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Simple training tool is insufficient for appropriate diagnosis and treatment of malnutrition: A pre-post intervention study in a tertiary center

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ABSTRACT

Objectives: To improve malnutrition awareness and management in our department of general internal medicine; to assess patients' nutritional risk; and to evaluate whether an online educational program leads to an increase in basic knowledge and more frequent nutritional therapies.
Methods: A prospective pre-post intervention study at a university department of general internal medicine was conducted. Nutritional screening using Nutritional Risk Score 2002 (NRS 2002) was performed, and prescriptions of nutritional therapies were assessed. The intervention included an online learning program and a pocket card for all residents, who had to fill in a multiple-choice questions (MCQ) test about basic nutritional knowledge before and after the intervention.
Results: A total of 342 patients were included in the preintervention phase, and 300 were in the postintervention phase. In the preintervention phase, 54.1% were at nutritional risk (NRS 2002 $\geq$3) compared with 61.7% in the postintervention phase. There was no increase in the prescription of nutritional therapies (18.7% versus 17.0%). Forty-nine and 41 residents (response rate 58% and 48%) filled in the MCQ test before and after the intervention, respectively. The mean percentage of correct answers was 55.6% and 59.43%, respectively (which was not significant). Fifty of 84 residents completed the online program. The residents who participated in the whole program scored higher on the second MCQ test (63% versus 55% correct answers, $P = 0.031$).
Conclusions: Despite a high ratio of malnourished patients, the nutritional intervention, as assessed by nutritional prescriptions, is insufficient. However, the simple educational program via Internet and usage of NRS 2002 pocket cards did not improve either malnutrition awareness or nutritional treatment. More sophisticated educational systems to fight malnutrition are necessary.

Introduction

Disease-related malnutrition (DRM) is defined by the European Society of Clinical Nutrition and Metabolism (ESPEN) as a condition that results from a lack of uptake or intake of energy and nutrients, which leads to an altered body composition with diminished function and a negative clinical outcome [1]. Many studies have been performed in hospitals and have found a high prevalence of DRM [2–4]. A multicenter survey conducted between 2003 and 2006, which included 32,837 newly admitted internal medicine patients of non-university Swiss hospitals, indicated that 18.2% of the inpatients were either malnourished or at severe nutritional risk [5].

DRM among hospital patients is a serious problem [6]. DRM negatively influences the immune system and muscle strength and is an independent risk factor for increased complication rates (mainly infections) and extended length of hospital stay, which results in a lower quality of life and higher healthcare costs [7,8]. DRM is a largely treatable co-morbidity, which makes rapid and simple identification as well as effective management essential. If nutritional risk is recognized early,

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then many patients with DRM can be treated uneventfully or even the disease can be prevented [9–11]. The ESPEN guidelines for good clinical nutrition management implied the screening of patients on admission, examination of malnourished patients, and implementation of nutritional support [12].

According to a Swiss study, patients with a Nutritional Risk Score 2002 (NRS 2002) of ≥3 should receive nutritional therapy that consists of oral nutritional support (dietary fortification, snacks, and oral nutritional supplements) or artificial nutrition (enteral or parenteral nutrition) [5,13].

Over the past decade, many surveys have evaluated the knowledge about the management of DRM among hospital physicians of different specialties. All of the surveys concluded that the knowledge concerning DRM management among physicians was poor, and consequently nutritional practice was insufficient; this circumstance results in a high prevalence of undetected DRM within hospitals [14–16]. Physicians and also medical students need more education and training in nutritional assessment and intervention [17].

To date, no study has sequentially tested the potential improvement of physicians' nutritional management knowledge and consequently increased the treatment of DRM after an online educational program. The specific aims of this prospective pre-post intervention study were to assess whether such a targeted educational intervention (online learning program) leads to an increase in basic knowledge in clinical nutrition and behavioral changes toward better malnutrition management and therefore to more frequent adequate nutritional therapies (measured by an aimed 10% more prescriptions).

Materials and methods

Study design

We conducted a prospective pre-post intervention study with a follow-up period. The study was conducted at the University Hospital of Bern from April 1, 2013, to July 31, 2014. The study was performed on three wards of the Department of General Internal Medicine (GIM). The study flow diagram and duration are illustrated in Figure 1.

