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ORIGINAL ARTICLE

Nutritional assessment and management in hospitalised patients: Implication for DRG-based reimbursement and health care quality

J. Ockenga*, M. Freudenreich, R. Zakonsky, K. Norman, M. Pirlich, H. Lochs

Department of Gastroenterology, Hepatology & Endocrinology, Charité, Universitätsmedizin Berlin, Schumannstrasse 20/21, 10117 Berlin, Germany

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Summary
Introduction: Malnutrition is associated with a higher morbidity resulting in an increased need for medical resources and economic expenses. In order to ensure sufficient nutritional care it is mandatory to identify the effect of malnutrition and nutritional care on direct cost and reimbursement. The primary aim of this study was to evaluate the economic effect of a nutritional screening procedure on the identification and coding of malnutrition in the G-DRG system.
Methods: All G-DRG relevant parameters of 541 consecutive patients at a gastroenterology ward were documented. Moreover, all patients were screened for malnutrition by a dietician according to the subjective global assessment (SGA). Patients were then grouped into the appropriate G-DRG and the effective cost weight (CW) was calculated.
Results: Ninety-two of 541 patients (19%) were classified malnourished (SGA B or C). Recognition of malnutrition increase from 4% to 19%. Malnourished patients exhibited a significantly increased length of hospital stay (7.7 ± 7 to 11 ± 9, $P < 0.0001$). In 26/98 (27%) patients, the coding of malnutrition was considered relevant by grouping and resulted in a rise of DRG benefit. Mean case mix value and patients' complexity and comorbidity level (PCCL) increased after including malnutrition in the codification (CV 1.53 ± 2.9 to 1.65 ± 2.9, $P = 0.001$ and PCCL 2.69 ± 1.4 to 3.47 ± 0.82, $P < 0.0001$). The reimbursement increase by 360 €/malnourished patient or an additional reimbursement of 35280 € (8.3% of the total reimbursement for all patients of 423186 €).

Nutritional support in a subgroup of 50 randomly selected patients resulted in additional costs of 10268 €. Forty-four of these patients (86%) were classified

*Corresponding author. Tel.: +49 0 30 450 514 034; fax: +49 0 30 450 514 916.
E-mail address: johann.ockenga@charite.de (J. Ockenga).

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malnourished (32 SGA B and 12 SGA C). However, the subsequent reimbursement covered only approximately 75% of the expenses (7869 €), but did not include the potential financial benefits resulting from clinical interventions.
Conclusion: Malnourished patients can be detected with a structured assessment and documentation of nutritional status and this is partly reflected in the G-DRG/ICD 10 system. In addition to increasing direct health care reimbursement, nutritional screening and intervention has the potential to improve health care quality.

Introduction

Several studies have reported an association between malnutrition and an increased risk of subsequent in-hospital morbidity and mortality.[1–3] In a recent study at our institution up to 20% of gastroenterological patients were classified malnourished according to the subjective global assessment (SGA).[4] In this context malnutrition refers to undernutrition. Despite its high prevalence, malnutrition is often not recognised and not treated due to the lack of nutritional screening programs.[5] Malnutrition results in higher hospital costs as a result of requiring a higher intensive of care or services, as well as longer length of stay.[6–10] In addition, malnutrition increases health-care cost directly and indirectly and there is strong evidence that treating malnutrition is economically beneficial.[11]

In order to introduce nutritional screening followed by adequate nutritional intervention in clinical routine it seems useful to define the economic impact of this procedure. In almost all European countries Diagnosis-related Groups (DRG) have been introduced for calculating reimbursement (Scandinavia, Portugal, Spain, Italy) or planning of health care budgets (France, Great Britain, Ireland). In Germany, a version of the DRG system designed specifically for the German Health care system (G-DRG) was recently introduced for the calculation of hospital care reimbursement (for further information see: www.g-drg.de). In accordance with the previously introduced DRG systems in other countries like Australia or the United States , malnutrition is considered a comorbidity or a complicating condition in the G-DRG system. It can be coded, if it causes additional therapeutic, diagnostic or care efforts. The documentation of malnutrition has the potential to increase the case weight and, therefore, the reimbursement. Similar effects have been described more than 10 years ago after the introduction of the Australian national diagnosis-related group (AN-DRG) classification system [12] as well as after the introduction of the DRG system in the United states.[13] However, due to differences in the health care systems these data are not transferable to the European situation. Up to now no current data are available about the detailed impact of the reflection of malnutrition in the G-DRG system and the consecutive effect on the financial reimbursement for hospitals. Because the impact of malnutrition on reimbursement is not a German specific problem, these data are of interest for all those, who handle with DRGs.

