

## Clinical Investigation

# A Comparison of Functional Independence and Medical Complexity in Geriatric and Physical Medicine Rehabilitation In-Patients

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**Background:** This study set out to verify the hypothesis that geriatric rehabilitation patients are lower functioning and more medically complex than their adult rehabilitation counterparts.

**Methods:** This retrospective study compares 101 Geriatric Rehabilitation Unit (GRU) and 100 Physical Medicine and Rehabilitation Unit (PMRU) patients treated in Ottawa and London, Ontario, in 1999. The measurements used were the Functional Independence Measure (FIM), Cumulative Illness Rating Scale (CIRS), medication changes, discharge medications, number of admission medications, physician progress notes, and days with laboratory tests.

**Results:** As expected, the GRU patients were significantly older than the PMRU patients. They had lower mean admission FIM scores, lower discharge FIM scores, and lower FIM improvements. Because lengths of stay were longer, their rate of FIM change was lower. GRU patients were also more medically complex than PMRU patients in all the dimensions measured.

**Conclusions:** Geriatric Rehabilitation patients have lower functional status and higher medical complexity than their Physical Medicine and Rehabilitation counterparts. As the population ages, more rehabilitation beds may need to be designated "geriatric," and future funding formulas will need to allow for the functional and medical differences of these patients.

**Key words:** Geriatric rehabilitation, physical medicine and rehabilitation, frailty, functional status, medical complexity

## INTRODUCTION

As the population ages, its health needs change. Increasingly, the frail older persons hospitalized in acute care hospitals require some form of rehabilitation before being able to return to their homes. The concept of frailty has evolved in the Geriatrics literature over the last decade to a dynamic multi-dimensional construct which includes functional ability and medical complexity, as well as psychological and socio-economic support.<sup>1,2</sup> Recent papers have suggested that rehabilitation programs aimed at maintaining frail, older persons in the community should focus on both disease and functional abilities.<sup>3,4</sup> Furthermore, higher medical complexity has been found to correlate negatively with functional status and outcome.<sup>5,6</sup>

The importance of medical complexity in rehabilitation outcome becomes even more relevant in the context of a *Prospective Payment System* (PPS). Following the lead of USA, the Canadian Institute for Health Information (CIHI) has devel-

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oped a reporting system for Rehabilitation, the *National Rehabilitation Reporting System* (NRS). A number of Canadian provinces are considering moving to a PPS for rehabilitation over the next few years. In effect, this moves payment from a "reimbursement of costs incurred" model to a "this is how much it should cost" model. If medical complexity decreases a patient's potential autonomy gain, or increases the time needed to reach this gain, a funding formula based on average functional change and average rate of change will cause the program treating this patient to lose money for this case. In this way, the formula may disadvantage programs which deal with proportionally more medically complex patients.

To examine the relationship between medical complexity and rehabilitation outcomes further, this study compares patients in Geriatric Rehabilitation programs with those in Physical Medicine and Rehabilitation programs. The hypothesis was that geriatric rehabilitation patients are lower functioning and more medically complex than their adult rehabilitation counterparts. This work was part of a larger project, aimed at better characterizing the role of Geriatric Rehabilitation in the current and future health-care environments and providing advice to the *Ontario Ministry of Health and Long-Term Care* on policy issues relating to Geriatric Rehabilitation.

## METHODS

The study took place in two mid-size Ontario cities, Ottawa and London, which have both Geriatric Rehabilitation Units (GRUs) and Physical Medicine and Rehabilitation Units (PMRUs).

In 1999, the Sisters of Charity of Ottawa (SCO) Health Service operated 86 of Ottawa's 160 rehabilitation beds. These were divided into a 36-bed GRU and a 50-bed PMRU. The latter were further subdivided into 28 Stroke, 17 Neuro-locomotor and 5 Traumatic brain injury (TBI) beds. The three treating physicians on the GRU had 2 years of training in family medicine with an extra year training in Geriatrics, while the four physicians on the PMRU were specialists trained in Physical Medicine and Rehabilitation.