Residents and patient selection

All of the residents (n = 84 [100%]) working at the GIM department were included in the study. The majority (42.9% in the first questionnaire and 53.7%

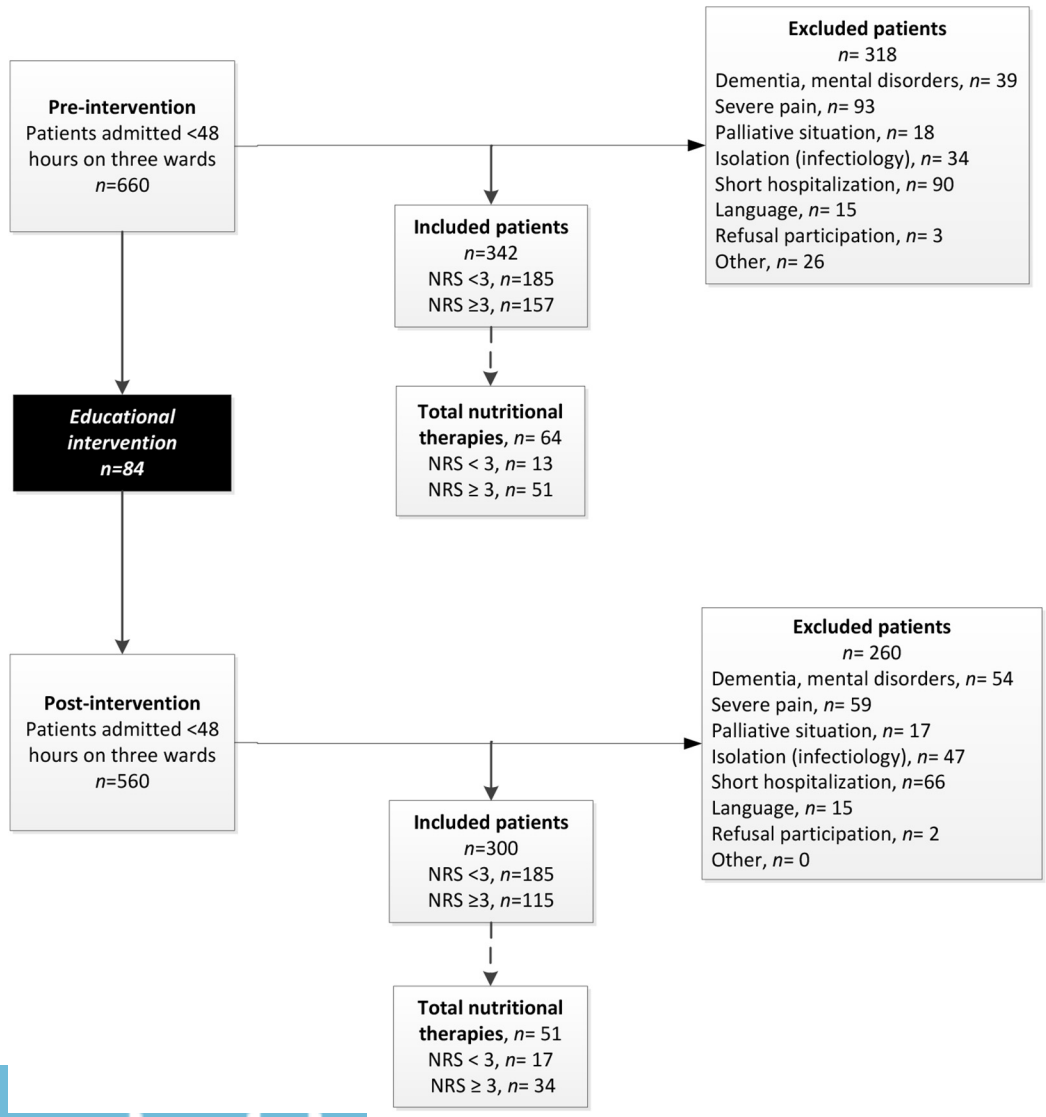

Fig. 1. Study flow chart. NRS, Nutritional Risk Score 2002.

in the second questionnaire) were third- or fourth-year residents. Only a few were more experienced (6.1% and 7.3% with more than six years' experience) or first- and second-year residents (16.3% and 19.5%). To prevent losing participating residents because of the high changing and rotating number at the GIM department, all of the new residents entering during the study phase were included in the study, and all of the departing residents had to finish the intervention program. The participation of the residents was voluntary, and their data were encoded in such a way that the participants could not be identified from the documents presented. Demographic and professional characteristics of the physicians were collected.

