

# **Reliability and Validity of the WorkHab Functional Capacity Evaluation**

**Carole L. James**

**MHSc(OT), BSc(OT), Dip COT**

This thesis is submitted in fulfilment of the requirements for the

Degree of Doctor of Philosophy (Occupational Therapy)

School of Health Sciences

University of Newcastle, NSW, 2308

Australia

February 2011

## **Statement of Originality**

*This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.*

## **Thesis by publication Acknowledgement of Authorship**

*I hereby certify that this thesis is in a form of a series of published papers of which I am a joint author. I have included as part of the thesis a written statement from each co-author, endorsed by the Faculty of Health Assistant Dean (Research Training), attesting to my contribution to the joint publications. These can be found in Appendix 1.*

*Signed:* \_\_\_\_\_

*Carole James*

*Date:* \_\_\_\_\_

## **Acknowledgements**

I wish to acknowledge and thank all the participants: the injured workers; students and staff of the university; occupational therapists; and other health professionals, who participated in this research without whom, this study would not have been possible. I would also like to thank all the health professionals who contributed along my journey, as participants in the study, and as peers and colleagues in providing advice and expertise.

I acknowledge the financial support provided by the University of Newcastle with an early career researcher grant and an equity fellowship grant which made this study possible.

A special thank you goes to my supervisors Dr Lynette Mackenzie and Professor Mike Capra. Both have been very generous with their time, provided much enthusiasm, scholarly advice, direction and support throughout this journey.

Thank you to the research assistants who have assisted in various stages of this project and also to my colleagues within the School of Health Sciences at the University of Newcastle, for your support and encouragement.

A heart sent thank you goes to my family and friends who have provided much practical assistance and support. A special thank you goes to my parents for their continuous support and faith in all my endeavours; to my husband Bernie, for his practical and emotional support and his belief in my abilities and to Zoe, my daughter, for her patience and understanding during this research journey.

## **Publications arising from work presented in this thesis**

### **Refereed Journal publications:**

1. James, C., Mackenzie, L. and Higginbotham, N. (2007). "Health Professionals' Attitudes and Practices in relation to Functional Capacity Evaluations." Work **29**(2): 81-88.
2. James, C. and Mackenzie, L. (2009). "Health Professional's Perceptions and Practices in Relation to Functional Capacity Evaluations: Results of a Quantitative Survey." Journal of Occupational Rehabilitation **19**(2): 203-211.
3. James, C. and Mackenzie, L. (2009). "The clinical utility of functional capacity evaluations: the opinion of health professionals working within occupational rehabilitation." Work **33**(3): 231-9.
4. James, C., Mackenzie, L. and Capra, M. (2010). "Test-retest reliability of the manual handling component of the WorkHab functional capacity evaluation in healthy adults." Disability and Rehabilitation **32**(22): 1863-1869.
5. James, C., Mackenzie, L. and Capra, M. (early online). Inter and Intra- rater reliability of the Manual Handling component of the WorkHab Functional Capacity Evaluation. Disability and Rehabilitation  
DOI:10.3109/09638288.2010.548896 (posted online: January 19, 2011).
6. James, C., Mackenzie, L. and Capra, M. (under review). "Content Validity of the WorkHab Functional Capacity Evaluation." Submitted for publication in Disability and Rehabilitation
7. James, C., Mackenzie, L. and Capra, M. (under review). "Physiological correlates of functional capacity evaluations: finding the safe maximal lift." submitted for publication in Archives of Physical Medicine and Rehabilitation

### **Conference paper presentations:**

8. James, C., Mackenzie, L. and Capra, M. (2006). Health Professionals' Attitudes and Practices in relation to Functional Capacity. 4th Congress of the World Federation of Occupational Therapists. Sydney, NSW, Australia.
9. James, C. and Mackenzie, L. (2008). The Clinical Utility of Functional Capacity Evaluations: the opinion of Health Professionals working within Occupational Rehabilitation. OT Australia 23rd National Conference. Melbourne, Australia.
10. James, C., Mackenzie, L. and Capra, M. (2010). Evidence for Functional Capacity Evaluations – the test-retest reliability of the WorkHab FCE. 15th Congress of the World Federation of Occupational Therapists. Santiago, Chile.