In London, there were 125 designated rehabilitation beds. Parkwood Hospital had 74 beds, including 26 GRU, the London Health Sciences Centre

(LHSC) had 21 PMRU beds, including 17 Neurological, and St-Mary's Hospital had a 30-bed PMRU, including 10 Orthopedic. The treating physicians on the GRU were internists with specialty training in Geriatrics, and a family physician with an additional year of training in Geriatrics. The physicians associated with the PMRUs were specialty-trained in Physical Medicine and Rehabilitation.

All units functioned with interdisciplinary teams, which included physicians, nurses, physiotherapists, occupational therapists, social workers, and pharmacists. Clinical nutritionists, speech-language pathologists, psychologists, and pastoral care workers participated on a consultation basis. The majority of patients were admitted directly from acute care hospitals, while some were admitted from home. Rehabilitation therapies were provided 5 days per week.

Data were collected from 201 charts of patients consecutively discharged from the designated rehabilitation units in fiscal year 1999. These included 101 patients discharged from the SCO Health Service rehabilitation programs between April and September 1999, and 100 patients discharged from the Parkwood Hospital, St. Mary's Hospital and London Health Sciences Centre between September 1999 and February 2000. September was chosen over April in London to maximize the number of charts with complete functional status scores. The 201 charts came from Ottawa GRU: 51 charts, London GRU: 50, Ottawa Stroke: 22, London Stroke: 25, Ottawa Neuro-locomotor: 28, and London Orthopedic: 25.

Functional status was measured using the Functional Independence Measure (FIM).<sup>7</sup> This tool scores 28 items from 1 (complete dependence) to 7 (complete independence). Global scores range from 18-126. Inter-rater reliability studies among clinicians in inpatient comprehensive medical rehabilitation facilities, have yielded Kappa coefficients of 0.96, indicating very high agreement.<sup>8</sup> Internal consistency is also high and has been measured at 0.93.<sup>9</sup> For the purposes of this study, the admission and discharge FIM scores were established by the rehabilitation teams. The Length of Stay Efficiency Ratio is a measure of the average daily rate of change in FIM scores achieved with rehabilitation.<sup>10,11</sup> It allows for comparisons of rehabilitation efficiency across patient populations.

Medical Complexity was measured using the

Cumulative Illness Rating Scale (CIRS).<sup>12</sup> On the basis of physician ratings using 5-point ordinal scales (score 0-4), the severity of pathology in each of 13 categories is estimated. The primary diagnosis is included in this calculation. Based on the ratings, two scores are derived. The Total Cumulative Illness Rating score (TCIRS), which reflects the overall burden of illness, is based on the total severity ratings across all 13 categories (range = 0 to 52). The Co-morbidity Index (CMI) score, which reflects the diversity of severe illnesses, is the total number of categories in which moderate or severe levels of pathology are noted (range = 0 to 13). Higher scores in both TCIRS and CMI indicate greater co-morbidity. The instrument has shown adequate test-retest reliability, construct and discriminative validity.<sup>13</sup> The CIRS has been validated for use with a geriatric population,<sup>14</sup> and has been used in the geriatric rehabilitation setting.<sup>5,6</sup> For the purposes of this study, the CIRS score was calculated by the auditor, based on information on the admission assessment, and medication orders and progress notes within 7 days of admission.

Several other measures were used as proxy indicators of medical complexity. Number of medications on admission was calculated using the physician order sheet. This included all regular medications ordered in the first 24 hours after arrival (i.e. PRN medication were excluded). Similarly, all changes to regular medications were counted based on the order sheets. Discharge medications were calculated from copies of the discharge medication administration records in London and from copies of prescriptions given to patients in Ottawa. It was also decided to use laboratory testing as a proxy measure. Because many medical conditions require groups of laboratory tests, it was decided to calculate the number of days on which lab tests were ordered, rather than the total number of tests ordered. These data were extracted from the order sheets as well. The last proxy for medical complexity was progress note entries written by physicians on the charts. In the cases where physicians wrote an extensive progress note covering a number of different issues, each issue was counted separately. Although physicians write progress notes for a variety of reasons, it was hypothesized that more progress notes would be written for patients with more medical complexity.

