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Classification of residents in nursing homes in Tuscany (Italy) using Resource Utilization Groups Version III (RUG-III)

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Abstract

Background and aims—Samples of nursing homes in Tuscany (Italy) classify their residents and determine their case-mix according to the Resource Utilization Groups System, Version III (RUG-III).

Methods—A large sample of nursing homes was selected, based on willingness to participate, representation of both public and private institutions, and wide geographic representation. Two registered nurses assessed all residents using the RUG questionnaire. The information collected was then used to group residents into 44 RUGs, and facility-specific case-mix indices were calculated using the RUG-specific weights previously validated in Italy.

Results—A total of 3981 residents from 93 nursing homes were assessed. Most residents were over 75 years old (87.4%) and women (68.6%). A large percentage was classified into RUGs within the following primary categories: reduced physical function (33.6%), impaired cognition (17.6%) and clinically complex (17.6%). The resulting nursing home case-mix indices ranged from 0.627 to 1.108 (mean 0.807 ± 0.110). No significant association was found between type of facility, level of fees, or extent of staff in the nursing homes and their case-mix indices.

Conclusions—RUG-III can provide information on types of nursing home residents and their care needs. This is useful for monitoring and evaluating long-term care services for the elderly, and allows for more effective planning and allocation of staffing and financial resources.

Keywords

Case-mix classification; long-term care; nursing home; RUG-III system

Introduction

The population of Tuscany (Italy) is one of the oldest in the world. Of its 3.5 million inhabitants, about 800,000 (22.7%) are 65 years of age and older and, of these, about 10% are disabled in one or more activities of daily living (ADL) (1). Providing care to the elderly, particularly those who are chronically disabled, is a crucial challenge for the Tuscany Local Health Authorities (ASLs). During the early 1990s, the burden imposed on community-based services for the

elderly was increased by the new hospital prospective payment system, which led to the early discharge of older patients before they had reached full medical stability (2,3) without parallel expansion of community services.

Currently, the network of services for the elderly in Tuscany includes a wide range of options: integrated home care services, a combination of health and social services aimed at providing help to disabled older persons who are still at home; day center services, semi-residential structures that host disabled elderly persons during the day; and nursing homes, long-term care residential facilities that mainly admit chronically disabled older persons who cannot be cared for at home, either because of the severity of their functional disability or because they lack adequate social support. In locations where the availability of services is limited, nursing homes also host older persons who are not disabled and have no need for qualified nursing care or physical therapy.

At the end of 2002, there were 229 nursing homes in Tuscany that could host about 9000 disabled, older persons. Of these facilities, 115 were public and 114 private but receiving financial support from the local health authorities through contractual arrangements. Nursing homes with only generic modules must provide at least 26,144 hours of personal care (CA), 6536 hours of nursing care by qualified staff (RGN) and 1634 hours of physical therapy (PT) per year for every 40 disabled residents. The costs of these basic services are covered by flat, per diem health fees (1st level fees), paid by the ASL where the facility is located.

At the time of this study, nursing homes with a specialized module (or at least 20% of beds) dedicated to demented or comatose residents were required to provide 1800 additional hours of nursing and/or rehabilitation care per year. As a result of these additional services, specialized facilities were eligible to receive slightly higher health fees, further differentiated into 2nd and 3rd level fees, depending on their structural characteristics. Most nursing homes have generic modules only, regardless of the great variability of their residents' mental status, physical function and health care needs, which is often not reflected in the organizational structure, size and qualifications of the staff. Furthermore, neither a region-wide information system to provide data on residents, nor a standard procedure to monitor the quality of the care provided, is currently in place in Tuscany nursing homes.

In the context of the "ASSI Project", a multi-regional research project sponsored by the Italian Ministry of Health to assess the status of the Social and Health Services for the elderly in Italy, a sample of Tuscany nursing homes was studied to classify their residents and determine their case-mix indices according to the Resource Utilization Groups system, version III (RUG-III). The general aim of the study was to assess whether a case-mix classification system could provide useful information to help monitor, evaluate and better plan long-term residential care services for the frail elderly in Tuscany.

