

THE USE OF THE EARNING CAPACITY ASSESSMENT FORM-2 IN A MEDICO-LEGAL SETTING: AN AUSTRALIAN EXPERIENCE¹

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The Earning Capacity Assessment Form-2 (Shahnasarian, 2010) assesses the factors that inhibit and facilitate an individual's vocational rehabilitation following an acquired disability (e.g., accident, misadventure). The purpose of this paper is to provide an introduction to the interpretation of the together with a critique of its use in an Australian context. Data on Australian accident victims (N=33) from a medico-legal vocational assessment practice were used as a basis for evaluation. It was concluded that there are psychometric strengths and weaknesses of the Earning Capacity Assessment Form and that it is worthwhile where economic loss is a consideration.

The evaluation of earning capacity following an accident or injury is a niche area within the practice of career development professionals in Australia. The earliest approaches evolved from vocational guidance and a trait-factor model that was psychological in its determination of vocational aptitudes. This complemented labour market considerations such as one's earnings at the time of an accident and post-accident employment opportunities, which had been taken into account in motor accident, workers' compensation and other personal injury claims but rarely with the assistance of outside experts until the late 1970s. Indeed, Hayes (1979) described economic loss as "the last frontier of tort liability for negligence" (p. 79).

The impetus for the determination of economic loss or residual earnings capacity has continued unabated but there is still no agreement on defined criteria or on an a priori measure of earning capacity impairment. In 2004, Shahnasarian introduced 14 specific factors that might be addressed in evaluating the vocational earning potential of a person (Shahnasarian, 2011).

This model was a precursor to the development of the *Earning Capacity Assessment Form-2* (Shahnasarian, 2010). The purpose of this paper is to evaluate the use of this instrument in an Australian context. The first section of this paper provides an introduction to the *Earning Capacity Assessment Form-2* (ECAF-2) and this is followed by the description of data collected in a medico-legal setting. ECAF-2 has been reviewed favourably in an American context (Field, 2012).

The Earning Capacity Assessment Form-2

The ECAF-2 is completed following a vocational evaluation. It comprises ratings that focus on individual characteristics related to employability. It emphasises claimant characteristics and post-incident consequences and does not rely on aggregate socio-demographic characteristics such as age or gender. An underlying postulate for the development of the ECAF-2 is the recognition of

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personal factors that facilitate employment or inhibit employment (p. 2; unless otherwise indicated all page references are to Shahnasarian, 2010).

The facilitators of employment are termed "drivers" and comprise: (a) stability of career development, (b) work propensity, (c) demonstrated earnings history, (d) career motivation and (e) cognition. The inhibitors of employment comprise: (a) the phase of career development, (b) subject specific issues, (c) ability to apply prior skills, (d) future career development prospects, (e) prognosis, (f) needing capacity for retraining, (g) pre-existing vocational handicaps, (h) acquired vocational handicaps, and (i) vocational adjustment issues. In some instances the effects of inhibitors and drivers may be reversed (p. 3). Finally, it is stated that "Drivers and inhibitors can be quantitatively and qualitatively evaluated... The ECAF-2 can be used to quantify drivers... quantify inhibitors" (p. 3). In essence it involves rating each inhibitor or driver.

The ratings (0-3) range from "a high level of vocational functioning or an absence of an impediment to career development... [to] progressively increasing levels of potential career-related problems that may affect future earning capacity" (p. 6). There is also provision for a rating that indicates an *insufficient basis to assess* or for indicating that an item is *not pertinent* (p. 7). The items and the specific rating criteria are listed in the Appendix (Table 1).

The internal consistency reliability or homogeneity of the 14 items on the ECAF was determined from the ratings of 23 experts. This resulted in a coefficient alpha of .82 (p. 35). The use of the coefficient alpha and the calculation of inter-item correlations imply that in essence the ECAF-2 is an interval rating scale.

Notwithstanding this observation, the overall impairment to earning capacity is categorical, although there is provision to describe it quantitatively from 0% (no loss or impairment of earning capacity) to 100% (catastrophic loss of earning capacity). Mild loss of earning capacity is in the range 1-20%; moderate loss of earning capacity is 21-50%; severe loss of earning capacity is 51-80% and extremely severe loss of earning capacity is 81-99%.

The ECAF varies from other psychometric approaches in that there is no composite score. In essence it reflects an overall judgement of residual earnings capacity. The judgement criteria are in the form of three over-arching rubrics comprising 16 heuristics. These are set out on pages 20-22 of the manual. The heuristics are also summarised in Table 2 of the Appendix where they are grouped into rubrics relating to (a) inhibitors; (b) drivers; and (c) those involving interaction between inhibitors and drivers.

