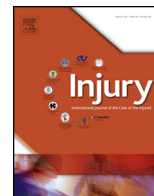




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Review

A review of the revised Functional Capacity Index as a predictor of 12 month outcomes following injury

Cameron S. Palmer^{a,b,*}, Peter A. Cameron^{a,c}, Belinda J. Gabbe^{a,d}

^a Department of Epidemiology & Preventive Medicine, Monash University, Melbourne, Australia

^b Trauma Service, Royal Children's Hospital Melbourne, Parkville, Australia

^c Emergency Medicine, Hamad Medical Corporation, Doha, Qatar

^d Farr Institute – CIPHER, College of Medicine, Swansea University, Swansea, United Kingdom

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ABSTRACT

The measurement of functional outcomes following severe trauma has been widely recognised as a priority for countries with developed trauma systems. In this respect, the Functional Capacity Index (FCI), a multi-attribute index which has been incorporated into the most recent Abbreviated Injury Scale (AIS) dictionary, is potentially attractive as it offers 12-month functional outcome predictions for patients captured by existing AIS-coded datasets.

This review paper outlines the development, construction and validation of the predictive form of the FCI (termed the pFCI), the modifications made which produced the currently available 'revised' pFCI, and the extent to which the revised pFCI has been validated and used.

The original pFCI performed poorly in validation studies. The revised pFCI does not address many of the identified limitations of the original version, and despite the ready availability of a truncated version in the AIS dictionary, it has only been used in a handful of studies since its introduction several years ago. Additionally, there is little evidence for its validity.

It is suggested that the pFCI should be better validated, whether in the narrow population group of young, healthy individuals for which it was developed, or in the wider population of severely injured patients. Methods for accounting for the presence of multiple injuries (of which two have currently been used) should also be evaluated.

Many factors other than anatomical injury are known to affect functional outcomes following trauma. However, it is intuitive that any model which attempts to predict the ongoing morbidity burden in a trauma population should consider the effects of the injuries sustained. Although the revised pFCI potentially offers a low-cost assessment of likely functional limitations resulting from anatomical injury, it must be more rigorously evaluated before more comprehensive predictive tools can be developed from it.

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* Corresponding author at: The Royal Children's Hospital Melbourne, Flemington Rd, Parkville, 3052, Australia.

E-mail addresses: cameron.palmer@rch.org.au (C.S. Palmer), peter.cameron@monash.edu (P.A. Cameron), belinda.gabbe@monash.edu (B.J. Gabbe).

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Background

Forty five years after its introduction, the Abbreviated Injury Scale (AIS) [1] remains the predominant method for scoring the severity of anatomical injury. The scaled severities assigned to each code in the AIS were originally intended to reflect more than mortality [2]. However, it has been known (and re-iterated) since the 1970s that AIS severities are weighted towards the likelihood of mortality [2–5]. In high income countries where mature trauma systems have brought about significant reductions in mortality, there has been a shift away from focusing on mortality-driven outcomes towards quantifying the extent of morbidity amongst the large proportion of trauma victims who survive their injuries [6–9]. Measurement of functional outcomes was identified as a priority for trauma systems research nearly 20 years ago [10,11], but most registries still do not routinely collect outcomes beyond death or hospital-based severity proxies such as length of stay [8,11,12].

The Functional Capacity Index (FCI) [13–15] is “a multi-attribute index that maps anatomic descriptions . . . of injury [from AIS codes] into scores that reflect the likely extent of functional limitations or reduced capacity at one year post-injury” [13]. First developed in the mid-1990s, the FCI was subsequently revised alongside the AIS, and was eventually incorporated into the current (2008) version of the AIS dictionary [4,16]. As such, the FCI is potentially attractive as a readily available alternative severity predictor using existing AIS-coded datasets.

This paper aims to review the construction and validation of the predictive Functional Capacity Index (termed pFCI), the modifications made to the ‘original’ version which produced the current ‘revised’ pFCI and its truncated version used in the 2008 AIS dictionary (termed pFCI08), and the extent to which this revised tool has been validated and used. This includes appraising the extent to which the revised versions have addressed or overcome limitations identified in the original pFCI. The primary objective of this process is to inform future research using the revised pFCI, and the truncated pFCI08.

Review strategy

The current review involved searches of the general term ‘functional capacity index’ and the acronym ‘FCI’ in titles or abstracts of papers referenced in the Scopus, CINAHL, Web of Science and PubMed databases. This was initially performed in late 2015, and updated in September 2016 with the addition of Ovid Embase and Google Scholar. Results not related to the FCI instrument (such as other uses of the acronym) were discarded. Scopus was also used to search for papers referencing critical studies in the development [13,14] and validation [17–20] of both versions of the FCI. Once all relevant papers were obtained, their reference lists were also reviewed for relevant citations not found elsewhere.

Development and validation of the original pFCI

Construction of the original FCI

The pFCI is an aggregated score, calculated across ten weighted ‘dimensions’ of function (Table 1). The developers of the original pFCI formulated descriptions of different levels of function within each dimension; an example of these (for the ambulation dimension) is shown in Table 2 [14]. An expert panel was then used to estimate, for each code in the 1990 AIS dictionary, the most likely level of function (in each dimension of function) which would be expected to result 12 months after the injury was sustained [13,14]. The weights for each dimension, and for each level of function within those dimensions, were derived from the responses of a convenience sample comprising both those familiar with trauma (as staff or patients) and lay people (a mixture of blue- and white-collar workers and college students). For each AIS code, the expected level and dimension scores were mathematically combined to produce an expected overall level of function 12 months following injury. An example of this process (for an AIS spinal injury code) can be seen in Fig. 1.

Table 1
Dimensions and levels of function comprising the original FCI [12,13].

Dimension of function	Levels of function	Dimension weighting (percentage)	Expected percentage loss of function for each level of function						
			A (no limitation)	B	C	D	E	F	G
Eating	3	75.2	0.0	38.2	100.0	–	–	–	–
Excretory function	4	74.0	0.0	43.1	74.6	100.0	–	–	–
Sexual function	3	45.7	0.0	49.7	100.0	–	–	–	–
Ambulation	6	66.6	0.0	21.8	45.6	68.5	80.6	100.0	–
Hand and arm	6	75.0	0.0	31.0	57.9	54.3	81.0	100.0	–
Bending and lifting	4	49.4	0.0	29.5	64.6	100.0	–	–	–
Visual	7	41.3	0.0	47.3	34.7	51.8	80.3	89.0	100.0
Auditory	5	34.8	0.0	19.6	36.5	66.8	100.0	–	–
Speech	4	68.5	0.0	29.6	65.6	100.0	–	–	–
Cognitive	6	100.0	0.0	26.7	49.9	78.2	92.5	100.0	–

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