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SHORT COMMUNICATION

VALIDATION OF THE ACTIVITY INVENTORY OF THE CHEDOKE-MCMASTER STROKE ASSESSMENT AND THE CLINICAL OUTCOME VARIABLES SCALE TO EVALUATE MOBILITY IN GERIATRIC CLIENTS

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Objective: **To evaluate the construct validity of the Activity Inventory of the Chedoke-McMaster Stroke Assessment and the Clinical Outcome Variables Scale (COVS), 2 measures of functional mobility.**
Design: **A retrospective longitudinal study of 24 inpatients (mean age 83 years (standard deviation 7)) on a geriatric rehabilitation unit.**
Participants: **The primary reasons for admission were deconditioning ($n = 9$) and hip fracture ($n = 7$).**
Method: **We tested hypotheses that Activity Inventory and COVS scores at admission and discharge, and change scores during hospital stay would correlate. Longitudinal construct validity was also estimated using effect size and standardized response mean.**
Results: **Correlations between scores on each measure ranged from $r = 0.59–0.93$ across subscales and total scales ($p < 0.01$). The effect size of the Activity Inventory and the COVS was 1.53 and 1.43, respectively. The standardized response mean of the Activity Inventory and the COVS was 1.83 and 2.30, respectively.**
Conclusion: **Although findings support the validity of both measures, the COVS appears more efficient and sensitive than the Activity Inventory to change in this population. A larger study is needed to confirm these findings.**

Key words: validity; outcome measures; rehabilitation; geriatric assessment.

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INTRODUCTION

Rehabilitation professionals use the Activity Inventory (AI) of the Chedoke-McMaster Stroke Assessment (CMSA) (1) and the Clinical Outcome Variables Scale (COVS) (2) to measure important aspects of mobility relevant to geriatric rehabilitation. The AI is comprised of 2 indices: the Gross Motor Function (GMF) Index (10 items) and the Walking Index (5 items) which includes 2-minute walk test (2MWT) (3) performance. The AI can be used to discriminate patient groups, and to predict and evaluate change for people with stroke (1). Furthermore, patients who score 30 or less on the AI will most likely require institutionalization, whereas patients with scores of 70 or more are capable of living alone in the community (1). The 2MWT appears feasible to administer among elderly individuals undergoing inpatient rehabilitation (4), but the psychometric properties of the AI in this population are unknown.

The COVS was developed to assess mobility in individuals with neurological and musculoskeletal conditions and a general geriatric population (2). It consists of 13 items that evaluate functional postural or locomotor control, as well as an item that addresses arm function. Total scores on the COVS can range from 13 to 91, where scores less than 58 indicate the need for physical assistance and scores ranging from 70–91 indicate functional independence (5). It has been shown to predict length of hospital stay for people with stroke (6).

In previous research on patients with neurological impairment, the AI was found to be more responsive than the COVS based on a relative efficiency (RE) of 1.47 (7). The COVS and AI are widely used in orthopaedic- and neurorehabilitation populations (8), and, frequently, both measures are used within the same organization. A comparison of the psychometric properties of these measures in inpatient geriatric rehabilitation would permit meaningful comparisons across populations.

The objective of this study was to evaluate the construct validity of the AI and the COVS in elderly individuals undergoing inpatient rehabilitation by testing the hypothesis that there would be at least a positive moderate to good correlation (i.e. $r = 0.50–0.75$) (9) between scores on these measures.

METHODS

Study design

A retrospective longitudinal study was conducted to evaluate the validity of the AI and the COVS among 24 individuals admitted to an inpatient rehabilitation unit of a large, geriatric hospital. Data on the AI and the COVS were collected on admission and at discharge as part of routine clinical assessment and were entered into a data-set for the purposes of program evaluation. Thus, informed consent was not obtained at the time of data collection. A retrospective chart review was conducted to obtain data on demographic and clinical character-

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istics and length of stay of participants. The research ethics boards at Baycrest and the University of Toronto approved the study.

Participants and evaluators

People admitted to the inpatient rehabilitation unit were considered eligible for the study. The criteria for admission to the unit were: 55 years of age or greater; adequate cognitive and physical functioning to permit participation in a rehabilitation program; an orthopaedic diagnosis such as total hip or knee arthroplasty, hip or knee fracture or general deconditioning secondary to an acute event; and the need for involvement of 2 or more healthcare disciplines.