Methods

Study design

The study was designed as a cross-sectional survey aimed at assessing the organizational characteristics of Tuscany nursing homes and the care needs of their residents. The study was presented to the social and health services coordinators of the 12 ASLs of Tuscany in June 2003. The coordinators were asked to assess the willingness of their nursing homes to participate and to provide a list of participating institutions, ensuring representation of both public and private facilities. Data on the organizational characteristics of the participating nursing homes and staff were collected through a structured questionnaire administered to the legal representative of each facility. Individual data on residents' characteristics were collected using the RUG questionnaire. Two registered nurses were selected from each nursing home to

participate in a 2-day training course on the proper administration and coding of the RUG questionnaire. On October 1, 2003, all residents were assessed, except for those admitted in modules totally dedicated to non-disabled residents. Additional data, mainly about physical therapy, were collected *via* telephone interviews with the facility coordinators.

RUG-III

RUG-III is a case-mix classification system, developed in the USA in the 1980s (4) and later updated into RUGS II (5) and then RUGS III (6). The latest version classifies elderly residents of long-term care institutions into 44 homogeneous RUGs. RUG-III has recently been validated in several countries (7-10) including Italy (11). In these studies, the RUG-III classification system explained a large proportion of the variance in care time received by residents. Although originally developed for epidemiological and management purposes, the RUG-III classification system has been used for prospective payment of Medicare nursing homes since 1998 (12).

Based on responses to 109 items predictive of the type and quantity of care needed, nursing home residents are first hierarchically grouped into seven main categories: rehabilitation (further divided into ultra high, very high, high, medium, and low), extensive care, special care, clinically complex, impaired cognition, behavioral problems, and reduced physical function. Under the assumption that the amount of physical therapy provided to the residents depends closely on the residents' conditions, residents are grouped into the five rehabilitation subcategories defined by the amount of physical therapy received, regardless of their health status. Residents who do not receive physical therapy are grouped into the other six categories, according to their most important clinical characteristics and care needs. Thus, residents who need parenteral feeding, tracheotomy or suctioning are grouped into the extensive care category, those with quadriplegia, stage 3 or 4 pressure ulcers or those who are comatose into the special care category, and those with aphasia, hemiplegia, terminal illness or who need dialysis or chemotherapy into the clinically complex category. Residents with impaired cognition or behavioral problems are grouped into the homonymous categories. Lastly, residents who do not meet any of the above-mentioned criteria are classified into the reduced physical function category.

Residents are then further grouped into the specific Resources Utilization Groups (RUGs) based on ADL disability scores, presence of depression, and nursing rehabilitation needs. The main categories include between 4 and 14 RUGs. Residents grouped into a specific RUG are assumed to have similar care needs and to require roughly the same amount of time of CA, RGN and PT care per day. Estimated total minutes of care needed are wage-weighted and indexed as RUG-specific weights, with a mean value of 1. The “heaviest” RUG is the first RUG of the rehabilitation category (RUG 1) and the “lightest” is the last RUG of the reduced physical function category (RUG 44). The mean weights of the category-specific RUGs decrease from the Rehabilitation to the Reduced Physical Function categories but, in general, the last RUGs in each category are “lighter” than the first RUGs in the following categories, demonstrated in the weight histogram by a saw-tooth shape. Specific weights have been produced for different countries. In this study, we used those previously developed in the Italian setting, based on the Italian study validation and suggestions from a panel of experts (unpublished data). These weights, used in all the “ASSI Project” centers using the RUG-III system in Italy, range widely, from 0.315 (RUG 44) to 2.039 (RUG 1) with an average value of 1 (Fig. 1). The mean weight of the entire nursing home resident population, defined as the case-mix index (CMI), depends on the distribution of the residents into the 44 RUGs, and is directly proportional to the estimated wage-weighted minutes of care each resident requires on average.