This study was set out to evaluate the economic effect of a nutritional screening procedure on the identification and coding of malnutrition in medical patients (gastroenterology) in the G-DRG system.

Methods

Patients

Five hundred and forty-one patients consecutively admitted to a 30 bed gastroenterological ward were included between January 2004 and December 2004 at the University Hospital Charité, Campus Mitte, Berlin, FRG. Patients were considered eligible for entry if they were over the age of 18, were assumed to stay longer than 2 days, and were willing and able to give written informed consent. Patients admitted to day care units were excluded. The study protocol was approved by the Ethics Committee of the Charité.

SGA

Several score systems have been validated for the assessment of nutritional status. In the current study we used the SGA, which was established by Norman et al. [14] and relies primarily on physical signs of malnutrition (loss of subcutaneous fat or muscle mass, oedema, ascites) and the patient's history regarding weight loss, dietary intake, gastrointestinal symptoms, functional capacity, and the disease and its relation to nutritional requirements. Each patient was classified as either well nourished (SGA A), moderately or suspected of being malnourished (SGA B) and severely

malnourished (SGA C). The SGA requires only a few minutes by a trained clinician. Its validity to indicate malnutrition-associated risks of poor outcome has been proven in a number of studies.[4,14]

Two dieticians (R.Z. and M.F) were trained by the principle investigator (J.O.) in performing the nutritional assessment. The nutritional state of the patients was assessed within 48 h after admission. Patients admitted during the weekend were assessed on the following Monday.

Body height was measured without shoes to the nearest 0.5 cm with a stadiometer. Weight was measured using calibrated Seca chair scales and compared with the body weight 6 months prior to admission to calculate weight loss. Data were recorded on a special sheet and deposited in the patients' medical record.

The mean daily time for nutritional assessment and documentation was approximately 45–60 min and was part of a nutritional support program. Patients with malnutrition were scheduled for further nutritional therapy according to the clinical situation, as described before.[1] Briefly, this includes a stepwise intervention program with nutritional counselling, energy and protein-rich oral supplements, or artificial feeding (enteral tube feeding, parenteral feeding).

Coding procedure

Diagnosis and procedures were classified on the basis of the German version of the ICD-10-GM-V.2004 and OPS-301 V2004 . Patients with SGA B or C were classified as having the comorbidity malnutrition (ICD-10: E46, R63). Those patients with the primary diagnosis of cancer and malnutrition received the comorbidity: cachexia (ICD-10: R64). Using a coding and grouping software (DIACOS Client, Version 2, Berlin, ID-GmbH, FRG) the medical records of all patients were then coded according to the diagnosis and procedures. With this information patients were then grouped into the appropriate G-DRG, in addition to patients' complexity and comorbidity level (PCCL). After considering length of stay the effective cost weight (CW) was calculated. In those patients with malnutrition as comorbidity this procedure was repeated without considering malnutrition and again the appropriate G-DRG$_{-malnut}$, PCCL$_{-malnut}$, and CW$_{-malnut}$ were calculated.

Assuming an average base rate of 3000 €, the reimbursement with and without coding of malnutrition were calculated by multiplying the CW and CW$_{-malnut}$ by 3000 €. The case mix index (CMI) was calculated by dividing the total cost weight by the number of patients.

To compare the number of patients with the coded comorbidity malnutrition (ICD 10: E46, R63, R64), the prospective generated data from 2004 were compared to retrospective data of 2003 extracted from the hospital database.

Nutrition-related direct costs

To analyse the direct costs associated with nutritional support we investigated a randomised subgroup of 50 patients receiving nutritional intervention in detail. In these patients the efforts for nutritional care were recorded over the time of hospitalization and recorded at a standard sheet using the following classification: dietary counselling (45 min), short counselling (15 min), special diet, oral supplements, enteral tube feeding, and parenteral feeding. The daily costs for the specific nutritional interventions were calculated according to a published German database[15] and are given in Table 3.