Research issues

This study examines the application of the ECAF-2 with medico-legal clients in an Australian context and it was hypothesised that the results should be consistent with the reported US data on inter-item correlations and internal consistency. The ECAF-2 manual, however, does not report data on the overall rating of severity or the responses to specific items. At the outset it was considered that in a medico-legal and compensation context the overall rating and item-response distribution would be skewed. Finally, the value of the three rubrics was evaluated.

Additional information relevant to validity that might also be examined could include (a) a comparison of the ECAF-2 ratings with the return-to-work status of the claimant at the time of

assessment and (b) whether the ECAF-2 earning impairment categories were related to ratings from a *Vocational Rehabilitation Index* (Cornes, 1990). It was hypothesised that (a) inability to work would be related to the extent of earning capacity impairment and (b) that the extent of earning capacity impairment would be reflected in the scores on a vocational rehabilitation index.

Method

Participants

The participants (12 females; 20 males) in this study comprised 32 claimants (28 plaintiffs and 4 defendants) from a medico-legal practice who underwent a vocational assessment in relation to the determination of economic loss. The injuries were categorised as 16 work-related, 11 motor vehicle accidents and 5 general liability (e.g., medical negligence, public risk). Patients came from rural (n=10) and city regions (n=22). The disabilities ranged from restriction in physical activities or work (22), incomplete use of legs or arms (3), nervous or emotional conditions (2), effects of head injury (2), incomplete use of arms or fingers (3). The whole person impairment was stated in 12 instances and it varied from 7-31%. Just over half of claimants (18) underwent surgery. Psychiatric conditions associated with the claim comprised 9 minor (e.g., post-traumatic neurosis, anxiety state), 11 major (e.g., personality change, cognitive deficit, functional overlay, poor motivation) and 11 with no effects.

The claimants ranged in age from 20 to 60 years (median = 37 years) and the median time post-injury was 3 years (range = 0-27 years). Participants completed a median of 10 years of schooling (range = year 8 to Year 12). The median reading grade of the sample assessed with the *Wide Range Achievement Test4* was junior high school level (median grade = 8.1).

Around 12 participants had a certificate or trade qualification, 3 had a diploma, 1 had a degree but half had no formal post-school qualification or training (16). Occupational groupings were diverse. They comprised 10 labourers, 5 trades, 3 elementary sales, 3 intermediate clerical, 3 intermediate production and transport, 1 intermediate service, 1 elementary service, 1 associate professional, 1 manager and 4 who were not in the labour force at the time of the accident (e.g., children or students).

At the time of interview, 13 had not worked following the accident, 10 returned to work and now were not working following the accident, 9 returned to work. No claim is made that this is a representative or random sample.

Instrument

The ECAF-2 was completed by the author following each vocational assessment. This assessment comprises a structured 1 ½ hour interview including aspects of educational and physical assessments.

Analysis and Procedure

Descriptive statistics for each item as well as the overall rating are reported in the following section. It is not clear that the items are true interval scores but in order to be consistent with the manual, a range of item-scale statistics were calculated to provide a comparison.