Newly admitted (<48 h) adult patients (>18 y old) on the three wards were selected to participate in this study. The principal investigator (C.A.), a pharmacy PhD student, evaluated and included the patients in the study if the inclusion criteria were met. In the pre- and postintervention phase, an identical patient recruitment process was conducted, always by C.A. The exclusion criteria were as follows: a palliative situation and/or life expectancy less than 30 d; foreign language (except German, French, Italian, and English); isolated patients for infection reasons, uncontrolled pain, or reduced level of consciousness; patients with dementia or mental disorders; and patients who refused or were not able to sign the informed consent. Participation was voluntary. The participants could not be identified from the collected material, and no plausible harm to the participating individuals was identified.

Data collection

The included patients were screened with NRS 2002 by C A. [12,18]. The international validated screening tool NRS 2002 is a fast and simple screening method that is based on four variables—weight loss, body mass index (BMI), general condition, and amount of food intake in the preceding week—in addition to the patient's age and the severity of the underlying disease. The total score was calculated from the impaired nutritional status section (score 0 to 3), the score for the severity of the disease (an indicator of stress metabolism and increased nutritional requirements; score 0 to 3), and age adjustment (score + 1 for >70 y), and the total score ranged from 0 to 7. Patients are classified as being malnourished (score ≥3) or not (score <3), according to the total score obtained [18]. The length of stay and nutritional prescriptions were collected from the electronic medical records.

Preintervention phase and online multiple-choice questions test

The patients' data were collected on the GIM wards without the residents knowing about the conducted study. In a further step, the baseline knowledge of the residents on the nutritional management was tested using an online multiple-choice questions (MCQ) test, which was created by three experienced physicians and specialists in clinical nutrition and sent to all residents of the GIM department by internal hospital e-mail. The test contained 16 multiple-choice questions about the basics of clinical nutrition, nutritional management, recognition of malnutrition, NRS 2002 scoring, and nutritional therapies. Additionally, in a closed question, the residents were asked about their attitude/barriers toward nutritional therapy ("Why do physicians pay little attention to nutritional issues?").

Educational intervention phase

The online educational program (easyLEARN) was based on the MCQ test (the same topics in the MCQ test as in the online program) and contained basic details about (clinical) nutrition; a detailed definition of DRM; its prevalence, causes, and consequences; screening tool (NRS 2002); and treatment and management of patients at nutritional risk. Information and online access to easyLEARN were provided by internal e-mail to all of the residents (duration of the program: 20 to 30 min). The educational objectives included identification of the causes and consequences of malnutrition, the use of a nutritional screening tool for identification of malnourished patients, options and implementation of an adequate nutritional therapy, and the correct monitoring. There were no interactive case studies. The easyLEARN program was developed by the authors in collaboration with the Institute of Medical Education of the University of Bern. Furthermore, a pocket card that contained the NRS 2002 and nutritional therapy options was created and handed out to all of the residents.

Postintervention phase

Two months after the intervention (education), a new evaluation of the patient data was performed in the postintervention phase using the same method as in the preintervention phase. Additionally, the residents were asked to participate in the online MCQ test again, using the same questions as in the preintervention period.

Statistical analysis

All statistical analysis was performed with the software IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp., released 2012). Some of the data were assessed using descriptive statistics only. Pearson two-sided chi-square test and paired *t* test were conducted, and *P* values <0.05 were considered to be statistically significant.

Ethics approval

This study was conducted in accordance with the ethics guidelines of the 1957 Declaration of Helsinki. Ethics approval for the study was obtained from the local ethics committee (Ethic Board Canton of Bern: Kantonale Ethikkommission Bern KEK Study No. 029/13). The participants provided written informed consent; the standard form of which was available on the file for each.

