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The Australian National Sub-acute and Non-acute Patient Casemix Classification (AN-SNAP): its application and value in a stroke rehabilitation programme

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Objective: To investigate whether the Australian National Sub-acute and Non-acute Patient Casemix Classification (SNAP) and Functional Independence Measure and Functional Related Group (Version 2) (FIM-FRG$_2$) casemix systems can be used to predict functional outcome, and reduce the variance of length of stay (LOS) of patients undergoing rehabilitation after strokes.
Design and setting: The study comprised a retrospective analysis of the records of patients admitted to the Cedar Court Healthsouth Rehabilitation Hospital for rehabilitation after stroke.
Subjects: The sample included 547 patients (83.3% of those admitted with stroke during this period). Patient data were stratified for analysis into the five SNAP or nine FIM-FRG$_2$ groups, on the basis of the admission FIM scores and age.
Main outcomes: The AN-SNAP classification accounted for a 30.7% reduction of the variance of LOS, and 44.2% of motor FIM, and the FIM-FRG$_2$ accounts for 33.5% and 56.4% reduction respectively. Comparison of the Cedar Court with the national AN-SNAP data showed differences in the LOS and functional outcomes of older, severely disabled patients. Intensive rehabilitation in selected patients of this type appears to have positive effects, albeit with a slightly longer period of inpatient rehabilitation.
Conclusions: Casemix classifications can be powerful management tools. Although FIM-FRG$_2$ accounts for more reduction in variance than SNAP, division into nine groups meant that some contained few subjects. This paper supports the introduction of AN-SNAP as the standard casemix tool for rehabilitation in Australia, which will hopefully lead to rational, adequate funding of the rehabilitation phase of care.

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Introduction

In 1996, the Commonwealth Government of Australia commissioned researchers from the University of Wollongong to develop a casemix system on which to base the funding of subacute and nonacute care (including rehabilitation). The classification (Australian National Sub-acute and Non-acute Patient Classification or AN-SNAP),[1,2] was based on 30 604 treatment episodes at 104 treatment sites, divided into five 'case types' (rehabilitation, geriatric evaluation and management, palliative care, psychogeriatric and maintenance), each of which was further broken down into four 'episode types' (overnight, same day, outpatient, and community).

The 4641 overnight rehabilitation cases were subclassified into 32 classes, which had the effect of reducing the variance in episode of care cost by 38.2%. (NB: Overnight patients were classified as such if 'admitted and discharged on different dates'. Rehabilitation was defined as 'an episode of care provided for a person with impairment, disability and handicap for whom the primary treatment goal is improvement in functional status, which is evidenced by an individualised and documented initial and periodic assessment of functional ability by use of a recognised functional assessment measure, and an individualised multidisciplinary rehabilitation plan which includes negotiated rehabilitation goals and indicative time frames.') Within this group, patients with strokes were further subdivided into five categories, based primarily on the admission motor score of the Functional Independence Measure (FIM),[3] and secondarily on either the FIM cognitive score, or age (Table 1).

The Commonwealth Government has recommended the adoption of the AN-SNAP classification as the national system for subacute and nonacute care in Australia, and its implementation has already commenced in several states.

The current study was undertaken for a number of reasons: First, criteria for admission to rehabilitation hospitals may not be consistent, and length of stay and cost of care may vary substantially. Even though the SNAP study included a range of rehabilitation facilities in both the public and private sectors, it is still important to test the usefulness and robustness of the AN-SNAP classification in a single hospital, within specific patient groups. Secondly, the primary aim of the SNAP study was to establish the cost of rehabilitation in Australia, and it did not explore whether the functional outcome of rehabilitation could be predicted by the initial classification into AN-SNAP groups; this is critical information for both rehabilitation professionals and funders.

