidence on functional capacity evaluation methods: a systematic review. J Occup Rehabil. 2018;28(3):418–428.
7. Kaiser M, Klipstein A, Knöpfel R, Rattin U, Vallon P. Resource-oriented reintegration into the labor market other organizations and institutions. Switz Med Doct. 2019;100(26):886–888. https://doi.org/10.4414/saez.2019.17942.
8. Bethge M, Markus M, Streibelt M, Gerlich C, Schuler M. Implementing the German model of work-related medical rehabilitation: did the delivered dose of work-related treatment components increase? Arch Phys Med Rehabil. 2018;99(12):2465–2471.
9. Neuderth S, Schwarz B, Gerlich C, Schuler M, Markus M, Bethge M. Work-related medical rehabilitation in patients with musculoskeletal disorders: the protocol of a propensity score matched effectiveness study (EVA-WMR, DRKS00009780). BMC Public Health. 2016;16:804. https://doi.org/10.1186/s12889-016-3437
10. Streibelt M, Bethge M. Effects of intensified work-related multidisciplinary rehabilitation on occupational participation: a randomized-controlled trial in patients with chronic musculoskeletal disorders. Int J Rehabil Res. 2014;37(1):61–66.
11. Bühne D, Alles T, Hetzel C, et al. The prognostic validity of the functional capacity evaluation ELA in work-related medical rehabilitation. Die Rehabil. 2018;57(2):92–99.
12. Tüscher J, Burrus C, Vuistiner P, Léger B, Rivier G, Luthi F. Predictive value of the fear-avoidance model on functional capacity evaluation. J Occup Rehabil. 2018;28(3):513–522. https://doi.org/10.1007/s10926-017-9737-7.
13. Reneman MF, Roelofs M, Schiphorst Preuper HR. Reliability and agreement of neck functional capacity evaluation tests in patients with chronic multifactorial neck pain. Arch Phys Med Rehabil. 2017;98(7):1476–1479.
14. Hollak N, Soer R, van der Woude LH, Reneman MF. Towards a comprehensive functional capacity evaluation for hand function. Appl Ergon. 2014;45(3):686–692. https://doi.org/10.1016/j.apergo.2013.09.006.
15. Jacobs NW, Berduszek RJ, Dijkstra PU, van der Sluis CK. Validity and reliability of the upper extremity work demands scale. J Occup Rehabil. 2017;27(4):520–529. https://doi.org/10.1007/s10926-016-9683-9.
16. Cavalini MA, Berduszek RJ, van der Sluis CK. Construct validity and test-retest reliability of the revised upper extremity work demands (UEWD-R) scale. Occup Environ Med. 2017;74(10):763–768. https://doi.org/10.1136/oemed-2017-104370.
17. MCCabe E, Gross DP, Bulut O. Procedures to develop a computerized adaptive test to assess patient-reported physical functioning. Qual Life Res. 2018;27(9):2393–2402.
18. Roossien CC, Stegenga J, Hodselmans AP, Spook SM, Koolhaas W, Brouwer S, Verkerke GJ, Reneman MF. Can a smart chair improve the sitting behavior of office workers? Appl Ergon. 2017;65:355–361. https://doi.org/10.1016/j.apergo.2017.07.012.
19. West N, Snodgrass SJ, James C. The effect of load on biomechanics of the back and upper limb in a bench to shoulder lift during the WorkHab functional capacity evaluation. Work. 2018;59(2):201–210.
20. James C, MacKenzie L, Capra M. Content validity of the WorkHab functional capacity evaluation. Aust Occup Ther J. 2019;66(3):380–392. https://doi.org/10.1111/1440-1630.12565.
21. Melino NL, James C, Snodgrass SJ. The effect of load in a floor-to-bench lift during the WorkHab functional capacity evaluation. Work. 2014;49(4):585–596. https://doi.org/10.3233/WOR-131698.
22. Andersson GBJ, Cocchiarella L. Guides to the evaluation of permanent impairment. 5th ed. Chicago: American Medical Association; 2000. ISBN-10: 1579470858
23. Schindl M, Wassipaul S, Wagner T, Gstaltner K, Betghe M. Impact of functional capacity evaluation on patient-reported functional ability: an exploratory diagnostic before-after study. J Occup Rehabil. 2019;29(4):711–717. https://doi.org/10.1007/s10926-019-09829-2.
24. Schindl M, Zipko H, Wassipaul S. Is work capacity in trauma patients influenced by comorbidity. In: 15th congress of EFRR congress of the European forum for research in rehabilitation Berlin, 15–17 2019 Berlin DRV-Schriften Band 117; 533–534
25. van Wilgen CP, Testa M. Proceedings of pain science in motion colloquium—3rd ed. May 31st—June 2nd, University of Genoa-Campus of Savona, Italy. Giving insight in pain research of tomorrow!·May/June 2019, Volume 4, Issue 3, p e753. https://doi.org/10.1097/PR9.0000000000000753. www.painreportsonline.com