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## Original Study

# The Influence of Activity-Based Funding on Treatment Intensity and Length of Stay of Geriatric Rehabilitation Patients

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## A B S T R A C T

**Keywords:**

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**Aim:** Little is known about the impact of activity-based funding (ABF) to increase treatment intensity and decrease length of stay (LOS) of inpatient geriatric patients. In January 2014, ABF was implemented in The Netherlands with the aim to increase treatment intensity and shorten LOS in geriatric rehabilitation (GR). **Objectives:** To describe the influence of ABF on treatment intensity and LOS of inpatient GR patients before and after ABF was implemented.

**Design:** Population-based, retrospective cohort study.

**Setting:** Thirty nursing homes providing inpatient GR across The Netherlands.

**Data Collection:** Digital medical records of patients who had received inpatient GR in Dutch nursing homes across The Netherlands were studied between January 1, 2013 and March 14, 2016. We calculated the mean treatment intensity in hours per week and median LOS in days in 3 cohorts according to the year of admittance. In addition, a historical representative cohort of GR patients who were admitted in 2007 was studied that represented the situation before the ABF reform was announced (eg, funding with a fixed price per day). In 2013, the funding with a fixed price per day was still in use but with compulsory ABF registration. In 2014 and 2015, the ABF was fully implemented.

Statistical differences in treatment intensity and LOS were calculated between patients admitted in 2007 and 2013, 2013 and 2014, and 2013 and 2015. Statistical significance was set at a  $P$  value of  $<.02$  (Bonferroni correction  $P = .05/3$ ). Discharge destinations of patients discharged from March 1, 2015 to January 1, 2016 could be obtained and compared with 2007.

**Results:** The treatment intensity and LOS of 16,823 GR patients could be obtained and compared with the historical cohort from 2007 ( $n = 2950$ ). Patients who were admitted in the year 2013 received higher treatment intensities and had the same median LOS compared with 2007. After the implementation of ABF in January 2014, the mean treatment intensity increased significantly by 37% (3.8 hours/week in 2013, 4.7 hours/week in 2014, and 5.2 hours/week in 2015). This trend was significant across all rehabilitation diagnoses. After the implementation of ABF, the median LOS decreased significantly by 7 days (46 days in 2013, 42 days in 2014, and 39 days in 2015), which was consistent in all rehabilitation categories except for patients with a total joint replacement or amputation.

**Conclusions:** Patients who received inpatient GR after introduction of ABF received higher treatment intensities and had a shorter LOS compared with the year before implementation.

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Inpatient geriatric rehabilitation (GR) is an effective intervention to improve functional activity, prevent permanent nursing home admissions and mortality of vulnerable elderly patients admitted to the hospital.<sup>1</sup> In The Netherlands, inpatient GR is solely provided by

nursing homes. The government provided funding, with a fixed price per day and a maximum length of stay (LOS) of 6 months. In 2008, the Dutch government began to prepare a change to health insurance payment by means of activity-based funding (ABF), which was finally implemented from January 1, 2014. ABF is an umbrella term for a type of funding on the basis of distinct diagnosis-based treatment episodes that is known by many synonyms internationally.<sup>2</sup> ABF is a political policy tool to reshape incentives in the provision of healthcare. In The Netherlands, ABF was adopted to facilitate both short and variable

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intensive treatments during GR. Incentives were realized by providing higher negotiable prices for high treatment intensities in combination with a short LOS.<sup>3</sup> Compulsory ABF registration was introduced but not financially implemented in the year 2013; ABF payment was financially applied starting January 1, 2014 in Dutch nursing homes offering inpatient GR. Until now, no international data is available about the impact of both financial incentives to increase treatment intensity and to decrease LOS during GR. Electronic patient records that hold basic information about GR can shed light on treatment intensity, LOS, and discharge destinations of GR patients. Therefore, the aim of the present study is to provide insight in trends in treatment intensity, LOS, mortality, and discharge destinations of GR patients who were admitted shortly before and after the institution of ABF in GR and to compare it with a historical cohort of GR patients from 2007, before ABF was announced.<sup>4</sup>