Statistics

Data are presented as mean ± standard deviation unless indicated otherwise. The χ^2 or the Fisher's exact test were used for discrete variables. The Student's *t*-test or Mann–Whitney's rank-sum test was used for unpaired data as indicated. *P*-values below 0.05 were considered statistically significant. The data were analysed using SPSS/PC+ V12.0 software (SPSS, Chicago, USA).

Results

Basic characteristics

The basic characteristics of the study population are given in Table 1. According to the subspecialty of the department most patients presented with gastroenterological diagnosis (Table 2). Ninety-two patients (19% of the eligible population) were classified malnourished (SGA B and C), of which 14 (3%) were severely malnourished (SGA C). No difference was seen in the distribution of age and gender with regard to the presence or absence of malnutrition. However, malnourished patients showed a significantly increased length of hospital stay (Table 1).

Effect on cost weight and reimbursement

After introducing the screening program the percentage of patients coded as malnourished

Table 1 Basic characteristics of the study population according to the presence of malnutrition.

	Without malnutrition	With malnutrition	*P*-value
N	449	92	
Age (years)	59±18	56±17	n.s.
Sex (f/m)	201/248	39/53	n.s.
BMI (kg/m^2)	27±6.7	22±4.7	< 0.001
LOS* (days)	7±7	11±9	<0.00001

*LOS, length of stay.

Table 2 The most frequently diagnosis-related groups* in which the comorbidity malnutrition has an effect on cost weight.

G-DRG code*(a)initial b)with malnutrition	G-DRG description	Cost weight	mhREP†
(a) G47C	Other gastroscopy without severe comorbidity	0.788	8.1
(b) G47B	Other gastroscopy with severe comorbidity	1.07	10.9
(a) G47B	Other gastroscopy with severe comorbidity	1.07	10.9
(b) G47A	Other gastroscopy with especially severe comorbitiy	1.453	13.5
(a) G48B	Coloscopy with severe comorbidity	0.555	8.1
(b) G48A	Coloscopy with especially severe comorbitiy	0.891	9.4
(a) G50B	Gastroscopy in case of non-severe illness without comorbidity	0.532	5.3
(b) G50A	Gastroscopy in case of non-severe illness with comorbidity	0.885	9.1
(a) H41B	Complex therapeutic ERCP with severe comorbitiy	1.057	9.3
(b) H41A	Complex therapeutic ERCP with especially severe comorbitiy	1.427	11.5

*G-DRG, German diagnosis-related groups.
†mhREP, mean hospital retention period according to the DRG classification.

increased from 4% (23/470 patients) in 2003 to 19% (92/541) patients in 2004 (Fig. 1). In 26/98 malnourished patients (27%) the inclusion of a malnutrition code resulted in a change of the G-DRG and hence a favourable reimbursement difference. In the remaining 73% of the malnourished patients the comorbidity malnutrition made no difference because these patients had already other complex comorbidities. Coding malnutrition did not change the general G-DRG, but increased the case severity of the G-DRG by increasing the patients PCCL levels (PCCL: 2,69±1.4 vs. $PCCL_{-malnut}$: 3.47±0.82, $P<0.0001$).

In the malnourished patient group the case mix index without coding malnutrition was 1.53±2.9 and the corresponding mean reimbursement 4599±8751. Although relevant only in 27%, the introducing of the comorbidity malnutrition increased the case mix index of the malnourished group to 1.65±2.9 and the reimbursement to 4956±8703. This indicates a mean difference of the cost weight of +0.12/malnourished patient, which means an additional reimbursement of 360 €/malnourished patient or an additional annually reimbursement of 35280 € (8.3% of the total reimbursement for all malnourished patients of 423186 €).