Results

Patient characteristics

When comparing the patients in the pre- and postintervention phase, no significant differences were found in the patients' characteristics (Table 1). On average, patients who were at nutritional risk were significantly older, with a mean age ± SD of 70.5 ± 15.65 y compared with patients without risk, with a mean age ± SD of 63.9 ± 16.52 y. Overall, the patients with NRS 2002 ≥3 stayed longer at the hospital, by 8.9 ± 6.07 d (range 0–36), compared with patients with NRS 2002 <3, by 7.0 ± 5.79 d (range 0–61). The mean BMI of the patients at risk was 23.5 ± 5.67 kg/m^2 (range 10.62–48.79, n = 262), whereas patients with NRS 2002 <3 had an average BMI of 28.0 ± 5.45 kg/m^2 (range 18.25–57.8,

Table 1
Comparison of characteristics between patient groups (pre- and postintervention)

Characteristic	Preintervention	Postintervention	*P*
Total, n (%)	342 (100)	300 (100)	
Sex, n (%)			0.625
Male	206 (60.23)	175 (58.33)	
Female	136 (39.77)	125 (41.67)	
Age (years; mean ± SD)	66.45 ± 16.91	66.92 ± 15.97	0.717
Age groups, n (%)			0.668
<45	39 (11.40)	29 (9.66)	
45 to 64	102 (29.82)	83 (27.67)	
65 to 84	157 (45.91)	152 (50.67)	
≥85	44 (12.87)	36 (12.00)	
BMI (kg/m^2; mean ± SD)	26.49 ± 6.64*	25.66 ± 5.07†	0.079
BMI groups, n (%)			0.053
<18.5	29 (8.68)*	21 (7.12)†	
18.5 to 24.9	116 (34.73)	121 (41.02)	
25 to 29.9	111 (33.23)	104 (35.25)	
≥30	78 (23.35)	49 (16.61)	
NRS 2002 (mean ± SD)	2.51 ± 1.36	2.41 ± 1.23	0.339
NRS 2002 groups, n (%)			0.053
NRS 2002 <3	185 (45.91)	185 (38.33)	
NRS 2002 ≥3	157 (54.09)	115 (61.67)	
Length of stay (days; mean ± SD)	7.78 ± 6.39	7.86 ± 5.49	0.478
Length of stay groups, n (%)			0.224
0 to <5	115 (34.80)	83 (27.76)‡	
5 to <10	136 (39.77)	136 (45.48)	
10 to <15	48 (14.06)	50 (16.72)	
15 to <20	21 (6.14)	13 (4.35)	
20 to <25	8 (2.34)	11 (3.68)	
≥25	10 (2.92)	6 (2.01)	
Reduced nutritional intake, n (%)	130 (38.01)	98 (32.67)	0.059
Weight loss, n (%)	132 (43.42)*	102 (35.79)†	0.158

BMI, body mass index; NRS 2002, Nutritional Risk Score 2002
Pearson chi-square 2-sided test
* n = 304.
† n = 285.
‡ n = 299.

n = 367). The percentage of the patients at nutritional risk (NRS 2002 ≥3) with overweight was 8.6% and obesity 4.9%, versus 25.6% overweight and 15.3% obesity in patients with NRS 2002 <3. Remarkably, looking at patients with nutritional risk only, one-third were overweight (20.6%) or obese (11.8%).

Nutritional therapy

Three-hundred forty-two patients were included in the preintervention phase and 300 in the postintervention phase (n = 642 [100%]). In the preintervention phase, 54.1% (n = 157) were at nutritional risk (NRS 2002 ≥3) versus 61.7% (n = 115) in the postintervention phase (χ^2[1, n = 642] = 3.75, P = 0.053). A nutritional intervention was performed on 18.7% (n = 64) in the preintervention phase and 17.0% (n = 51) in the postintervention phase. Figure 2 shows the prescribed nutritional therapies in both phases. No significant difference regarding the number of nutritional prescriptions between the pre- and postintervention phases (χ^2[1, n = 642] = 0.319, P = 0.572) was observed; thus, the goal of 10% more prescriptions was not reached. Focusing on the NRS 2002, 32.5% with NRS 2002 ≥3 had a nutritional intervention in the preintervention phase and 29.6% in the postintervention phase (χ^2[1, n = 272] = 0.263, P = 0.691). Furthermore, 7% with NRS 2002 <3 received a nutritional therapy in the preintervention phase and 9.2% in the postintervention phase (χ^2[1, n = 370] = 0.580, P = 0.568).