## Methods

### Study Population

The study population consisted of 16,823 patients who were admitted to Dutch inpatient GR institutions across The Netherlands between January 1, 2013 and January 1, 2016. We analyzed patient data originating from all 30 nursing homes across The Netherlands, which made use of the electronic health record system of Gerimedica Ltd (Amsterdam, The Netherlands). All participating institutions gave their consent in providing anonymous patient data from the electronic health record system of Gerimedica Ltd. The Medical Ethics Committee of the VU Medical Center approved the study with a waiver of informed consent. Patients admitted before January 1, 2016, were followed until the extraction date on March 14, 2016. Patients that were not discharged at March 14, 2016 were excluded from analysis. In addition, patients who were admitted more than once were excluded from analysis (3.7%) because the electronic health record data was not indexed for each stay period. The study population included patients who were labeled for GR (in the electronic health record) by the attending elderly care physician. Patients that were admitted in the year 2013 were labeled as being admitted before the ABF was implemented but was registered, and the cohorts who were admitted in 2014 and 2015 were labeled as being admitted after the implementation of ABF. The historical cohort of 2007 (for comparison) consisted of a representative sample of 2950 GR patients from The Netherlands. This cohort was originally used to estimate the size, character and duration of GR in The Netherlands.<sup>4</sup>

### Data Collection

Data was extracted from the electronic patient record system named YSIS on March 14, 2016. Data from the historical cohort of 2007 was extracted from the published report. Because mean age was only reported for men and women separately, the first author of this report was asked to additionally supply information about mean age and the standard deviation of the entire group. Treatment intensity and LOS of all patients, including those of the historical cohort, were presented according to the year of their admittance. The following patient characteristics were obtained: age, sex, marital status, original living place, year of admittance, main rehabilitation diagnosis, and the number of patients who received outpatient rehabilitation at the end of their inpatient stay. At discharge, the following patient outcomes were extracted: LOS (including outpatient stay which is maximal 12 weeks), inpatient mortality, treatment intensity registered by physicians, physiotherapists, occupational therapists, dietitians, social workers, psychologists, speech therapists, spiritual caretakers, recreational therapists, and music therapists in hours per week. In addition, the following treatment activities by nurses were registered: wound

treatment, indwelling catheter placement and flushing, ventilation support, central venous catheter care, enteral feeding care, and guidance of behavioral problems. Information regarding treatment intensity from 2007 consisted of the treatment provided by the aforementioned therapists and high-qualified nurses such as nurse practitioners.

Discharge destinations were structurally registered from March 1, 2015 to January 1, 2016. The treatment intensity was calculated by the inbuilt time registration application of the electronic health record system that prompted the user to register the duration of treatment after each patient-related entry in the patient health record.

### Analysis

Trends in patient characteristics and outcomes between the cohort of 2013 and the other cohorts (2007, 2014, 2015) were calculated (3 comparisons). Differences in categorical variables were analyzed using the  $\chi^2$  test. For normal distributed continuous variables the Student *t* test was performed and the Mann-Whitney U test for not Gaussian distributed variables. Differences of *P* values of  $<.02$  were regarded significant because of a Bonferroni correction attributable to 3 comparisons between the cohorts;  $P = .05/3$ . Data was extracted from the electronic patient record system by means of data-extraction software Kibana v 4.4.2 (Elastic Inc, Sacramento, CA) and analyzed by SPSS v 20. (SPSS Inc, Chicago, IL).

## Results

### Distribution of Patients

Figure 1 shows the place of residences of the study patients across The Netherlands. When comparing patient characteristics between the urban regions (Noord Holland, Zuid Holland and Utrecht) and more rural regions, no statistical significant differences in sex, age, LOS, treatment intensities, and outcome (rate of returning home) were found.

### Trends in Patient Characteristics

The proportion of female patients and mean age significantly decreased from 67% and 79.6 years in 2007 to 64% and 78.5 years in 2013 (Table 1). The distribution of main rehabilitation diagnoses showed a significant proportional decline of patients with stroke or with a total joint replacement in 2013 compared with 2007 ( $P < .02$ ). The proportion of stroke patients decreased further in 2014–2015 in favor of patients with miscellaneous diagnoses ( $P < .02$ ).

### Trends in Treatment Intensity and LOS

The total mean treatment intensity in hours per week differed significantly between the historical cohort of 2007 and 2013 (3.3 hours/week and 3.8 hours/week, respectively;  $P < .02$ ). Compared with 2013, treatment intensity significantly increased further to 4.7 hours/week and 5.3 hours/week in, respectively, 2014 and 2015 ( $P < .02$ ). Trends in treatment intensity during 2007, and 2013–2015 are shown Figure 2 and Table 2. Overall, in all rehabilitation diagnoses a significant increase in treatment intensity was present between 2013, 2014, and 2015 (Appendix 1). There was no difference in LOS between 2007 and 2013. Compared with 2013, the median LOS decreased with 7 days from 46 to 39 days in 2015 ( $P < .02$ ), which was consistent in all rehabilitation categories except for patients with a total joint replacement or amputation in which trends in LOS were not significant (Table 2 and Appendix 1).

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