Table 1 AN-SNAP and FIM-FRG (version 2) classifications for patients with strokes

Class	FIM motor score	FIM cognitive score	Age (years)
AN-SNAP SYSTEM			
204	63–91	20–35	All
205	63–91	5–19	All
206	47–62	5–35	All
207	14–46	5–35	> 74
208	14–46	5–35	< 74
FIM–FRG$_2$ SYSTEM			
9	74–91	31–35	All
8	63–73	31–35	All
7	63–91	5–30	All
6	56–62	5–35	All
5	49–55	5–35	All
4	38–48	5–35	All
3	13–37	18–35	> 74
2	13–37	5–17	> 74
1	13–37	5–35	16–74

FIM, Functional Independence Measure.
The possible range of motor FIM is from 13 to 91, and that for cognitive FIM is 5–35.

Finally, it seemed important to compare the usefulness of AN-SNAP with the FIM-FRG classification, which forms part of the Uniform Data System for Medical Rehabilitation, and which was developed for similar reasons by the State University of New York in Buffalo. Version 2 of this system ($FIM\text{-}FRG_2$)[4] divides patients with stroke into nine groups, also based on admission motor and cognitive FIM scores and age (Table 1). This casemix classification has widespread acceptance in the USA, where most of the research on its use has been carried out. However rehabilitation practice and costs in America and Australia may be quite different.

Cedar Court Health South Rehabilitation Hospital (CCHSRH) in Melbourne, is a private rehabilitation hospital, serving a large number of patients with the admission diagnosis of stroke. Patients are routinely assessed on admission and discharge using FIM, by staff who are trained, and accredited in its use. Patient data have been computerized since 1990, and this gave us the opportunity to investigate whether both the SNAP and $FIM\text{-}FRG_2$ classifications are of value in the context of a single Australian rehabilitation hospital.

Methods

The aim of the study was to investigate:

- How well the admission SNAP classification predicts functional outcome, and reduces the variance of length of stay (and hence treatment costs) of patients admitted for neurological rehabilitation at CCHSRH.
- How well the admission $FIM\text{-}FRG_2$ classification predicts functional outcome, and reduces the variance of length of stay (and hence treatment costs) of patients admitted for neurological rehabilitation at CCHSRH.
- Which method was better and/or more appropriate for use in a rehabilitation hospital.

The study comprised a retrospective analysis of the records of patients admitted for rehabilitation after stroke, and discharged during the five-year period 1 January 1993 to 31 December 1997. The data, which were stored on the CCHSRH computerized database, were analysed using SPSS version 8.[5]

The database included 657 patients, from whom we excluded 41 with incomplete data, 62 who had treatment interruptions requiring transfer to acute hospitals, five with a length of stay of < five days, and two who died before discharge. The final sample was thus 547 patients (83.3% of those admitted with the diagnosis of stroke during this period).

The data were subdivided on the basis of both the AN-SNAP and $FIM\text{-}FRG_2$ classifications, and the means, medians, standard deviations (SD) and other descriptive statistics of the groups were calculated. The reduction in variance (RIV) was then calculated. This statistic is the R^2 of regression analysis, which can be interpreted as the proportion of variability in the dependent variable that can be accounted for by the model; mathematically, it is the ratio of the variability between the groups (rather than within the groups) to the total variability. The variances of the whole group, and the subgroups, were measured to allow us to establish how much of the variance could be explained by subdivision into the groups.

Results

Length of stay

The means and standard deviations (SD) of the length of stay (LOS), and discharge motor and cognitive FIM in each AN-SNAP class, and each $FIM\text{-}FRG_2$ class, are shown in Table 2.

Using the AN-SNAP classification, the patients were unevenly distributed into the classes, i.e. nearly half fell into class 204 (FIM motor 63–91, cognitive FIM 20–35), and further 28.3% into class 206 (FIM motor 47–62, cognitive FIM 5–35). This meant that only approximately 10% were in each of groups 207 and 208 (FIM motor <46, and ages >74 years and <74 years respectively) and very few in class 205 (FIM motor >63, cognitive FIM 5–19).

