Clinical Nutrition xxx (2017) 1–6

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Original article

Undernutrition is associated with increased financial losses in hospitals

Pedro Marques-Vidal [a, *], Saman Khalatbari-Soltani [a, b], Sahbi Sahli [a], Pauline Coti Bertrand [c], François Pralong [c], Gérard Waeber [a]

[a] Department of Medicine, Internal Medicine, Lausanne University Hospital, Lausanne, Switzerland
[b] Institute of Social and Preventive Medicine (IUMSP), Lausanne University Hospital, Lausanne, Switzerland
[c] Service of Endocrinology, Diabetes and Metabolism, Lausanne University Hospital, Lausanne, Switzerland

ARTICLE INFO

Article history:
Received 10 October 2016
Accepted 12 February 2017

Keywords:
Diagnosis-related groups
Costs
Reimbursements
Hospital undernutrition

SUMMARY

Background & aims: Undernutrition is associated with increased hospital costs. Whether these increased costs are totally compensated by third payer systems has not been assessed. We aimed to assess the differences between actual and reimbursed hospital costs according to presence/absence of nutritional risk, defined by a Nutritional risk screening-2002 (NRS-2002) score ≥3.

Methods: Retrospective study. Administrative data for years 2013 and 2014 of the department of internal medicine of the Lausanne university hospital. The data included total and specific costs (i.e. clinical biology, treatments, pathology). Reimbursed costs were based on the Swiss Diagnosis Related Group (DRG) system.

Results: 2200 admissions with NRS-2002 data were included (mean age 76 years, 53.9% women), 1398 (63.6%) of which were considered nutritionally 'at-risk'. After multivariate adjustment, patients nutritionally 'at-risk' had higher costs (multivariate-adjusted difference ± standard error: 34,206 ± 1246 *vs.* 22,214 ± 1666 CHF, $p < 0.001$) and higher reimbursements (26,376 ± 1105 *vs.* 17,783 ± 1477 CHF, $p < 0.001$). Still, the latter failed to cover the costs, leading to a deficit between costs and reimbursements of 7831 ± 660 CHF in patients 'at-risk' vs. 4431 ± 881 in patients 'not at-risk' ($p < 0.003$). Being nutritionally 'at-risk' also led to a lower likelihood of complete coverage of costs: multivariate-adjusted odds ratio and 95% confidence interval 0.77 (0.62–0.97). Patients 'at-risk' had lower percentage of total costs in medical interventions, food, imaging and "other", but the absolute differences were less than 2%.

Conclusion: Hospital costs of patients nutritionally 'at-risk' are less well reimbursed than of patients 'not at-risk'. Better reporting of undernutrition in medical records and better reimbursement of undernourished patients is needed.

1. Introduction

Undernutrition is a common feature among hospitalized patients: in Switzerland, it is present in slightly less than one out of five patients [1,2]. Undernutrition leads to increased in-hospital morbidity and mortality [3], as well as increased hospital costs [4,5]. In most European countries, health costs are covered by the government, prepaid private insurances and the patients themselves [6]. Switzerland has one of the best health systems in the word [7], which also ranks amongst the most expensive: total health costs for 2013 were estimated at 9752 US$ per capita, almost one quarter (22.9%) being paid by the patients [6]. In Switzerland, hospitals are reimbursed based on the Diagnosis Related Groups (DRG), a system aimed at making hospital paying more transparent and also at evaluating hospital performance [8]. The Swiss Diagnosis Related Groups (Swiss DRG) system exists since 2012, is based on its German counterpart and has approximately 1000 different categories [9]. In a well-managed system, hospital costs should be balanced by reimbursements; hence, the highest hospital costs due to undernutrition should be covered by higher reimbursements,

* Corresponding author. Department of Internal Medicine, Internal Medicine, Lausanne University Hospital (CHUV), Office BH10-642, Rue du Bugnon 46, 1011 Lausanne, Switzerland.
E-mail addresses: Pedro-Manuel.Marques-Vidal@chuv.ch (P. Marques-Vidal), Saman.KhalatbariSoltani@unil.ch (S. Khalatbari-Soltani), Sahbi.Sahli@chuv.ch (S. Sahli), Pauline.Coti@chuv.ch (P. Coti Bertrand), Francois.Pralong@chuv.ch (F. Pralong), Gerard.Waeber@chuv.ch (G. Waeber).

http://dx.doi.org/10.1016/j.clnu.2017.02.012
0261-5614/

provided the adequate DRG codes are indicated. Still, whether this is actually the case has never been assessed.

We have previously shown that being nutritionally 'at-risk' was associated with higher in-hospital mortality and total costs [10]. We now assessed the costs, reimbursements and corresponding net result (i.e. the difference between costs and reimbursements) according to presence/absence of nutritional risk. We also assessed the distribution of specific costs (i.e. related to imaging, laboratory analyses, etc.) according to presence/absence of nutritional risk. The objective is to know whether patients nutritionally 'at-risk' differ from the others regarding specific costs and if they represent a financial burden for the institution.