Eight physiotherapists administered the AI and the COVS. They had practised in a rehabilitation setting between 1 and 27 years (mean = 10.8 years). Four therapists had received training in the administration of the COVS (using a self-directed training videotape (n = 2), attending an in-service (n = 2)) while 7 therapists received training in the administration of the AI (participation in a full-day training workshop (n = 5) (10), attending an in-service (n = 2)).

Measurement

All items of the AI, except for the 2MWT, are rated on a 7-point ordinal scale based on standardized descriptors. For the 2MWT, 2 points are assigned if the distance walked is age appropriate. Scores on the 2 indices are added to produce a total score ranging from 14 to 100, with a higher score denoting greater function. Each item on the COVS (2) is scored on a 7-point ordinal scale based on standardized descriptors. To enable an evaluation of construct validity of the AI subscales, the COVS was divided into GMF (items 1a to 4b) and walking (items 5 to 9) subscales by matching similar items to that of the AI subscales, as reported in a previous study (7). Items 10a and b comprise the arm function subscale, which does not match any items in the AI.

Statistical methods

Cross-sectional construct validity was evaluated using Pearson correlation coefficient, testing the hypothesis that scores on the COVS would correlate with scores on the AI on admission and at discharge. Longitudinal construct validity was evaluated using Pearson correlation coefficient and sensitivity to change. Pearson correlation was used to test the hypothesis that change scores on the COVS will correlate with change scores on the AI measured between admission and discharge. Sensitivity to change from admission to discharge was evaluated using effect size (ES) (11), standardized response mean (SRM) (12) and relatively efficiency (RE) (12).

The data analysis was conducted for each subscale and the scales as a whole, with and without the arm function subscale for the COVS. With respect to the AI, all data analyses for the walking subscale included 2MWT results and the sensitivity to change of the 2MWT alone was also determined. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) program, version 14.

Table II. *Correlation (Pearson r) between Clinical Outcomes Variables Scale (COVS) and Activity Inventory (AI) scores on admission, at discharge and change from admission to discharge (n = 24)*

Outcome Measure Domain	Admission	Discharge	Change
Gross Motor Function	0.92*	0.91*	0.83*
Walking	0.80*	0.82*	0.59
Total AI vs. Total COVS	0.91*	0.92*	0.84*
Total AI vs. Total COVS – Arm	0.92*	0.93*	0.85*

*$p < 0.01$.

RESULTS

The mean age of participants was 83 years (standard deviation (SD) 7, range 71–99 years) and 75% of patients were female. The reasons for admission were pelvic or lower limb fracture (n = 10), general deconditioning (n = 9), or total hip or knee arthroplasty (n = 5). The mean number of co-morbidities was 2.8 (SD 1.4, range 0–5). Cardiovascular (n = 16), orthopedic (n = 14) and psychological (n = 4) co-morbidities were most frequently observed. Mean length of stay was 44 days (SD 24).

Table I presents scores obtained on admission and at discharge, the change scores between admission and discharge and estimates of ES and SRM for the AI and COVS. Some scores on the 2MWT were missing at both admission and discharge (n = 1), on admission only (n = 1), or at discharge only (n = 1). These 3 individuals were thus excluded from the calculation of ES and SRM for the 2MWT and a value of 0 out of 2 was imputed on the 2MWT item for computing scores on the AI Walking Index. The ES of the AI and the COVS was 1.53 and 1.43, respectively. The SRM of the AI and the COVS was 1.83 and 2.30, respectively. The ES and SRM of the 2MWT was 1.81 and 1.28, respectively (n = 21). The RE of the AI compared with the COVS (AI/COVS) was 1.18 for the GMF subscale, 0.47 for the walking subscale, 0.64 for the total scales with the arm subscale of the COVS and 0.73 without the arm subscale.

Table II displays the correlation between AI and COVS scores obtained on admission and at discharge, as well as change scores on these measures.