This may reflect the selection bias inherent in the private health care system, where the maximum length of stay is dictated by the health funds. This is in contrast to public hospitals (also included in the SNAP study) where funding is

Table 2 Length of stay and median admission and discharge FIM in the five AN–SNAP and nine FIM–FRG_2 groups

Class	Number	%	Length of stay			Admission FIM			Discharge FIM		
			Mean	Median	SD	Motor	Cognitive	Total	Motor	Cognitive	Total
AN-SNAP											
204	261	47.7	19.5	18	9.19	75	32	107	88	33	121
205	21	3.8	27.9	26	11.34	73	15	88	89	23	112
206	155	28.3	29.9	29	12.86	56	28	84	76	30	106
207	60	11.0	40.9	44	12.93	37	25	62	63	29	92
208	50	9.1	37.8	38	16.47	37	26	63	68.5	29	97.5
Total	547	100.0									
FIM–FRG											
1	27	4.9	37.9	43	20.10	31	23	54	53	27	80
2	9	1.6	44.0	46	16.84	23	12	35	41	17	58
3	21	3.8	38.7	43	14.54	33	28	61	59	29	88
4	67	12.2	38.5	42	12.10	43	26	69	73	31	104
5	57	10.4	32.3	33	12.80	53	28	81	75	31	106
6	84	15.4	27.2	26.5	12.22	59	28	87	78	30	108
7	117	21.4	22.9	21	10.19	75	26	101	88	29	117
8	70	12.8	21.9	20	9.99	69	33	102	84	35	119
9	95	17.4	15.4	14	6.29	82	34	116	89	35	124
Total	547	100.0									

currently calculated on a *per diem* basis, with no limits being set as to the maximum length of stay.

Using the FIM-FRG_2 classification, the groups were more evenly spread, but the increased number of classes meant that some contained very few patients (e.g. 27, 9 and 21 in classes 1–3 respectively, i.e. FIM motor score of 14–37). This, again, reflects the admission criteria of the private health care system.

The AN-SNAP classification accounted for a 30.7% reduction of the variance of length of stay, and the FIM-FRG_2, 33.5% reduction of this variance.

Functional outcomes

All SNAP groups had a significant increase in the motor and total FIM during the admission (paired Student's t-test, $p < 0.01$). There was definite trend of increase in the cognitive FIM too (median 15–23), but this did not reach statistical significance.

AN-SNAP accounted for a 40.3% reduction in the variance of the discharge total FIM and 44.2% of the motor FIM, but only 20.5% of the cognitive FIM.

The FIM-FRG_2 classification accounted for 52.9% reduction in the variance of the total discharge FIM, and 56.4% of the motor FIM.

Comparison between the CCHSRC data and the national AN-SNAP databases (Table 3)

Comparative analysis of the CCHSRC and AN-SNAP databases showed little difference between any of the dependent variables studied in classes 204 and 206, while the small numbers in class 205 (21 at CCHSRH) invalidated statistical analysis.

In contrast to the SNAP study, however, in which the length of stay increased progressively through classes 204 to 208, at CCHSRH the length of stay in class 208, was shorter than in class 207. This is particularly interesting, because it meant that older, severely disabled patients spent more time in hospital than those who are younger but similarly disabled (class 208), which is precisely what clinical experience would dictate, but was paradoxically not the case in the national SNAP study.

In the SNAP study, only 34% of the elderly patients in class 207 were discharged to their own homes after a median of 29 days in rehabilitation. They also achieved a relatively poor functional status, the median discharge motor and total FIM being only 38 and 60 respectively. In contrast at CCHSRH, albeit after a median of 44 days, the patients in class 207 achieved quite reasonable functional outcomes, the motor FIM increasing

Table 3 Comparison of the Cedar Court data with the national AN–SNAP database

AN–SNAP class	Number of patients		Length of stay (median)		Discharge total FIM (median)		Discharge motor FIM (median)		Discharge cognitive FIM (median)	
	SNAP	CCH	SNAP	CCH	SNAP	CCH	SNAP	CCH	SNAP	CCH
204	247	261	17	18	118	121	87	88	33	33
205	34	21	19.5	26	106	112	87.5	89	21	23
206	154	155	26	26	104.5	106	75.5	76	30	30
207	127	59	29	44	60	92	38	63	24	29
208	116	50	39.5	38	84.5	97.5	59	68.5	25	29

