Integrating FCE to predict work rehabilitation outcomes

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Dr. David Bühne
Integrating FCE to predict work rehabilitation outcomes

Body functioning & structures \(\xrightarrow{}\) Health condition \(\xrightarrow{}\) Activities \(\xrightarrow{}\) Participation \(\xrightarrow{}\) Environmental factors

modified from World Health Organization, 2005, p.23
Integrating FCE to predict work rehabilitation outcomes

Body functioning & structures → Activities → Participation

Modified from World Health Organization, 2005, p.23

Environmental factors

Personal factors

ICF
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Body functioning & structures → Activities → Participation

For example, many body functioning tests may not accurately predict participation in certain activities. Many false estimat.
Body functioning & structures

Activities

Participation

FCE

LESS false estimat.
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Activities

Standard FCE

Customized* FCE

Participation

Body functioning & structures

*) orientated on the individual job demands
Why also use customized FCE?

- Standard FCE Tests are mostly focused on the identification of below average abilities.

- Increasing patient’s compliance with maximum individual care and minimum transfer from testing situation to real working life.
Negative influences on reliability because of individual, requirement-based test choice and –design will be overcompensated by a higher validity in assessing work-related physical capacity.
Possible Modifications

- Used items in lifting and carrying tests
- Duration, amounts of repetitions
- Distances, heights and weights
- Wearing PSD
- Specified techniques, limited motional space
- ...

Integrating FCE to predict work rehabilitation outcomes
Use in WMR

- aim: observing the „real“ job performance
- observation of only 4 to 6 important tests (decision by rehab-team for each patient) \(\rightarrow\) individual short protocol
- duration: up to 1 hour (incl. description of job demands)

FCE: Core element in WMR diagnostic

- individual short protocols
- useful, when based on real work demands
- test adaptation necessary
  \(\rightarrow\) high „individual“ validity, but low „statistical“ validity?
Integrating FCE to predict work rehabilitation outcomes

**Background**

**ELA**

Einschätzung körperlicher Leistungsfähigkeiten bei arbeitsbezogenen Aktivitäten

(Work-related Physical Functional Capacity Evaluation)

**4 dimensions**

- posture
- locomotion
- movement of body parts
- complex categories

**24 subtests**

- e.g. standing, sitting, bent posture
- e.g. walking, climbing, crawling
- e.g. reaching, handgrip strength
- e.g. lifting, carrying, pushing
### ELA-procedure

**Background**

- Interview
- Requirement profile
- Test selection & modification
- Test implementation
- Consistency check
- Report including profile comparison
- Therapy planning
- RTW-recommendations

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#### Comparison of physical capabilities with occupational requirements

*The capabilities are ... than the occupational requirements*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Assessment</th>
<th>much higher (++)</th>
<th>rather higher (+)</th>
<th>equal to (=)</th>
<th>rather lower (-)</th>
<th>much lower (--)</th>
<th>N/A (Ø)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting</td>
<td></td>
<td>×++</td>
<td>Ø+</td>
<td>Ø=</td>
<td>Ø</td>
<td>Ø−</td>
<td>ØØ</td>
</tr>
<tr>
<td>Standing</td>
<td>Ø++</td>
<td>Ø+</td>
<td>Ø=</td>
<td>Ø−</td>
<td>Ø−</td>
<td>Ø−</td>
<td>ØØ</td>
</tr>
<tr>
<td>Kneeling</td>
<td>Ø++</td>
<td>×−</td>
<td>Ø=</td>
<td>Ø−</td>
<td>Ø−</td>
<td>Ø−</td>
<td>ØØ</td>
</tr>
<tr>
<td>Crouching</td>
<td>Ø++</td>
<td>Ø−</td>
<td>Ø=</td>
<td>Ø−</td>
<td>Ø−</td>
<td>Ø−</td>
<td>ØØ</td>
</tr>
<tr>
<td>Sitting tilted forward</td>
<td>Ø++</td>
<td>×−</td>
<td>Ø=</td>
<td>Ø−</td>
<td>Ø−</td>
<td>Ø−</td>
<td>ØØ</td>
</tr>
<tr>
<td><strong>Standing tilted forward</strong></td>
<td>Ø++</td>
<td>Ø−</td>
<td>Ø=</td>
<td>×−</td>
<td>Ø−</td>
<td>Ø−</td>
<td>ØØ</td>
</tr>
<tr>
<td>Arms in front/over head</td>
<td>Ø++</td>
<td>×−</td>
<td>Ø=</td>
<td>Ø−</td>
<td>Ø−</td>
<td>Ø−</td>
<td>ØØ</td>
</tr>
</tbody>
</table>