The charts were audited by one physician in each centre. Conference calls and e-mail communica-

tions were used to clarify the process of data abstraction. A pilot was conducted to ensure the feasibility of the study, including the availability of the data in the different settings, the clarity of the data abstraction form, and the inter-rater reliability of those doing abstraction in Ottawa and London. Ten charts from each city were coded by both of the data abstractors. The intra-class correlation coefficient was 0.74 for the TCIRS on admission, thus meeting minimal standards of reliability.<sup>15</sup>

The data were analyzed using SPSS version 10 software. The t-test for Independent Samples was used for all comparisons, except for categorical data, where a Chi-square Analysis was performed.

For the sample size calculation, it was considered that a two to three point difference in total Cumulative Illness Rating Scale (TCIRS) scores between GRU and PMRU patients, equating to a moderate difference in complexity for one system or a smaller difference in two or three systems, would be clinically important. Data from the pilot reliability study were used for an estimate of the standard deviation in CIRS scores (SD=4). Using conventional values for Type I and Type II error of .05 (two-tailed) and .10 (90% power), respectively, it was determined that 84 subjects were needed in each group. To allow for missing data, 100 charts were to be reviewed from each type of unit, with at least 50 GRU charts and 50 PMRU charts from each city. Because it was expected that GRUs would have significant numbers of patients with fractures and strokes as the primary admission diagnosis, it was decided to compare the GRU patients to PMRU patients from units where a majority of patients had these diagnoses. Therefore, patients from other specialty units, such as traumatic brain injury (TBI), spinal cord and amputee units, were excluded.

The most significant data to be missing were FIM scores. FIM scores were available as follows: Ottawa GRU: 49/51 admission (AFIM) and discharge (DFIM), London GRU: 39/50 AFIM and 36 DFIM, Ottawa Neuro-Locomotor: 28/28 AFIM and 27/28 DFIM, London Orthopedic: 6/25 AFIM and DFIM, Ottawa Stroke 13/22 AFIM and DFIM, and London Stroke: 25/25 AFIM and 24/25 DFIM. In total then, complete FIM data were available for 155 (75%) of the 201 cases. Five patients were missing the number of medications at discharge. All other data were complete.

**RESULTS**

An analysis of the data shows that patients admitted to the GRUs were 12.5 years older than their counterparts on PMRUs (81.0 years vs 68.5 years, respectively). Women made up 58% and 47% of the groups respectively. One-third of patients selected from both GRUs and PMRUs had an orthopedic reason for admission; one-half of selected PMRU patients had had a stroke compared to one-fifth of patients from the GRUs.

GRU patients were found to be more functionally impaired on admission and discharge than PMRU patients, and to achieve more modest functional gains during longer inpatient stays (**Table 1**). GRU patients were also found to be more medically complex than PMRU patients, as measured by the TCIRS and CMI, as well as in terms of all of the other proxy measures of medical complexity selected for the study (**Table 2**).

**DISCUSSION**

When trying to describe the population treated on Geriatric Rehabilitation Units, the term ‘frailty’ is often used. Most descriptions of frailty in older persons include one or both of the functional and medical dimensions. This study shows that there are significant differences in functional status between GRU and PMRU patients. At the time of admission, the GRU patients had significantly

**Table 1. Functional Scores**

	GRUs (n=85)	PMRUs (n=70)	Mean Difference	Conf Lower	In Upper	P
Admission						
FIM*	73.6	82.6	-9.0	-15.6	-2.4	0.008
Discharge						
FIM	91.7	107.2	-15.5	-21.9	-9.2	<0.001
FIM						
Change	18.1	24.0	-5.9	-10.7	-1.1	0.02
Length of						
stay	50.8	43.3	7.5	0.6	14.5	0.03
LOS						
efficiency	0.37	0.60	-0.2	-0.4	-0.1	<0.001