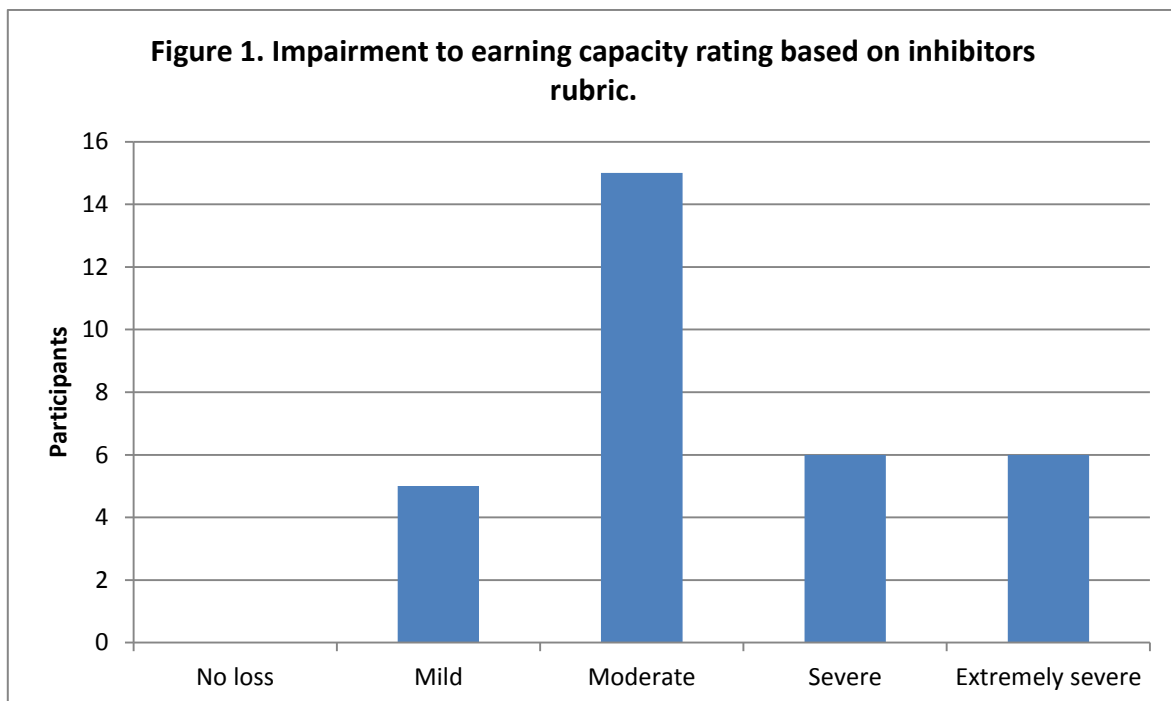
This study also applied the 16 judgemental heuristics to provide a judgement of no loss, moderate, mild, severe, extremely severe or unable to be calculated. The judgemental heuristics were programmed into an Excel spreadsheet to provide a classification for the three rubrics based on (a) inhibitors, (b) drivers and (c) interaction between inhibitors and drivers. The programmed classification was checked against the two cases cited in the test manual for accuracy.

The impairment to earning capacity rating was also compared with an indication of whether the participant had not worked, returned to work but was now not working or was working. This was considered as a partial indication of criterion-related validity. The ECAF-2 judgement was compared to the *Vocational Rehabilitation Index* (Cornes, 1990; Cornes & Roy, 1991). This index ranges from 7 to a maximum of 24 and scores are typically divided into bands of 7-11, 12-14, 15-17 and 18 or more. The index is based on the age, sex, occupational skill level, length of medical treatment, local labour market conditions, history of spinal injury and the psychological problems following injury.

Results

Impairment to Earning Capacity Rating

The ratings on the impairment to earning capacity rating scale for these 32 participants varied according to the rubric that was used. The results are summarised in Table 1. The classifications across the three rubrics were not consistent (see the distribution of values in the last column of Table 1). As expected, the impairment to earning capacity rating was not normally distributed.



A judgement of earning capacity impairment was able to be determined in every instance using the inhibitors (see Figure 1) but was able to be determined in only 11 out of 32 cases for drivers and in only 25 of 32 cases using the heuristics for interaction. When the decisions from the inhibitor heuristic and the driver heuristic were compared, only 1 out of the 8 judgements was the same. In this sample all the 25 cases were classified as moderate impairment using the interaction rubric, (this resulted in 13 out of 25 judgements being identical with the inhibitor rubric).

Table 1 Impairment to earning capacity rating and return to work status at the time of assessment

Maximum rated impairment to earning capacity	Not worked	Returned to work now not working	Returned to work	TOTAL
<i>Based on inhibitors</i>				
No loss	0	0	0	0
Mild	1	1	3	5
Moderate	6	8	1	15
Severe	2	1	3	6
Extremely severe	4	0	2	6
<i>Based on drivers</i>				
No loss	5	0	0	5
Mild	0	0	0	0
Moderate	4	0	0	4
Severe	0	0	0	0
Extremely severe	0	0	0	0
Unable to be classified	4	10	9	23
<i>Based on interactions</i>				
No loss	0	0	0	0
Mild	0	0	0	0
Moderate	11	7	7	25
Severe	0	0	0	0
Extremely severe	0	0	0	0
Unable to be classified	2	3	2	7

Within each rubric, only the heuristics for the inhibitor rubric yielded a consistent ordering similar to a Guttman scale. In other words, someone rated as extremely severe also satisfied the criteria for severe, moderate and mild classifications. This was not the case with the other rubrics.