Data analysis and statistical methods

The data collected with the RUG questionnaires were entered into a dedicated database and used to classify the assessed residents into the 44 RUGs using the algorithm originally developed by Fries (5). Data were checked for internal validity. The study coordinators conducted a second assessment in a sample of residents to verify that their characteristics matched those collected by the RUG questionnaires during the first assessment. The case-mix indices for each nursing home were calculated as the average RUG-related weights of the residents in the facility. Statistical analysis was performed using the SPSS statistical package. Mean values between groups were compared by ANOVA, proportions of explained variance were estimated by η^2 , and correlations between variables were measured using Pearson's correlation statistics.

Results

1. Nursing homes

Ninety-three nursing homes (40.3% of all those in Tuscany) participated in the project. Their distribution per ASL and ownership is given in Table 1 and their geographical location is shown in Figure 2.

Of the selected nursing homes, 63 are public institutions and 30 are private (13 not-for-profit, 17 for-profit), representing 54.8% and 25.9%, respectively, of the public and private nursing homes in Tuscany at the time of the study. All 12 ASLs of Tuscany contributed to the study. Two ASLs participated with all (ASL 11) or almost all (ASL 7) of their nursing homes. In three ASLs, including ASL 10 (Florence), no private, under-contract institution was included in the study.

Fifty-eight nursing homes were eligible for the basic *per diem* fees, 30 for the 2nd/3rd level fees, and 5 were receiving midway fees. Only 10 nursing homes had a specialized module dedicated to elderly people with dementia, and only one of them had a module for comatose residents. On average, the facilities provided about 33,000 CA hours, 9640 RGN hours and 2120 PT hours per year every 40 disabled residents, which is slightly above the standard set by the regional law in force at the time of the study. However, staffing varied widely among the ASLs even in nursing homes eligible for the same level of *per diem* fees. Total wage-weighted hours of CA and RGN care per 40 disabled residents ($CA = 0.7 \text{ RGN}$) varied from 17,882 to 86,000 (Fig. 3; incidentally, all 3 facilities with more than 60,000 hours of care were well-staffed private facilities with very few residents) and the number of PTs working in the facilities ranged from 0 to 6.7 per 40 disabled residents being, on average, higher in the private for-profit nursing homes than in the public ones (respectively 2.2 vs 1.1 PTs).

2. Resident composition

A total of 3981 subjects made up the study population. Their age and sex distribution is given in Table 2. Overall, 87.4% of subjects were 65 years or older and, of these, 72.9% were women. Notably, 38.7% were 85 years or older, of whom 82.5% were women. A significant proportion (12.6%) was under 65. Of these, 61.9% were men, representing 24.8% of male residents.

Most participants (3563; 89.5%) were legally disabled and health *per diem* fees were being paid for them. A few (418; 10.5%) were not assigned health *per diem* fees. Most of these had probably not been certified as disabled (hereafter called “non-disabled residents”), but were nevertheless included in the study as they were mixed with the disabled residents and assisted by the same personnel. Non-disabled residents were unevenly distributed among the ASLs, representing between 0 and 70% of the residents.

3. Classification of residents into RUGs

The distribution of the 3981 nursing home residents into the 44 RUGs is given in Figure 4. About 10% of the 3563 disabled residents were classified into the Rehabilitation category (RUGs 1-14), almost all falling into the medium and low intensity rehabilitation groups (RUGs 9-14). Most of these (82.7%) received some form of physical therapy aimed at preventing further decline of physical function (13), and only a small percentage (17.3%) received rehabilitation therapy after an acute event such as a stroke or hip fracture.

Only 3% of the disabled residents were classified into the Extensive Care category (RUGs 15-17), mainly because they were receiving some intravenous treatment (68%) and/or parenteral nutrition (32%); about 15% were classified into the Special Care category (RUGs 18-20), due to pressure ulcers (42%) or surgical wounds (43%); about 18% were classified into the Clinically Complex category (RUGs 21-26), either because they had needed at least two medical consultations to adjust their drug treatment during the preceding month (42%) or because of post-stroke hemiplegia with severe disability scores (26%). Of the disabled residents classified into these three main categories, 46 were comatose, including the 4 residents in the single specialized module for comatose patients.