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Integrating FCE to predict work rehabilitation outcomes
**ELA-procedure**

<table>
<thead>
<tr>
<th>item</th>
<th>job requirement</th>
<th>standard test-design</th>
<th>modified test-design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifting  floor – work surface</td>
<td>lifting a driver-platform (12.5kg) every 15 minutes from pallet (15cm) to height of 80cm</td>
<td>floor – work surface (100cm); object: crate; 10 lifts per set; weight is increased until the maximum weight is observed</td>
<td>level 1: floor level 2: 80cm object: crate 10 lifts per set target: 15kg</td>
</tr>
<tr>
<td>Standing tilted forward</td>
<td>...</td>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

**Background**
### ELA-procedure

<table>
<thead>
<tr>
<th>item</th>
<th>job requirement</th>
<th>standard test-design</th>
<th>modified test-design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifting floor – work</td>
<td>lifting a driver-platform (12.5kg) every 15 minutes from pallet (15cm) to height</td>
<td>floor – work surface (100cm); object: crate; 10 lifts per set; weight is increased until the maximum weight is observed</td>
<td>level 1: floor level 2: 80cm object: crate 10 lifts per set target: 15kg</td>
</tr>
<tr>
<td>surface</td>
<td>of 80cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing tilted forward</td>
<td>...</td>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>
Integrating FCE to predict work rehabilitation outcomes

Objective

predictive validity of ELA

general estimation of physical work ability

- body posture
- local motion
- part em.
- compl. phys. Char.

- sitting
- walking
- torso rotation
- lifting

- standing
- ascending
- reaching
- pushing

Return to Work

outcome
Objective: evaluation of the ability of a short-form FCE to predict sustainable return to work (RTW)

Design: multicentric prospective cohort study (with four outpatient rehabilitation clinics)

Participants: patients (N=198) with musculoskeletal disorders

Data collection: between September 2013 and January 2016
Integrating FCE to predict work rehabilitation outcomes

**Outcome:**

- Employment at 3-month follow-up
- Less than 1.5 weeks of sick leave because of musculoskeletal disorders within the follow-up period

**FCE-Indicator**

1. Overall FCE-rating (positive vs. negative)
2. Dimension-specific test results
3. Activity-specific test results
Results - Assessors

**Age**
- 35.3 years (SD=7.7)

**Experience**
- **FCE**
  - 1.1 years (SD=1.9)
- **ELA**
  - 2.2 months (SD=3.6)

Bühne et al., 2018
## Results - Sample & RTW-Outcome

### Patient characteristics (admission)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>47.7 (SD=10.0)</td>
</tr>
<tr>
<td>Male gender</td>
<td>66.2%</td>
</tr>
<tr>
<td>Sick-listed</td>
<td>80.3%</td>
</tr>
<tr>
<td>ICD-10 (M40-M54)</td>
<td>52.0%</td>
</tr>
<tr>
<td>Expected RTW-duration (&gt;1 month)</td>
<td>62.6%</td>
</tr>
<tr>
<td>PHQ-2 (Score&lt;3)</td>
<td>76.8%</td>
</tr>
<tr>
<td>Health-related disability at work (heavily)</td>
<td>25.3%</td>
</tr>
<tr>
<td>Employed</td>
<td>82.3%</td>
</tr>
<tr>
<td>Days of sick-leave (&gt;=100)</td>
<td>43.4%</td>
</tr>
<tr>
<td>ELA-result (positive)</td>
<td>79.8%</td>
</tr>
</tbody>
</table>