CCH, Cedar Court Healthsouth Rehabilitation Hospital.

from a median of 37 to 63, and the total from 62 to 92. Moreover 94.9% of these patients were discharged to their own homes. These results suggest that intensive rehabilitation could have positive effects in selected elderly, severely disabled patients, even though a longer period of inpatient rehabilitation may be required. This raises the question of whether such patients, who appear to progress poorly in the early stages after admission, may be transferred prematurely to residential care, whereas rehabilitation of greater sufficient intensity or duration could have achieved a better functional outcome.

There were similar, but less marked differences seen between the CCHSRH and national databases with respect to class 208, i.e. the patients at CCHSRH achieved better functional outcomes (discharge motor and total FIM scores of 68.5 and 97.5, compared with 59 and 84.5 respectively in the SNAP study), and the home discharge rate was 96% versus 61% in the national group.

Discussion

Several important points arise from the analyses described above. First, it confirms the value of the AN-SNAP classification, which does appear robust enough to assist in prediction of length of stay, and hence cost, in a single rehabilitation institution.

Moreover, division of patients on the basis of the AN-SNAP groups explained even more of the variance of the functional outcome than the length of stay. This is an essential aspect of rehabilitation management, which markedly increases the value of the classification. This finding is consistent with published work, suggesting that discharge FIM is predicted by admission FIM, the latter being integral to the AN-SNAP classification.[6] It is also in keeping with recently published work using the second version of the more complex FIM-FRG classification.[4]

Although the more complex FIM-FRG$_2$ classification performs better than AN-SNAP with respect to discharge total and motor FIM, the difference between the performance of the two classifications is small when length of stay is the dependent variable. Moreover, using our data, several of the FIM-FRG$_2$ classes had very small

Clinical messages

- The AN-SNAP classification helps predict functional outcome, length of stay and cost of rehabilitation, and may thus have an important role in rehabilitation management.
- It is proposed that AN-SNAP is introduced as the standard rehabilitation casemix tool in Australia.
- Comparison of this hospital data with the national database, showed that patients aged >74 years stayed longer in rehabilitation than nationally, but had far better outcomes. Younger patients spent less time in rehabilitation, but also achieved better functional outcomes. As patients at CCHSRH have seven days of rehabilitation per week, compared with the five days that is common in the public sector, and more hours of rehabilitation per day. This points to the need for research into how much therapy is ideal, or adequate, after stroke.

numbers (27, 9 and 21 patients in classes 1–3 respectively), making the results somewhat unreliable. Thus, even though the FIM-FRG_2 appears very effective in the context of the large UDS database (26 339 in the Stineman study[4]), the more parsimonious SNAP model is likely to have advantages in Australia, particularly in the context of a single hospital.

Finally, this study suggests that a casemix classification such as this can also be a powerful management tool. As discussed, analysis of the CCHSRH data has brought the most severely disabled patients into focus, as those who were aged > 74 years stayed longer in rehabilitation than in the national study, but did far better. Conversely the younger patients spent less time in rehabilitation than nationally, but also achieved better functional outcomes. This opens up interesting avenues for research, oriented to the identification of determinants of outcome. For example, all patients at CCHSRH have seven days of rehabilitation per week, compared with the five days that is common in the public sector, and have 5 or 6 hours of rehabilitation per day, in comparison with the 2–3 hours that is common in many rehabilitation wards. This leads naturally to further debate on what is ideal, or adequate, funding for inpatient rehabilitation.

The authors thus believe that this paper provides support for further development of the AN-SNAP classification as a standard casemix tool for rehabilitation in Australia, which will, it is hoped, lead to rational, adequate funding of the rehabilitation phase of care in both the private and public sectors.

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