Nutritional related cost

Nutritional support in the 50 randomised selected patients resulted in additional costs of 10268 € (Table 3). In 44/50 (86%) the diagnosis of malnutrition (32 SGA B and 12 SGA C) was coded. In 11of the 44 patients (25%) this resulted in a favourable change of the CW and increased reimbursement of 7869 €. In the 6 patients with SGA A ($n = 6$)

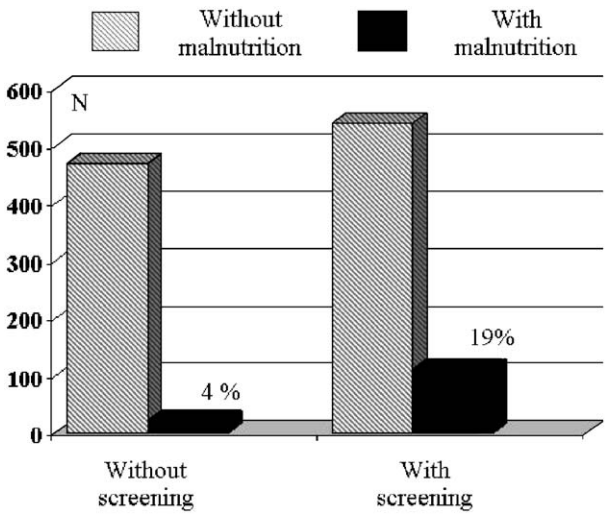

Figure 1 Effect of a nutritional screening and documentation program on the number of coding the comorbidity malnutrition. The left bars represent a 6 months period before introducing a screening program, whereas the right bars represent the number with a screening program.

nutritional support was started because of a longer period (>5 days) of insufficient caloric intake, but this could not be coded due to the missing OPS code in the German system.

Discussion

Our present data confirm previous data on a high prevalence of malnutrition (21%) in German and Swiss gastroenterological patients.[4,17] Coding of malnutrition according to the ICD-10-GM in the G-DRG system is capable to increase total reimbursement by 8.3%. However, a subgroup analysis indicates, that the direct cost for nutritional interventions were not fully covered by additional coding of malnutrition.

Malnourished patients had a longer LOS than non-malnourished patients, indicating a higher need for resources. This is in accordance with several studies showing an independently negative effect of malnutrition on outcome.[18] Malnutrition results in higher hospital costs as a result of requiring a higher intensity of care or services, as well as longer length of stay.[6–11,19]

Despite a high prevalence of malnutrition among hospitalised patients, recognition, treatment and documentation of malnutrition is often poor. This is the first study to evaluate the effect of recognition and coding of malnutrition in the G-DRG system. Our nutritional screening program increases the detection and improves medical documentation from 4% to 19%, which is in line with previous published data.[4,17] The coding of malnutrition resulted in an overall increased reimbursement of 360 €/malnourished patient or an additional reimbursement of 35280 € during the 6 months study period (8.3% of the total reimbursement for all screened patients of 423186 €). The additional coding of malnutrition was DRG relevant in only 27% of patients, which is related to the fact, that in patients with already complex comorbidities the single effect of malnutrition made little or no difference in case severity and therefore, in reimbursement. This effect has been described before in the Australian national diagnosis related group (AN-DRG) classification system[12] as well as in DRG system in the United states.[13] Therefore, the effect of coding malnutrition may differ between patient groups and this may explain the different financial benefit observed.[13,20,21] A further effect of coding of malnutrition is an increased mean expected hospital retention period (mhREP). It seems to be noteworthy to mention, that a direct comparison between data from Australia or the United States are difficult, due to major differences in the health care systems.

In almost all European countries DRG have been introduced in the health care system to certain extend. In Scandinavia, Portugal, Spain, and Italy DRGs are used for calculating the reimbursement; whereas in France, Great Britain and Ireland DRGs are used for planning of the health care budgets. Therefore, the adequate implementation of malnutrition as a significant comorbidity, as well as nutritional support as a procedure in the DRG systems is not only relevant for the German health care system.

From the economic point of view it is mandatory not only to look on the changes in reimbursement, but also to investigate the additional costs of nutritional interventions. Indeed, our data indicate that the direct cost of subsequently introduced nutritional interventions are only covered by ~75% by the additional funding according to coding in the G-DRG system (Table 3). However, we did not evaluate the indirect beneficial effect of nutritional intervention (i.e. reduced nosocomial infection rate, improved wound healing, reduced length of hospital stay) and the related economic impact. Recent studies have shown a cost effectiveness of nutritional management in several patients groups.[22–28] Based on a retrospective analysis of nine randomised controlled trials, a conservative calculation on the cost saving by oral nutritional support in hospital estimates a minimum potential of 5–6% of total cost.[29] Further large pragmatic studies have to follow to evaluate the direct and

Table 3 Direct cost for nutritional support in a randomised subgroup of 50 patients scheduled for nutritional intervention.