### Outcome

- Employed ≥3h/day: 74.7%
- Employed ≥3h/day & <1.5 weeks during follow-up: 59.1%

Bühne et al., 2018
1) predictive validity of FCE-information at discharge

<table>
<thead>
<tr>
<th></th>
<th>$R^2_{\text{Nagelkerke}}$</th>
<th>AUC-ROC</th>
<th>CCR</th>
<th>Odds ratio (FCE)</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crude (FCE-result positive vs. negative)</strong></td>
<td>0.287</td>
<td>0.737</td>
<td>73.2%</td>
<td>17.2 (6.2–57.8)</td>
<td>94.9%</td>
<td>42.0%</td>
</tr>
<tr>
<td><strong>Reference model</strong>**</td>
<td>0.291</td>
<td>0.780</td>
<td>72.2%</td>
<td>---</td>
<td>82.9%</td>
<td>56.8%</td>
</tr>
<tr>
<td><strong>Reference model + FCE (ELA)</strong></td>
<td>0.440</td>
<td>0.835</td>
<td>78.8%</td>
<td>14.6 (4.8–44.9)</td>
<td>90.6%</td>
<td>61.7%</td>
</tr>
</tbody>
</table>

* Adjusted for assessors

** Adjusted for assessors and age, gender, employment status, family status, vocational qualification, sick-listed at admission, sick leave 1 year preadmission, work demands, initial diagnosis & baseline

RTW=0, N-RTW=1

Bühne et al., 2018
- the lack in specificity can be explained at least in part by non-physical RTW-barriers
- framework conditions must be taken into account!
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**ELA**

Predictive validity of ELA

General estimation of physical work ability

- Body posture
- Locomotion
- Body part movement
- Compl. phys. Char.
- Sitting
- Walking
- Torso rotation
- Lifting
- Standing
- Ascending
- Reaching
- Pushing
- ...
## Results

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>p</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Employment status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0=employed</td>
<td>1.66</td>
<td>0.001</td>
<td>5.27</td>
</tr>
<tr>
<td>1=unemployed</td>
<td></td>
<td></td>
<td>(1.91-14.54)</td>
</tr>
<tr>
<td><strong>Health-related disability at work</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0≤slightly</td>
<td>1.58</td>
<td>&lt;0.001</td>
<td>4.88</td>
</tr>
<tr>
<td>1=heavily</td>
<td></td>
<td></td>
<td>(2.06-11.55)</td>
</tr>
<tr>
<td><strong>Body posture</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0=no failed test</td>
<td>0.96</td>
<td>0.021</td>
<td>2.60</td>
</tr>
<tr>
<td>1≥1 failed test</td>
<td></td>
<td></td>
<td>(1.15-5.88)</td>
</tr>
<tr>
<td><strong>Locomotion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0=no failed test</td>
<td>1.56</td>
<td>0.023</td>
<td>4.75</td>
</tr>
<tr>
<td>1≥1 failed test</td>
<td></td>
<td></td>
<td>(1.24-18.14)</td>
</tr>
<tr>
<td><strong>Body part movem.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0=no failed test</td>
<td>0.43</td>
<td>0.395</td>
<td>1.53</td>
</tr>
<tr>
<td>1≥1 failed test</td>
<td></td>
<td></td>
<td>(0.58-4.07)</td>
</tr>
<tr>
<td><strong>Compl. phys. char.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0=no failed test</td>
<td>0.97</td>
<td>0.022</td>
<td>2.65</td>
</tr>
<tr>
<td>1≥1 failed test</td>
<td></td>
<td></td>
<td>(1.15-6.08)</td>
</tr>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0=positive</td>
<td>0.45</td>
<td>0.943</td>
<td>1.05</td>
</tr>
<tr>
<td>1=negative</td>
<td></td>
<td></td>
<td>(0.31-3.58)</td>
</tr>
</tbody>
</table>

*RTW=0, N-RTW=1
Constant: -1.86, R (Nagelkerke): 0.438, CCR: 76.3%, AUC: 0.838
Integrating FCE to predict work rehabilitation outcomes

ELA

general estimation of physical work ability

body posture
loco-motion
body part movem.
compl. phys. Char.
sitting
walking
Torso rotation
lifting
standing
ascending
reaching
pushing
...
...
...
...