# Table of Contents

Statement of Originality.....	ii
Thesis by publication Acknowledgement of Authorship.....	iii
Acknowledgements.....	iv
Publications arising from work presented in this thesis .....	v
Refereed Journal publications: .....	v
Conference paper presentations:.....	vi
Table of Contents.....	vii
Table of Figures .....	x
Table of Tables .....	xi
Abbreviations .....	xii
Thesis Abstract .....	1
Chapter 1 Introduction.....	3
1.1 The Problem .....	6
1.2 Aims of the research.....	7
Usage:.....	7
Reliability of the WorkHab FCE: .....	8
Validity of the WorkHab FCE: .....	8
1.3 Significance of the thesis .....	10
1.4 Thesis overview .....	11
Chapter two.....	11
Chapter three .....	11
Chapter four .....	12
Chapter five.....	13
Chapter six .....	13
Chapter 2 Literature Review.....	14
2.1 What is function? .....	14
2.2 What are Functional Capacity Evaluations? .....	16
2.3 Models and theoretical frameworks applied to FCEs .....	19
2.4 Types of Functional Capacity Evaluations.....	22
2.5 Best practice and Functional Capacity Evaluation .....	24
2.6 The use of Functional Capacity Evaluations in practice – application to the work environment .....	28
2.7 The WorkHab Functional Capacity Evaluation .....	33
2.8 Evidence of psychometric properties of FCEs.....	36
2.9 A review of published studies related to the reliability and validity of FCEs.....	41
2.10 Chapter Summary.....	56
Chapter 3 Current Practice with Functional Capacity Evaluations.....	58
3.1 Manuscript: Health Professionals' Attitudes and Practices in relation to Functional Capacity Evaluations.....	62
Abstract .....	62
3.1.1 Introduction and Literature review .....	63
3.1.2 Methodology .....	64
3.1.3 Results and Discussion.....	66
3.1.4 Conclusion .....	71
Acknowledgements .....	72
References.....	72
Appendix A.....	75
3.2 Manuscript: Health Professionals' Perceptions and Practices in relation to Functional Capacity Evaluations – Results of a Quantitative Survey.....	76
Abstract .....	76
3.2.1 Introduction .....	78
3.2.2 Method.....	80
3.2.3 Results .....	81
3.2.4 Discussion.....	87
3.2.5 Conclusions .....	91
Acknowledgements .....	91
References.....	91
3.3 Manuscript: The Clinical Utility of Functional Capacity Evaluations: the Opinion of Health Professionals working within Occupational Rehabilitation .....	95

Abstract: .....	95
3.3.1 Introduction and Literature review .....	96
3.3.2 Method .....	98
3.3.3 Results .....	99
3.3.4 Discussion .....	103
3.3.5 Conclusion .....	107
Acknowledgements .....	108
References .....	108
3.4 Chapter Summary .....	111
Chapter 4 The WorkHab Functional Capacity Evaluation: Reliability .....	114
4.1 Manuscript: Test - Retest reliability of the Manual Handling component of the WorkHab Functional Capacity Evaluation in healthy adults .....	119
Abstract .....	119
4.1.1 Introduction .....	120
4.1.2 Method .....	121
4.1.3 Results .....	123
4.1.4 Discussion .....	126
4.1.5 Conclusion .....	129
Acknowledgements .....	129
References .....	129
4.2 Manuscript: Inter and Intra-rater reliability of the Manual Handling component of the WorkHab Functional Capacity Evaluation .....	133
Abstract .....	133
4.2.1 Introduction .....	135
4.2.2 Method .....	136
4.2.3 Results .....	138
4.2.4 Discussion .....	145
4.2.5 Conclusion .....	148
Acknowledgements .....	149
References .....	149
4.3 Chapter Summary .....	152
Chapter 5 The WorkHab Functional Capacity Evaluation: Validity .....	155
5.1 Manuscript: Content Validity of the WorkHab Functional Capacity Evaluation .....	163
Abstract .....	163
5.1.1 Introduction .....	165
5.1.2 Method .....	167
5.1.3 Results .....	169
5.1.4 Discussion .....	177
5.1.5 Conclusion .....	183
Acknowledgements .....	183
References .....	183
5.2 Manuscript: Physiological correlates of functional capacity evaluations: finding the safe maximal lift .....	188
Abstract .....	188
5.2.1 Introduction .....	189
5.2.2 Methods .....	190
5.2.3 Results .....	192
5.2.4 Discussion .....	195
5.2.5 Conclusions .....	198
Acknowledgements .....	198
References .....	198
5.5 Chapter Summary .....	202
Chapter 6 Discussion .....	205
6.1 Key research findings within the thesis .....	205
Current usage of FCEs .....	205
Clinical utility .....	207
Reliability .....	208
Validity .....	209
6.2 Limitations within the program of research for the thesis .....	212
6.3 Implications of thesis findings for clinical practice .....	214