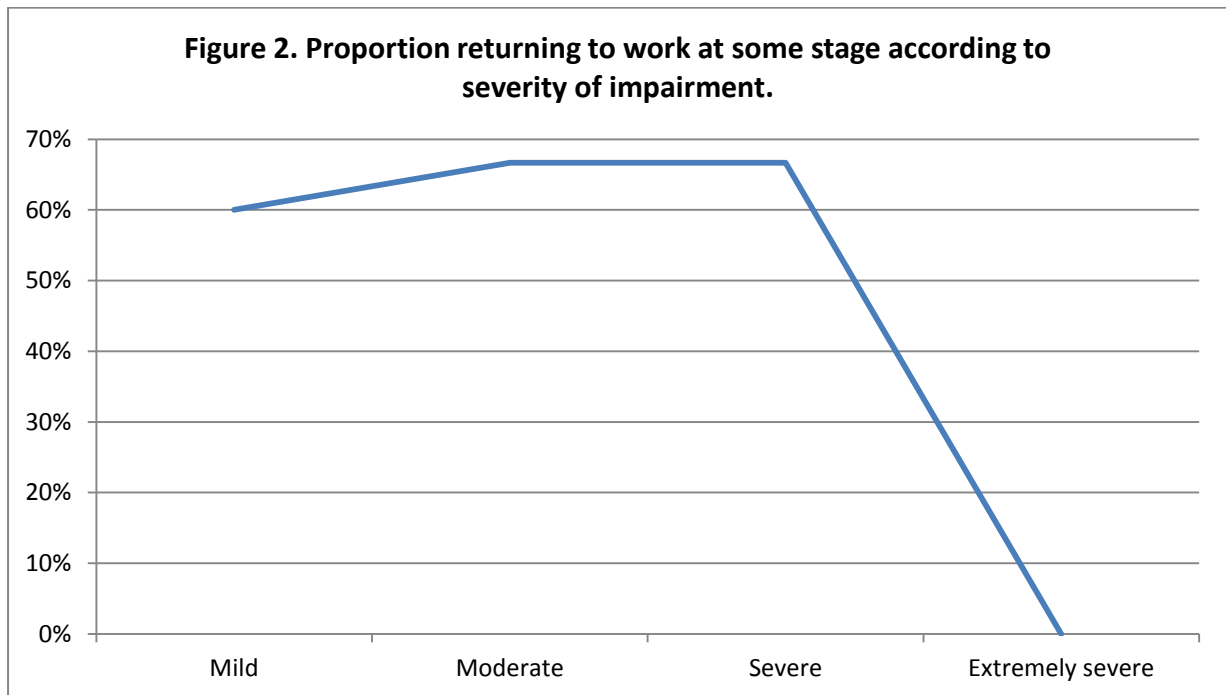
ECAF and return to work

The criterion validity of the impairment to earning capacity rating was supported partly in this small sample. It was expected a priori that the proportion returning to work at some stage would decrease as the severity of the impairment to earning capacity increased. When the impairment to earning capacity was rating was based on the inhibitors, 4 out of 5 for those rate mild impairment returned to work at some stage, compared with 9 out of 15 for those rated as moderate impairment, 4 out of 6 for those rated as severe impairment, and 2 out of 6 for those rated as extremely severe impairment (see Figure 2).

The classification of participants into mild, moderate, severe or extremely severe impairment on the basis of the inhibitors was not related significantly ($F(3,28)=.69, p=.56, ns$) to the level of the *Vocational Rehabilitation Index*.

Table 2 Vocational Rehabilitation Index (VRI) scores of earning capacity impairment groups

Impairment to earning capacity (based on inhibitors)	N	VRI M	VRI SD
Mild	5	16.2	1.92
Moderate	15	17.0	3.04
Severe	6	18.8	1.83
Extremely severe	6	17.2	4.07



Item statistics

The item statistics are summarised in Table 3. This sample was characterised in modal terms as one in which: (a) difficulty in progressing career development was certain; (b) there were typically few unusual personal barriers; (c) participants had generally transferable skills; (d) substantial problems with career development were expected; (e) degenerative problems and exacerbations would adversely impact work participation; (f) substantial training was required; (g) there were few pre-existing vocational handicap[s]; (h) acquired vocational handicaps were likely to adversely affect career development; and (i) vocational adjustment issues were likely to affect career development.

In terms of employment drivers, the modal characteristics of the participants were: (a) a sample with generally stable career development; (b) a sample with propensity for maintaining part-time or full-time employment and evidence of an average work ethic; (c) a consistent earnings history; (d) average career motivation; and (e) cognitively intact.