About 18% of the disabled residents were classified into the Impaired Cognition category (RUGs 27-30) and 4% in the Behavior Problems category (RUGs 31-34). About 21% of residents in these two categories were under 65 years of age, and of these, 61% were men. It should be noted that only some residents with impaired cognition and/or behavior problems fell into these two categories, since residents with other problems not related to mental status were classified into the higher RUGs and residents with severe ADL disability into the Reduced Physical Function category, regardless of their cognitive status. In fact, of the 139 disabled residents admitted to the 10 specialized modules dedicated to dementia, 39.5% were classified into RUGs 15-26, only 17.2% into the Impaired Cognition and Behavior Problems categories, and 35.3% in the “heavy” RUGs Reduced Physical Function.

Lastly, about 32% of disabled residents were classified into the Reduced Physical Function category (RUGs 35-44), mainly “heavy” (RUGs 36-38), which include subjects affected by severe disability. About 8% of these residents were classified into the RUG 44 as they were essentially non-disabled and had no special care needs. As expected, the 418 non-disabled residents were mostly classified into the “light” RUGs: about half of them fell into the Reduced Physical Function category (RUGs 35-44) and, of these, 72% were classified into the RUG 44.

4. Case-mix indices

The distribution of residents into the 44 RUGs varied considerably across the 93 ASLs. Consequently, the resulting case-mix indices ranged from 0.627 to 1.108 (mean 0.807, SD 0.110), meaning that residents with the highest CMI required almost twice as much care as those with the lowest. The uneven distribution of the non-disabled residents, whose mean weight was significantly lower than that of the disabled residents (0.637 vs 0.849), and the variable availability of PTs among the ASLs which could influence the resident's chances of being classified into the heavy RUGs of the Rehabilitation category, regardless of their health status, may explain part of the observed CMI variability. However, CMI variability persisted after restricting analysis to disabled residents and ignoring rehabilitation care. Figure 5 shows the CMI of the 93 participating ASLs considering only disabled residents and ignoring rehabilitation care. They range from 0.627 to 1.144 (mean 0.822 ± 0.102).

The mean CMI (only disabled residents, rehabilitation not considered) was slightly different across ASLs, type of ownership, and level of flat health fees assigned (Table 3), although the differences did not reach statistical significance (ANOVA test *p*-values respectively 0.323,

0.663 and 0.583). Notably, the three different levels of health fees explained only 3.7% of the variance in the observed CMI (Eta^2). Lastly, no correlation was found between total wage-weighted hours of CA and RGN care per 40 disabled residents available at the nursing homes and their CMI calculated considering only disabled residents and ignoring rehabilitation care (Pearson's $r = 0.042$; $p\text{-value} = 0.689$). Conversely, as shown in Figure 6, the variability of the ratios total wage-weighted hours of CA and RGN care available at the nursing homes to their CMI was even greater than the variability of the CMI itself.

Conclusions

There is robust evidence from studies in many countries that the RUG-III classification system explains a large proportion of the variance in the amount of care required by residents in nursing homes. Although in the USA the RUG-III system is currently used for prospective payments of nursing homes, it has also been demonstrated to provide reliable information for monitoring the quality of care and verifying the adequacy of resource allocation.

Some RUG-specific weights used in this study were based on a limited number of observations and need further confirmation. However, the results of this study are striking and do not change significantly even when different country-specific weights are used.

In the nursing homes included in this study, the amount of care needed by the residents varied widely across structures. Despite the small variation in the set standards for staff and resources, great variability was also observed in the level of staffing among the nursing homes. However, it was not related to the amount of care needed by residents, and the variability of the ratios of staff resources to residents' care needs is even greater than CMI variability. It must be assumed that there are differences in the quality of care among these nursing homes. However, unless systematically used, RUG-III alone does not give sufficient information to examine the quality of care, and this hypothesis was not verified.