Results

predictive validity of ELA

Return to Work
outcome
## Results

<table>
<thead>
<tr>
<th>Activity</th>
<th>Status</th>
<th>b</th>
<th>p</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing – bent posture</td>
<td>0=positive</td>
<td>1.15</td>
<td>0.022</td>
<td>3.17 (1.18-8.52)</td>
</tr>
<tr>
<td></td>
<td>1=negative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifting (floor – work surface)</td>
<td>0=positive</td>
<td>0.68</td>
<td>0.110</td>
<td>1.97 (0.86-4.51)</td>
</tr>
<tr>
<td></td>
<td>1=negative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrying with both hands</td>
<td>0=positive</td>
<td>2.46</td>
<td>0.022</td>
<td>11.65 (1.42-95.46)</td>
</tr>
<tr>
<td></td>
<td>1=negative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remaining tests</td>
<td>number of failed tests</td>
<td>0.373</td>
<td>0.015</td>
<td>1.45 (1.08-1.96)</td>
</tr>
<tr>
<td></td>
<td>(0 up to 3 or more)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>0=positive</td>
<td>0.94</td>
<td>0.059</td>
<td>2.55 (0.96-6.76)</td>
</tr>
<tr>
<td></td>
<td>1=negative</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*RTW=0; Costant: -2.12, R2 (Nagelkerke): 0.259, CCR: 69.9%, AUC: 0.751*
Integrating FCE to predict work rehabilitation outcomes

**Results**

Predictive validity of ELA

General estimation of physical work ability

- Body posture
- Locomotion
- Body part movement
- Compl. phys. Char.

- Sitting
- Walking
- Torso rotation
- Lifting

- Standing
- Ascending
- Reaching
- Pushing

... ... ...

Return to Work outcome
### Results

#### RTW-prediction at admission

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>p</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELA</strong> 0=positive 1=negative</td>
<td>0.96</td>
<td>0.004</td>
<td>2.67 (1.38-5.20)</td>
</tr>
<tr>
<td><strong>Health-related disability at work</strong> 0=slightly/no 1=heavily</td>
<td>1.99</td>
<td>&lt;0.001</td>
<td>7.29 (3.34-15.93)</td>
</tr>
</tbody>
</table>

*RTW=0; Costant: -1.29, R2 (Nagelkerke): 0.285, CCR: 73.5%, AUC: 0.757*

<table>
<thead>
<tr>
<th>ELA-result</th>
<th>Health-related disability at work</th>
<th>RTW-probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>positive</td>
<td>&lt;=slightly</td>
<td>78,4%</td>
</tr>
<tr>
<td></td>
<td>heavily</td>
<td>46,9%</td>
</tr>
<tr>
<td>negative</td>
<td>&lt;=slightly</td>
<td>70,6%</td>
</tr>
<tr>
<td></td>
<td>heavily</td>
<td>24,8%</td>
</tr>
</tbody>
</table>
Limitations

- validity of test-selection questionable
- validity of physical work-demands-assessment questionable
- reliability of ELA is unknown
- influence of contextual factors (e.g. employment rate)

Conclusion

The study confirms the predictive validity of crude and adjusted FCE-information
Are ELA-results valid?

**ELA**

Overall and activity-related ability to cope the physical work demands

Return to Work

Ability to cope with the physical work demands
Integrating FCE to predict work rehabilitation outcomes

RTW

Tolerance of environmental influences
Ability to cope with the cognitive work demands
Ability to cope with the psychosocial work demands
Work ability

Work-related physical capacity
(Ability to cope with the physical work demands)

Motivation

Availability of a workplace
Social conflicts in the workplace
Operational support
Children to be cared for
Family members to be nursed

General Context Conditions

Personal Context Conditions

Limitations
Objective:
1. Evaluation of the ability of a short-form FCE to predict sustainable return to work after controlling for non-physical reintegration barriers
2. Identification of limiting factors
Thank you for your attention

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