\*n=160 (see text)  
GRUs=Geriatric Rehabilitation Units; PMRUs=Physical Medicine and Rehabilitation Units; Conf Int=Confidence Intervals; FIM=Functional Independence Measure; LOS=length of Stay

**Table 2. Medical Complexity**

	GRUs (n=101)	PMRUs (n=100)	Mean Difference	Conf Lower	In Upper	P
TCIRS						
Admit	12.2	9.3	2.8	1.8	3.9	<0.001
CMI Admit	4.4	3.3	1.1	0.6	1.6	<0.001
No Admit						
Meds	7.4	6.0	1.4	0.5	2.3	0.003
No Med						
Changes	14.7	11.1	3.6	0.8	6.4	0.01
No DC						
Meds*	7.8	5.9	1.9	1.0	2.0	<0.001
No Progress						
Notes	26.3	10.4	15.9	10.4	21.4	<0.001
Rate PNs						
(/day)	0.51	0.21	0.3	0.2	0.4	<0.001
Lab Test						
Days	8.5	5.6	2.9	1.3	4.5	<0.001

\*n=196 (see text)  
GRUs=Geriatric Rehabilitation Units; PMRUs=Physical Medicine and Rehabilitation Units; Conf Int=Confidence Intervals; TCIRS=Total Cumulative Illness Rating Scale; CMI=Co-morbidity Index; Med=Medication; PN=Progress note

lower FIM scores. On the other hand, patients on PMRUs had shorter lengths of stays (LOS) and greater functional gains. This is consistent with the literature, which has suggested that higher co-morbidity correlates with lower functional status, longer LOS, and lower LOS efficiency.<sup>5,6</sup> This study also supports the hypothesis that GRU patients are more medically complex, as defined by the CIRS, number of medications, progress notes and laboratory tests.

There are two main weaknesses of this study. First, it would have been preferable to have more complete FIM data. FIM scores were not done routinely in all London rehabilitation units at the time selected for this audit. There is no way of knowing if the missing PMRU FIM scores would have affected the absolute results of the functional comparison in this study, but the relative difference is typical for the last few years in Ontario.<sup>16</sup> The second weakness was that the match by principal reason for admission was not perfect. The reason for this was that it was difficult to find rehabilitation units in Ottawa and London that would have provided a better match. Nonetheless, the percentage of orthopedic (33.7) and stroke (20.8) reasons for admission on the GRUs ended up being remark-

ably close to the typical GRU population in Ontario (32% and 17%, respectively).<sup>17</sup> Furthermore, the distribution of patients with orthopedic (50.0%) and stroke diagnoses (33.0%) in our PMR group was not substantially different from that reported by all North American rehabilitation programs submitting to Uniform Data Systems for medical rehabilitation (UDSmr<sup>R</sup>) in 1999 (38% and 30%, respectively).<sup>16</sup> To assess whether the differences that were found in complexity between GRU and PMRU patients were maintained in specific diagnostic groupings, separate post-hoc comparisons of GRU and PMRU stroke and orthopedic patients were performed. The differences in TCIRS admission scores in these sub-groups were similar to those found in the main analyses, and despite smaller numbers, were still statistically significant (2.5 to 3.6 TCIRS points,  $P < 0.05$ ).

Because frail older patients who require rehabilitation, are more medically complex, it is our belief that they are best cared for in specially designed programs that can provide comprehensive geriatric assessment and management. Furthermore, in areas where there are both Geriatric and Physical Medicine Rehabilitation beds, medical complexity could be considered as a variable that helps triage older patients to the most appropriate program. In areas where there are no designated Geriatric Rehabilitation beds, it would be important that the rehabilitation staff acquire training in Geriatrics. With the aging of the population, there should be an increase in the proportion of rehabilitation beds dedicated to the care of the frail elderly. Finally, the financial impact of medical complexity needs to be considered when designing the funding formulas for prospective payment systems for rehabilitation.

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