2. Materials and methods

2.1. Study design

This is a retrospective study using electronic administrative data for years 2013 and 2014 of the department of internal medicine of the Lausanne university hospital. Data from all adult (≥18 years old) hospitalizations who stayed at least one day (≥24 h) in the department of internal medicine was collected and coded before being handled for analysis. Data extraction, merging and coding was performed by a specific team of the Lausanne university hospital and the investigators were blinded to the hospitalizations' identities.

2.2. Nutritional risk screening and data collection procedure

Nutritional risk screening was defined by the presence of NRS-2002 score in the electronic medical records. Since January 2013, all data related to nutritional status (including screening) is available in the patient's electronic file. According to the Lausanne university hospital guideline, undernutrition risk screening should, whenever possible, include all patients, and be systematic for patients with chronic obstructive pulmonary disease (COPD) and heart failure. For the other patients, decision for screening is based on the subjective evaluation by the health care team. Evaluation should be based on the NRS-2002 of the Danish Society for Parenteral and Enteral Nutrition [11,12]. The reason for focusing on patients with COPD and heart failure is the high prevalence of undernutrition among those patients [13,14].

Hospitalized patients were interviewed the first day of admission about their nutritional status, and nutritional risk scoring was performed according to the NRS-2002 criteria. Nutritional risk was scored from 0 to 3; disease severity was scored from 0 to 3, and an extra score of 1 was added to hospitalizations older than 70 years. The nutritional risk score is determined due to three different parameters 1) quartile decreased of estimated oral food intake requirements, 2) presence of weight loss more than 5% within the previous 1–3 months and 3) low body mass index. The severity of disease was categorized as none, slight, moderate and severe with the score of 0–3, respectively. The scores were added and hospitalizations with a NRS-2002 score ≥3 were considered as nutritionally 'at-risk'.

2.3. Costs and reimbursements

Actual total and specific costs (i.e. related to treatments, medical interventions, imaging, laboratory analyses, food, intensive care units …) were collected from the hospital accounting system. Costs were expressed in Swiss Francs (CHF); 1 CHF = 1.021 US$ or 0.919 € (www.xe.com, assessed 29th of June, 2016). Specific costs were expressed as percentage of the total costs. Only specific costs whose median represented at least 1% of total costs were considered; hence, costs related to anesthesia (median = 0); pathology (median = 0); dialysis/transplantation (median = 0) and medications (median = 0.6) were not considered. Of note, the costs related to food include neither oral nutritional supplements (ONS), nor enteral or parenteral nutrition, and costs related to ONS could not be identified from the files.

Reimbursements were computed according to the Swiss DRG [9]. We considered 1 DRG point = 10,500 CHF (average value for 2014). For each patient, the difference between costs and reimbursements was also computed. Total costs and reimbursements were used either as continuous variables or categorized into lower/higher than the 75th percentile or lower/higher than the 90th percentile. Coverage of the costs was computed as the ratio of costs/reimbursements and expressed as percentage, or categorized as complete (≥100%) or less than complete (<100%).

2.4. Other variables

Socio-demographic data included age, sex and origin (i.e. coming from home or other health care facilities). Medical data included International classification of diseases, version 10 (ICD-10) codes for the main cause of hospitalization and comorbidities (up to 26), and vital status at discharge (alive or dead). Main cause of hospitalization was categorized into infectious, oncologic, endocrine, neuro-psychiatric, cardiologic, pulmonary, digestive, bone and joint, urologic, and other. The Charlson Index was computed from ICD-10 codes according to an algorithm defined for Switzerland [15]. Total hospital length of stay (in internal medicine and other departments) was collected. Data for the medical provision categories (*groupe de prestations* or GPC), a system assessing the main type of medical treatment (i.e. intensive care, respiratory system, pain management, infection …) was also collected.

2.5. Exclusion criteria

Hospitalizations were excluded if there was a lack of information on NRS-2002, costs, sex, age, origin, main diagnosis, or Charlson Index; moreover, patients with main diagnosis of obstetric and/or gynecological disease were also excluded as they usually managed in other departments of the hospital.

2.6. Statistical analysis

Statistical analyses were performed using Stata version 14.1 for windows (Stata Corp, College Station, Texas, USA). Descriptive results were expressed as number of participants (percentage) or as average ± standard deviation. Bivariate analyses were performed using chi-square for categorical variables and Student's t-test or Kruskal–Wallis test for continuous variables. Associations between variables were assessed using Spearman rank correlation. For continuous variables, multivariate analysis was performed using analysis of variance and results were expressed as multivariate-adjusted mean ± standard error. Due to the skewness of the distribution of costs leading to large confidence intervals of the estimates, an analysis based on quantiles of costs was performed to confirm the findings. For dichotomous variables, multivariate analysis was performed using logistic regression and the results were expressed as odds ratio (OR) and 95% confidence interval (CI). Sensitivity analyses were carried out after excluding hospitalizations with extreme costs (>100,000 CHF, N = 39) or related to intensive care (N = 85) as the latter are associated with high costs for specific categories (i.e. emergency, medical interventions). Statistical significance was considered for a two-sided test with $p < 0.05$.

Please cite this article in press as: Marques-Vidal P, et al., Undernutrition is associated with increased financial losses in hospitals, Clinical Nutrition (2017), http://dx.doi.org/10.1016/j.clnu.2017.02.012