Table 3 Ratings of inhibitors and drivers and item statistics

ECAAF-2	Ratings				<i>M</i>	<i>SD</i>	<i>Contingency coefficient</i>
	0	1	2	3			
<i>Inhibitors</i>							
Phase of career development	0	8	19	5	1.91	.641	.551*
Subject specific issues	16	6	9	1	0.84	.954	.589*
Ability to apply prior skills	1	2	21	8	2.13	.660	.708***
Future career development prospects	0	8	23	1	1.78	.491	.578*
Prognosis	1	9	22	0	1.66	.545	.351 ns
Need and capacity for retraining	3	7	17	5	1.75	.842	.696***
Pre-existing vocational handicaps	27	1	4	0	0.28	.683	.552*
Acquired vocational handicaps	0	5	25	2	1.91	.466	.552*
Vocational adjustment issues	3	14	15	0	1.38	.660	.484 ns
<i>Drivers</i>							
Stability of career development	3	22	7	0	1.13	.554	.484 ns
Work propensity	11	15	6	0	0.84	.723	.369 ns
Demonstrated earnings history	15	12	5	0	0.69	.738	.340 ns
Career motivation	2	28	2	0	1	.359	.384 ns
Cognition	21	7	4	0	0.47	.718	.430 ns

ns = not significant

It is not appropriate to report item-total correlations as this is not a summative scale. In any event the item ratings are nominal categories rather than scores. Instead a contingency coefficient based on the item category (0, 1, 2, 3) and the overall impairment rating (e.g., mild, moderate, severe, extremely severe) from the inhibitor rubric was calculated. This result is shown in the final column of Table 3. As expected the inhibitor items tended to relate significantly to the estimate of overall impairment. The two exception were (a) prognosis and (b) vocational adjustment issues.

The coefficient alpha for the ECAF2 in this Australian context was .795. The pattern of inter-item correlations is indicated in Table 4. The statistically significant ($p < .05$) correlations are highlighted in bold. Inspection of the pattern of correlations shows that there is little overlap between inhibitors and drivers.

Table 4 may also be viewed from the perspective of a multi-trait multi-method matrix in which the mean of the inhibitor correlations in the upper left triangle of the correlation matrix is .230. The mean of the driver correlations in the lower right triangle of the correlation matrix is .470 while the mean of the interaction between inhibitors and drivers in the lower rectangle of the correlation matrix is .120. This supports the convergent and discriminant validity of the inhibitors and drivers. It is consistent with the construct validity of these two categories.

Table 4 ECAF-2 inter-item correlations

Item	I1	I2	I3	I4	I5	I6	I7	I8	I9	D1	D2	D3	D4
I1													
I2	-.130												
I3	.105	.596											
I4	.446	.269	.485										
I5	.459	-.107	.392	.433									
I6	.433	.231	.638	.566	.579								
I7	-.085	.614	.420	-.003	-.252	.126							
I8	.402	-.107	-.066	.331	-.131	.267	.086						
I9	.086	.506	.333	.062	-.168	.174	.188	.118					
D1	-.239	.527	.574	.104	.147	.138	.160	-.329	.486				
D2	-.242	.524	.380	-.099	-.059	.040	.288	-.236	.397	.695			
D3	-.201	.478	.348	-.017	-.035	-.026	.372	-.370	.248	.652	.751		
D4	-.280	.376	.272	.000	.000	.000	.000	-.579	.272	.487	.497	.365	
D5	.099	.252	.349	.209	-.070	.200	.315	.232	.434	.335	.394	.407	.125

N=32; Mean inhibitor correlation = 0.230; Mean driver correlation = 0.470; Mean driver and inhibitor correlations = 0.120

Discussion

This study provided additional evidence in support of the validity of the concept of earning impairment. The determination of the impairment to earning capacity was coherent and monotonically ordered in every instance using the inhibitors as the basis for classification but this was not the case for impairment ratings based on the drivers or those based on the interaction between inhibitors and drivers.

It is not clear that the rubric for the driver items is working at all satisfactorily. This was tested in this sample and it was based on the heuristics or decision criteria listed in the manual. There are also anomalies in the rubrics, such as heuristic #14 which is listed under interaction effects but in the final analysis refers only to inhibitors.