Higher specialization modules installed widely in nursing homes, a trend encouraged by recent legislation in Tuscany, may improve the ratios between care needs and available resources at single institutions, thus improving the quality of care. In this context, the RUG-III classification system could usefully monitor the effects of enforced modularization, provide data to define further improvements, and help nursing home managers to allocate human resources properly, so that residents with more complex care needs receive more assistance. Furthermore, if systematically used, some items of the RUG questionnaire may be used directly to assess the quality of care.

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Fig. 1. The 44 RUG-specific weights

Fig. 2. Map of Tuscany and geographic location of facilities included in study

Fig. 3. Total wage-weighted CA and RGN hours of care per 40 disabled residents

Fig. 4. Resident distribution in 44 RUGs. Disabled residents (n=3563) are shown in white and non-disabled residents (n=418) in black

Fig. 5. Nursing home case-mix indices (CMI, only disabled residents; rehabilitation care not considered)

Fig. 6. Ratios of total wage-weighted hours of CA and RGN care per 40 disabled residents to CMI

Table 1

Selected nursing homes per ASL and ownership

ASL	Tot.	Selected	%	Tot.	Selected	%	Tot.	Selected	%
1	4	4	100	14	9	64.3	18	13	72.2
2	7	5	71.4	5	3	60.0	12	8	66.7
3	8	4	50.0	5	0	0.0	13	4	30.8
4	5	2	40.0	8	2	25.0	13	4	30.8
5	16	7	43.8	11	4	36.4	27	11	40.7
6	6	1	16.7	6	2	33.3	12	3	25.0
7	17	17	100	3	2	66.7	20	19	95.0
8	21	4	19.0	6	0	0.0	27	4	14.8
9	7	3	42.9	6	1	16.7	13	4	30.8
10	13	5	38.5	41	0	0.0	54	5	9.3
11	9	9	100	2	2	100	11	11	100
12	2	2	100	9	5	55.6	11	7	63.6
Tot.	115	63	54.8	116	30	25.9	231	93	40.3

Table 2**Study subjects by sex and age group**

Age-groups	Males	Females	Total
<65 yrs	(n=310)	(n=191)	(n=501)
15-24 yrs	0 (0.0%)	1 (0.5%)	1 (0.2%)
25-34 yrs	12 (3.9%)	2 (1.0%)	14 (2.8%)
35-44 yrs	39 (12.6%)	16 (8.4%)	55 (11.0%)
45-54 yrs	99 (31.9%)	39 (20.4%)	138 (27.5%)
55-64 yrs	160 (51.6%)	133 (69.6%)	293 (58.5%)
≥65 yrs	(n=942)	(n=2538)	(n=3480)
65-74 yrs	277 (29.4%)	296 (11.7%)	573 (16.5%)
75-84 yrs	395 (41.9%)	970 (38.2%)	1365 (39.2%)
85+ yrs	270 (28.7%)	1272 (50.1%)	1542 (44.3%)
Total population	(n=1252)	(n=2729)	(n=3981)
<65 yrs	310 (24.8%)	191 (7.0%)	501 (14.4%)
>65 yrs	1252 (75.2%)	2538 (93%)	3480 (85.6%)

Table 3

Mean CMI by ASL (only disabled residents; rehabilitation care not considered).

			Mean CMI	Nursing homes Mean±SD
ASL	1		0.78	13±0.09
	2		0.82	8±0.09
	3		0.80	4±0.08
	4		0.79	4±0.13
	5		0.84	11±0.10
	6		0.82	3±0.06
	7		0.81	19±0.10
	8		0.91	4±0.16
	9		0.75	4±0.11
	10		0.85	5±0.16
	11		0.83	11±0.08
	12		0.89	7±0.06
Owner	Public	Local Council	0.84	11±0.11
		Other Public	0.79	14±0.07
	Private	Not-For-Profit	0.82	63±0.11
		For-Profit	0.81	13±0.09
			0.84	17±0.09
Level of health fee	1		0.82	58±0.10
	2		0.84	10±0.08
	3		0.84	20±0.11
Total			0.82	93±0.10