Table I. *Performance on the Activity Inventory and the Clinical Outcomes Variables Scale (COVS) and estimates of effect size (ES) and standardized response mean (SRM) (n = 24)*

Measure	Admission		Discharge		Change			
(Scoring)	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	ES	SRM
Activity inventory								
GMF (/70)	40.6 (8.7)	23–55	52.0 (6.2)	41–70	11.4 (6.7)	2–25	1.31	1.70
Walking (/30)	9.3 (3.9)	4–17	15.8 (6.1)	5–26	6.3 (4.7)	–3–14	1.62	1.35
2MWT, m	23.2 (19.8)	0–58.0	60.1 (31.4)	0–105.0	36.9 (28.9)	–17.0–85.0	1.81	1.28
Total (/100)	50.0 (11.6)	27–68	67.8 (10.9)	51–96	17.7 (9.7)	3–36	1.53	1.83
COVS								
GMF (/42)	25. 4 (5.9)	13–35	32.1 (3.5)	26–42	6.8 (4.3)	2–15	1.15	1.57
Walking (/35)	17.4 (4.7)	7–23	24.5 (4.6)	15–32	7.4 (3.8)	0–15	1.60	1.96
Total (/91)	55.0 (10.1)	34–71	69.5 (7.9)	55–88	14.5(6.3)	6–29	1.43	2.30
Total Arm (/77)	42.4 (9.7)	22–57	56.6 (7.1)	45–74	14.2 (6.6)	4–29	1.46	2.15

GMF: Gross Motor Function; SD: standard deviation; 2MWT: 2-minute walk test.

DISCUSSION

Results of this study support the construct validity of the AI and the COVS among elderly inpatients undergoing rehabilitation. Positive correlations between AI and COVS scores for the subscales, and the scales as a whole with and without the arm function subscale of the COVS, were observed on admission and at discharge as well as for change scores. The strength of these correlations was moderate to good. Findings reflect previous observations among patients with stroke and other neurological conditions (7).

The correlation values for the walking subscale were lower than those of the GMF and total scores, both with and without the arm function subscale of the COVS. This may be explained by the differences in tasks comprising the walking subscales, whereas the performance tasks of the GMF subscales are similar.

In the evaluation of longitudinal construct validity, ES and SRM values were greater than 0.8 for subscales and total scales of the AI and the COVS, indicating that these measures are sensitive to change in status from admission to discharge among elderly inpatients undergoing rehabilitation. The ES values for the AI subscales and total scale were larger than corresponding ES values on the COVS, indicating that the AI was more sensitive to change than the COVS. In contrast, the SRMs for the walking and total COVS scores were considerably higher than corresponding values on the AI. ES is computed by dividing the mean change in score from admission to discharge by the SD of *baseline* scores, whereas the SRM is computed by dividing the mean change in score by the SD of *change* scores. Thus, the SRM will exceed the ES when there is less variability or spread in change scores compared with baseline scores, which occurs when participants improve to a similar degree. Consequently, the SRM is considered to better reflect change than the ES.

Elderly inpatients undergoing rehabilitation appear to improve more uniformly on COVS walking items, which include such aspects of ambulation as use of aids, endurance, velocity and wheelchair mobility, than on AI walking items that capture walking indoors, outdoors, use of stairs and the 2MWT. Conversely, the GMF subscale of the AI appears more sensitive to change than the COVS GMF items based on the SRM value. These findings highlight the importance of evaluating the sensitivity to change of subscales as well as total scales to enhance understanding of what factors might contribute to changes in the total score.

In conclusion, findings suggest that the COVS is better able to detect change in mobility status than the AI in a geriatric inpatient rehabilitation setting and will allow for smaller sample sizes to be used in research studies. The lower sensitivity to change of the AI Walking Index may relate to the high difficulty level of 2 out of the 5 walking items (walking 150 m over rough ground and walking 6 city blocks). These activities may not be targeted and, as a result, patient functioning on these items may not improve during geriatric inpatient rehabilitation. If it is important for a patient to improve on the activities comprising the GMF subscale of the AI and if evidence of reliability for this subscale is demonstrated, then it could be used as an independent measure of GMF.

Although the small sample size may limit generalizability, participants were similar to other rehabilitation populations described in the literature (14). The administration of assessments by different physiotherapists potentially introduced some error in the scoring of the measures. This concern is offset by the high level of inter-rater reliability of these measures observed primarily in neurological populations (2, 7, 15, 16), although the reliability among elderly inpatients undergoing rehabilitation is unknown.

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