These initial results may imply that the impairment to earning capacity in an Australian context is best assessed through the inhibitors. If this perception is correct then it provides a challenge to the theoretical basis of the ECAF-2 which is founded on the counterbalancing interaction between inhibitor and drivers. While it is conceptually sound to reason that drivers may overcome the effects of inhibitors, the reality may be that for all intents and purposes inhibitors provide the practical limits to earning capacity.

The criterion validity of the ECAF-2 inhibitors was supported by the low proportion returning to work in the extremely severe impairment category. It is recognised that this criterion is not a perfect measure as it is influenced by many factors and was also determined at the time of interview, so it does not represent the ultimate outcome.

The lack of statistically significant relationship with the *Vocational Rehabilitation Index* may say as much about that index as it says about the ECAF-2. Any potential relationship is also limited by a restriction of range in that the sample does not include persons without impairment and of necessity

the participants comprised insurance claimants who generally need to meet a threshold of 10% whole person impairment before a claim can proceed. This is also a limitation of this study in that the sample – by definition – does not include a substantial proportion of participants who do not have earning capacity impairment. As a result this limits the evaluation of the instrument. In short, some type of control group is required.

The items posed an important theoretical and methodological issue. These are essentially categories rather than interval scores but they have been treated as scores within the manual. As an example, Driver Item 4 is Career Motivation. This categorised as: 0= High; 1= Average; 2 = Poor; 3 = Unmotivated. It is obvious that the numerals on each item are used as the basis for categorisation but 0, 1, 2, 3 could just as easily have been replaced by A, B, C and D. It may seem a trivial issue but these same ratings are illustrated in the profile on the last page as occupying the same width indicating that the step from one category to the next is seen as equal. Secondly, parametric statistics such as the internal consistency (coefficient alpha) and correlations were computed in the test manual but these assume some fundamental measurement properties, none of which can be claimed for categorical variables. The items are not true interval measures because they do not represent coherent quantities (see Michell, 2005). Cronbach's alpha, for instance, is an indicator of how adequately the sum score represents an expected score in the universal domain (of earning capacity), even if that domain is widespread.

The same conflation of categories and quantities occurs with the category descriptors of the earning impairment capacity. For example mild is rated as 1-19%, moderate as 20-49%, severe as 50-79% and extremely severe as 80-99%. If anything, it seems more likely that severity would be a logarithmic scale. If the items were computed as logarithms then it may even be possible to summate ratings; alternatively it may be possible to analyse the ECAF-2 according to a polytomous item-response model.

Notwithstanding these observations, the coefficient alpha for the ECAF2 in this study ($\alpha=.795$) is consistent with the value of .82 cited in the manual (p. 35). It is doubtful, however, that the reliability of the ECAF-2 has been established merely by another satisfactory coefficient alpha from this study. The real proof is the test-retest reliability, not only for the normative sample in a test manual but for every sample for whom this assessment is reported.

If anything, the pattern of inter-item correlations between inhibitors and drivers confirmed the view that these are separate factors. The convergent and discriminant validity of the inhibitors and drivers was supported in this study even though the pattern of intercorrelations was different from that in the ECAF-2 manual. For instance, the substantial inter item correlations within the drivers implies that this is the more coherent set. The fact that the inhibitor rating for subject specific issues correlated significantly with four out of the five driver items indicated substantial overlap for this item. The existence of nine negative correlations in the left upper triangle of the correlation matrix indicates complex relations between the inhibitors. The pattern of correlations, however, does not appear to be consistent with that provided in the manual (p. 37), where for instance there are only two negative correlations amongst inhibitors and where cognition (somewhat inexplicably) does not correlate positively or significantly with other employment drivers.

A recognised limitation of this study is that a single rater provided all ECAF-2 subject assessments and that these were derived from a high proportion of plaintiff cases. As such, this evaluation does

represent an idiosyncratic set of results and it is accepted that this limits the generalizability to other users. This viewpoint is supported by differences between the pattern of correlation in Table 4 and the correlation matrix in the manual. That correlation matrix was provided by five raters who assessed 70 claimants (N= 40-64) but it is not clear how the final set of correlations on page 37 of the manual was derived. It may be worth noting that the issue of generalizability plagues all group research in that it would not be possible to infer from group results (e.g., multiple raters of the ECAF-2) to a single rater's use of the ECAF-2.