Intervention	Cost* (€)	Number	Cumulative costs
Short counselling	6	116	696
Counselling	22	20	440
Special diet	10	174	1740
Oral supplements	2	309	618
Enteral tube feeding†	33	84	2772
Total parenteral feeding†	69	58	4002
Total costs			10,268
Additional reimbursement by coding malnutrition			7869

*For details see Method Section.
†Days of enteral or parenteral feeding.

indirect cost effects of nutritional intervention (e.g. according to changes in morbidity, length of stay, etc.).[30]

Regardless of the implications for reimbursement our study has implications for the development of standards of practice for cost effective nutritional care. The management of health care resources does not necessarily mean that one should spend less, but that the resources should be used in a more efficient manner. Looking for the optimal nutritional care is based on the binomial of quality and cost.[11] There is a high correlation between malnutrition and disease complications.[18] As mentioned above, a beneficial effect of nutritional screening and intervention programs on clinical outcome parameters in medical, geriatric, gastroenterological, intensive care, and pre- and postoperative patients have been shown.[22–28] In addition, these studies have shown, that nutritional intervention does not only improve the operating medical quality, but nutritional intervention has been shown to be cost effective, too. This evidence supports the implementation of a structured process for identification, documentation, and appropriate treatment for malnutrition as done in our study and outlined in Fig. 2. The development of this process is further supported by: (i) the development of the ESPEN guideline on screening for malnutrition[16]; (ii) the ESPEN guideline for enteral nutrition (www.espen.org); (iii) the implementation of nutritional screening as a mandatory criteria for health care quality by the Joint Commission on Accreditation of Health care Organizations (http://www.jcaho.org/).

In the present study screening was performed by dieticians using the SGA. Several nutritional screening tools have been validated in the past, including

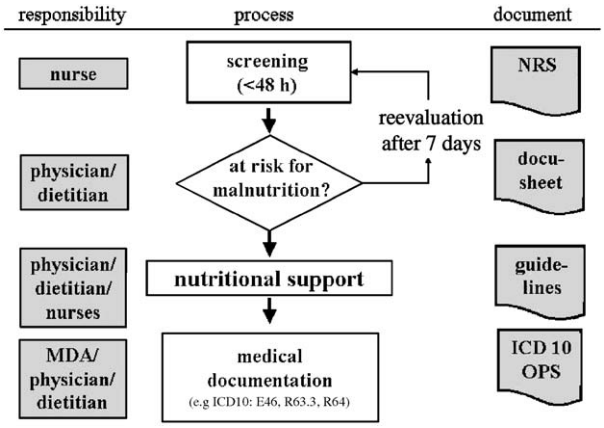

Figure 2 Proposed pathway to a rational process of screening and documentation of malnutrition in hospitalised patients: NRS, nutritional risk score according[16]; MDA, medical documentation assistance; ICD, international classification of disease; OPS, operating procedure system.

the Nutritional Risk Score (NRS), which has been published by Kondrup et al. and accreted by the European Society of Parenteral and Enteral Nutrition (ESPEN).[16] In addition, the initial screening may be done by nurses and in patients with a nutritional risk, an individual nutritional treatment plan should be implemented in the overall treatment. This step of the process should be done by dieticians and/or physicians. The last step, the documentation and coding in the DRG system is not only important for actual reimbursement. The general documentation of the prevalence and impact of malnutrition in the nationwide G-DRG database is necessary to maintain and improve the role of nutrition in clinical practice (see Fig. 2).

Malnutrition is a frequent feature in gastroenterological patients. The introduction of a nutrition screening program increases its documentation leading to a substantial increase in G-DRG-based reimbursement. In addition a structured process of nutritional screening and intervention increases the awareness of nutritional therapy as a comprehensive part of treatment modality in our patients, resulting in improvement of health care quality.

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