6.4	Future directions for research .....	218
6.5	Conclusions .....	219
	References .....	222
	Appendices .....	238
	Appendix 1 Co-author statements .....	239
	Manuscript 1: (3.1) Health Professionals' Attitudes and Practices in relation to Functional Capacity Evaluations.....	240
	Manuscript 2: (3.2) Health Professionals' Perceptions and Practices in relation to Functional Capacity Evaluations – Results of a Quantitative Survey.....	243
	Manuscript 3: (3.3) The Clinical Utility of Functional Capacity Evaluations: the Opinion of Health Professionals working within Occupational Rehabilitation .....	245
	Manuscript 4: (4.1) Test - Retest Reliability of the Manual Handling Component of the WorkHab Functional Capacity Evaluation in Healthy Adults .....	247
	Manuscript 5: (4.2) Inter and Intra-rater Reliability of the Manual Handling Component of the WorkHab Functional Capacity Evaluation.....	250
	Manuscript 6: (5.1) Content Validity of the WorkHab Functional Capacity Evaluation .....	253
	Manuscript 7: (5.2) Physiological correlates of Functional Capacity Evaluations: Finding the Safe Maximal Lift.....	256
	Appendix 2: Poster presentations .....	259
	Appendix 3: Questionnaire - Health Professionals' Attitudes and Practices in relation to Functional Capacity Evaluations .....	266
	Appendix 4: Content validity online survey instrument - Application of an FCE. ....	277

## Table of Figures

Figure 1: Diagram of project plan and studies completed .....	9
<u>Manuscript 3.2.</u>	
Figure 1: Utilisation of All Components of Standardised FCE (n=71*) .....	84
Figure 2: Utilisation of PARTS of FCE (n=60) .....	84
Figure 3: Frequency of use of most popular Standardised FCEs .....	85
Figure 4: Influences for choices of FCE .....	86
<u>Manuscript 3.3</u>	
Figure 1: Usefulness and Relevance of FCEs (n=77) .....	100
Figure 2: Adaptability and Flexibility of FCEs (n=77) .....	101
Figure 3: Therapist perceived requirements to administer FCEs (n=77) .....	102
Figure 4: Issues in practice administering FCEs (n=77) .....	103
<u>Manuscript 4.1</u>	
Figure 1: Limits of Agreement: Bench to bench, Floor to bench and Bench to shoulder lifts. ...	125
<u>Manuscript 4.1</u>	
Figure 1 – Relationship of Lifting FCE components to DOT physical demands. ....	177
<u>Manuscript 5.2</u>	
Figure 1: Lift time, muscle involvement and weight progression (N=20) .....	193
Figure 2: RMS as % of MVC for each muscle for each weight. (N=20) .....	193