Furthermore, in a competitive litigation context it is possible that a professional acting for the defence might assess a claimant differently than one acting for the plaintiff. Just as a control group of subjects was recommended, it is also recommended that a control group of raters is really necessary for this type of study. This is a double-edged sword for the ECAF-2 as there is an implication that all uses of the ECAF-2 are idiosyncratic. It suggests a priori subjectivity in the ECAF-2, which it is the intention of the instrument to reduce. It is claimed that the ECAF-2 "standardises and objectifies the assessment of loss of earning capacity claims" (p.2). Finally, it should be recognised that the intercorrelations will not be affected if for instance plaintiffs are given higher ratings on all inhibitors as correlations assess patterns and not differences. The pattern of correlations would be affected if inhibitors were over-rated and drivers were under-rated.

Conclusions

The evaluation of economic loss following injury is an issue of both theoretical and practical importance. It seeks to address the key factors that contribute to labour force involvement of person following an injury and in its own way provides *a de facto* model of work adjustment. From a practical perspective the development of a valid assessment of earning capacity impairment provides a tangible endpoint for such theorising.

This study has supported the potential use of the inhibitor items on the ECAF-2 as a basis for the rating of the impairment to earning capacity. The results highlighted the need to evaluate the judgemental heuristics for drivers and the interaction between inhibitors and drivers that underlie the theoretical basis of the ECAF-2. The categorical nature of the items posed methodological difficulties and to my mind precludes the value of the psychometric statistics such as coefficient alpha and the correlations (even those reported in this study). The differences in the observed pattern of correlations are problematic. As noted above, they may reflect the idiosyncrasy of individual judgement (see Kaufmann & Athanasou, 2009) or cross-cultural differences in the perception of the effects of injury, and if so this means that local validation is required in Australia. In summary, the ECAF-2 is seen as having potential but further work is required to cement the basis for its conceptual, theoretical, psychometric and methodological validity. A program of research is underway in Australia to test which inhibitors and drivers are related to the impairment of earning capacity.

Acknowledgements

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APPENDIX

Table 1a ECAF-2 inhibitor items and specific rating criteria

Item	0	1	2	3
1.Phase of career development	Able to progress	May have difficulty progressing	Difficulty progressing is certain	Severely impaired ability to progress
2.Subject-specific issues	No unusual personal barriers	Some personal barriers; little effect on career development	Personal barriers will adversely impact career development	Severe personal barriers preclude career development
3.Ability to apply prior skills	Capable of applying acquired skills to same or prior job	Possesses directly transferable skills that can be applied to jobs other than those performed in the past	Possesses generally transferable skills	No transferable skills to aid future career development
4.Future career development prospects	Ability to pursue future career development is not impaired	Nominal problems with career development expected	Substantial problems with career development expected	Insurmountable career development problems
5.Prognosis	No appreciative degenerative problems anticipated; future work participation will be unaffected	Degenerative problems may mildly impact future work participation	Degenerative problems and exacerbations will adversely impact work participation	Degenerative problems are expected to preclude work participation
6.Need and capacity for retraining	Capable of pursuing past or future related vocational activities without retraining	May require some retraining; capacity for retraining is present	Substantial retraining required; difficulty pursuing retraining without outside support is anticipated	Significant retraining to pursue competitive employment is anticipated; acquired disabling problems make a successful outcome unlikely
7.Preexisting vocational handicaps	None	Pre-existing vocational handicaps combined with acquired vocational handicaps will adversely impact career development	Pre-existing vocational handicaps combined with acquired vocational handicaps will adversely impact career development	Pre-existing vocational handicaps combined with acquired vocational handicaps will preclude career development
8.Acquired vocational handicaps	None	Will have mild to no effect on a future career	Will adversely affect future career development	Will preclude employment
9.Vocational adjustment issues	None anticipated	May adversely impact career development	Will adversely impact career development	Unable to pursue career development

Table 1b ECAF-2 driver items and specific rating criteria

Item	0	1	2	3
1.Stability of career development	Stable and likely to continue	Generally stable	Unstable and inconsistent	Erratic with frequent periods of unemployment
2. Work propensity (e.g., a claimant's work involvement)	Propensity to maintain full-time or greater employment: strong work ethic	Propensity for maintaining part-time to full-time employment: evidence of an average work ethic	Periods when vocational activities were not pursued: below average work ethic	Extended periods of absence or unemployment for no apparent reason
3.Demonstrated earnings history	Consistent earnings history, marked by above average earnings increases	Generally consistent earnings history	Inconsistent earnings history and suggestion of less than full work participation: no valid reasons for this history	Erratic work history, with documentation of nominal or no earnings in some years
4.Career motivation	High	Average	Poor	Unmotivated
5.Cognition	Cognitively intact	Mild cognitive problems, not anticipated to impact future career development	Cognitive deficits will adversely impact career development	Cognitive deficits preclude gainful work participation