## Table of Tables

Table 1: Summary of findings of functional capacity evaluation psychometric property literature .....	44
<u>Manuscript 3.1</u>	
Table 1: Details of Participants .....	65
<u>Manuscript 3.2</u>	
Table I: Descriptive information on sample (n=77) .....	82
Table II: Usage by FCE type and Profession (n=77). .....	83
Table III: Mean score of importance of different qualities/ criteria in choice of FCE (n=77) .....	86
<u>Manuscript 3.3</u>	
Table 1: Features related to the clinical utility of a tool. ....	97
<u>Manuscript 4.1</u>	
Table 1: Results of means, differences, standard deviations, 95% confidence intervals and ICC's for lifts. ....	124
Table 2: Percentage agreement and Cronbach's alpha for the manual handling score components. ....	126
<u>Manuscript 4.2</u>	
Table 1: Intra-rater agreement: ICC for Manual Handling components (N=14). ....	139
Table 2: Intra-rater agreement: Manual Handling Score Results: means, difference, standard deviations 95% confidence intervals and ICC for each injured worker (subject). (N=14). ....	140
Table 3: Intra-rater agreement-Manual Handling Component Results: mean difference (time1: time 2), standard deviation, 95% confidence intervals and ICC for each injured worker (subjects) (N=14). ....	142
Table 4: Inter-rater agreement: ICC for Manual Handling components (N=17). ....	143
Table 5. Inter-rater agreement for manual handling components for each injured worker (N=17). ....	144
<u>Manuscript 5.1</u>	
Table 1: Relevance of WorkHab FCE components .....	170
Table 2: Difficulty of WorkHab FCE components .....	173
Table 3 Percentage agreement between WorkHab FCE components and the DOT physical demands (n=56). ....	176
<u>Manuscript 5.2</u>	
Table 1: Differences between lifting load up and down, before and after SML and with increasing weight (N=20) .....	194

## Abbreviations

AWP	Assessment of Work Performance
BOH	Bench to Overhead
BS	Bench to Shoulder
BTE	Baltimore Therapeutic Evaluation
CLBP	Chronic Low Back Pain
DOT	Dictionary of Occupational Titles
DVD	Digital video disc
EMG	Electromyography
FAST	Functional Assessment Screening Test
FB	Floor to Bench
FCE	Functional Capacity Evaluation
GAPP-FCE	Gibson Approach to Functional Capacity Evaluation
Hz	Hertz
ICC	Intra-class Correlation
ICF	International Classification of Functioning, Disability and Health
IDR	Instrument for Disability Risk
IWS	Isernhagen Work Systems
LBP	Low Back Pain
mV	Millivolts
MVC	Maximum Voluntary Contraction
NIOSH	National Institute for Occupational Health and Safety
NSW	New South Wales (Australia)
OT	Occupational Therapist
PDI	Pain Disability Index
PILE	Progressive Isoinertial Lifting Evaluation
PWPE	Physical Work Performance Evaluation
RMS	Root Mean Square
RTW	Return to Work
RWL	Recommended Weight Limit
SD	Standard Deviation
SEMG	Surface Electromyography
SML	Safe Maximal Lift
UK	United Kingdom
WRULD	Work-related Upper Limb Disorder
WWS	Work Well Systems Functional Capacity Evaluation
VAS	Visual Analogue Scale

## **Thesis Abstract**

Functional Capacity Evaluations (FCEs) are part of practice in occupational rehabilitation, and are designed to define an individual's functional abilities in the context of safe, productive work tasks. The WorkHab Functional Capacity Evaluation is one of many currently available FCEs. It is commonly used in Australian occupational rehabilitation: however, there is a lack of evidence of its psychometric properties. This thesis reports on research that investigated reliability and aspects of validity of the WorkHab FCE.

The current practice of FCE use in the Australian occupational rehabilitation context was investigated. Qualitative and quantitative methodology were used to study the perceptions and practices of health professionals about the use and clinical utility of FCE's. Results found health professionals use more than one FCE, with the WorkHab FCE the second most commonly used in NSW Australia. There was consistency and similarities in FCE use in practice, with participants adapting FCEs to suit the situation and completing parts rather than the whole of a FCE.

Four studies subsequently investigated the measurement properties of the WorkHab FCE. The manual handling components were evaluated, including test-retest reliability in healthy adults, and intra-rater and inter-rater reliability using DVD footage of injured workers FCEs. Content validity was evaluated using a cross sectional survey of health professionals who use FCEs in practice. Construct validity of the bench to shoulder lift was explored using Electromyography (EMG) to study muscle activity in the upper body.

Results found substantial levels of test-retest reliability and intra-rater and inter-rater reliability for the lifting components of the WorkHab FCE. The findings support content validity for the WorkHab FCE specifically in relation to manual work and vocational retraining; however, construct (convergent) validity of the safe maximal lift of the bench to shoulder lift of the WorkHab FCE was unable to be established using EMG physiological parameters.

Future directions for research of the WorkHab FCE and implications for clinical practice are discussed.