Adapted from Shahnasarian 2010, pages 8-13

Table 2 Heuristics for the judgment of impairment to earning capacity

(a) Interpretive criteria

Level of impairment	Ratings	Inhibitors
1. Extremely severe or catastrophic	3	any two inhibitors
2. Severe	3	any inhibitor
3. Moderate to severe	2	more than two inhibitors, when accompanied by a rating of 1
4. Moderate to severe (younger persons)	2-3	Inhibitor items #1, #4 or #6
5. Mild to moderate	1-2	on two to three inhibitors (#2, 4, 5, 7, 8, 9)
6. No loss to mild loss	0-1	all inhibitor items

Level of impairment	Ratings	Drivers
7. Catastrophic	3	driver items #4 or #5
8. Moderate to severe	2-3	driver #5
9. No loss	0	driver #1
10. No loss necessarily	2-3	driver items #1, #2 and #3

(b) Interaction between inhibitor and driver

Level of impairment	Ratings	Inhibitors and Drivers
11. Moderate or more	2-3	Driver item #5 may relate to inhibitor items #3, #4, #6 and #8
12. Moderate to severe	2-3	Three or more inhibitor items #3, #4, #6 and #8; as well as driver item #5
13. Moderate to catastrophic	2-3	Inhibitor item #5; even with 0-1 on all driver items and 0 on inhibitor item #3 and #6
14. Mild to severe	1-2 2-3	Inhibitor item #1, and: Inhibitor item #3 and #6
15. Moderate or more	2-3 0-1	Two of the following #1, #4, #5, #7 or #9; All driver items
16. Mild or no loss	0-1 0-1	Inhibitor items #3, #4, #5, and #8, and; All driver items

Source: Shahnasarian, 2010, pp. 20-22

Table 3 Original dataset for replication

ID	I1	I2	I3	I4	I5	I6	I7	I8	I9	D1	D2	D3	D4	D5
1	2	1	2	2	1	0	0	2	1	1	0	0	1	0
2	2	0	2	2	2	3	0	2	1	1	0	0	1	1
3	2	2	2	2	2	2	0	2	2	1	1	1	1	0
4	2	1	2	2	2	2	0	2	1	1	0	0	1	1
5	1	2	2	1	0	1	2	2	2	1	1	1	1	0
6	3	0	2	2	2	2	0	2	1	1	0	0	1	0
7	1	0	2	1	2	1	0	1	1	1	0	1	1	0
8	2	0	2	2	2	2	0	2	1	1	0	0	1	0
9	2	0	2	2	2	2	0	2	0	1	1	1	1	0
10	2	2	3	2	2	3	0	1	2	2	2	2	2	1
11	3	0	2	2	2	3	0	3	1	0	0	0	0	0
12	2	2	3	2	2	3	2	2	1	1	1	1	1	0
13	2	0	2	2	2	2	0	2	2	1	0	0	1	0
14	1	0	1	2	1	1	0	2	0	0	0	0	1	0
15	1	2	2	2	1	1	0	2	2	2	1	1	1	0
16	1	1	2	1	1	1	0	2	2	1	1	0	1	1
17	3	1	2	2	2	2	0	2	2	1	0	0	1	0
18	3	2	3	2	2	2	2	2	2	1	1	1	1	2
19	2	0	2	2	1	2	0	3	2	1	1	1	1	2
20	1	3	3	2	1	2	2	2	2	2	2	2	1	2
21	2	2	3	2	2	2	1	2	1	2	2	2	1	1
22	2	0	0	1	1	0	0	2	1	0	1	0	1	0
23	2	0	3	2	2	2	0	2	1	1	1	0	1	0
24	2	0	1	1	1	0	0	1	1	1	1	2	1	0
25	2	0	2	2	2	1	0	2	2	2	2	2	1	2
26	2	0	2	2	2	2	0	2	1	1	0	0	0	0
27	1	2	3	2	2	2	0	1	2	2	2	1	2	0
28	2	1	2	2	2	2	0	2	1	1	1	0	1	0
29	2	0	2	1	1	2	0	2	2	1	1	0	1	1
30	1	0	2	1	2	1	0	1	0	1	1	1	1	0
31	2	1	2	1	2	2	0	2	2	2	2	1	1	0
32	3	2	3	3	2	3	0	2	2	1	1	1	1	1