Intervention and knowledge test

The first MCQ test was completed by 49 of the 84 residents (response rate 58%). The mean percentage of correct answers was 55.6 ± 9.38 (min, 35.7%; max, 78.6%). Additionally, the residents were asked, "Why do physicians pay little attention to nutritional issues?" The two most frequently mentioned barriers were that the manifest malnutrition of the individual patient was not noticed and that there was insufficient knowledge about malnutrition in general (see Fig. 3). In the intervention phase, 50 residents (response rate 60%) completed the easyLEARN program. Forty-one residents filled in the postintervention MCQ test (response rate 48%). The mean percentage of correct answers was 59.4 ± 16.35 (min, 42.9%; max, 73.6%). There was no significant difference in the percentage of correct answers between the pre- and postintervention MCQ test (χ^2[323, n = 42] = 326.04, P = 0.442). Only 26 residents completed the total intervention procedure (first MCQ test, easyLEARN program, and second MCQ test; response rate 31%) (see Fig. 4). These participants demonstrated improved results in the postintervention MCQ test compared with the preintervention MCQ test (mean percentage of correct answers 63.0 ± 10.43 versus 55.3 ± 9.39) (t [23] = −2.30, P = 0.031).

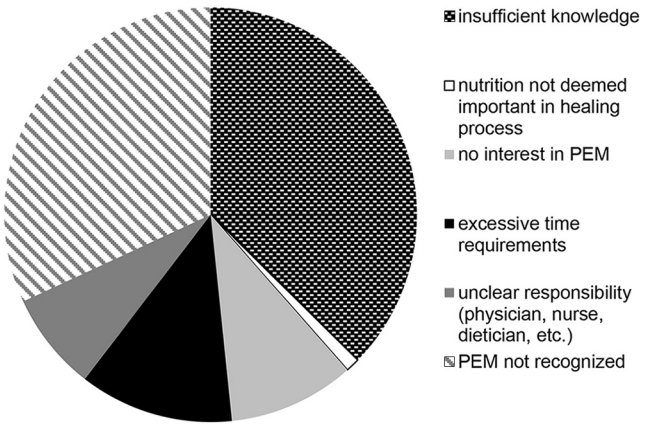

Fig. 3. Question of the multiple-choice questions (MCQ) test: "Why do physicians pay little attention to nutritional issues?" PEM, protein-energy-malnutrition.

Discussion

This prospective pre-post intervention study aimed to assess patients' nutritional risks and whether an online learning

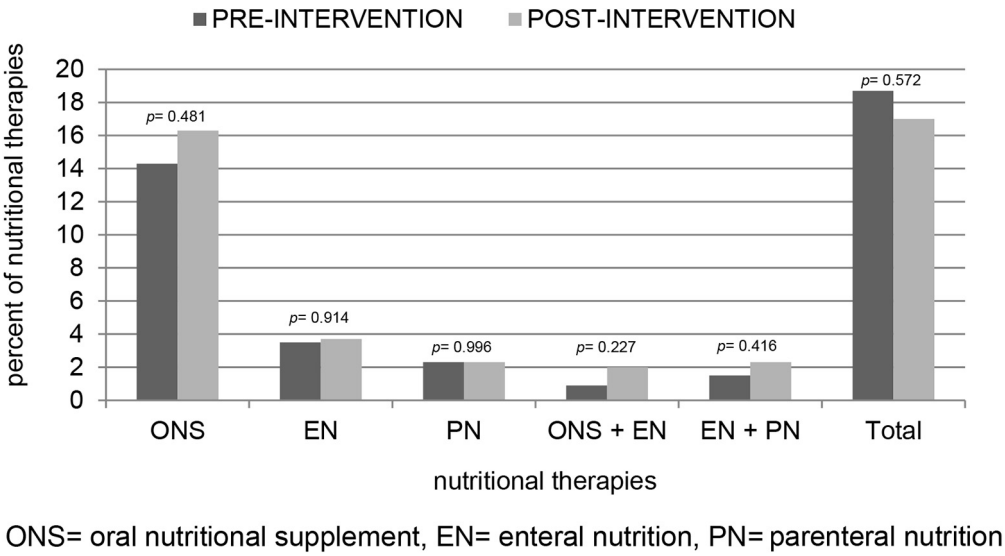

Fig. 2. Comparison of nutritional therapies given to patient groups (pre- and postintervention). EN, enteral nutrition; ONS, oral nutritional supplement; PN, parenteral nutrition.

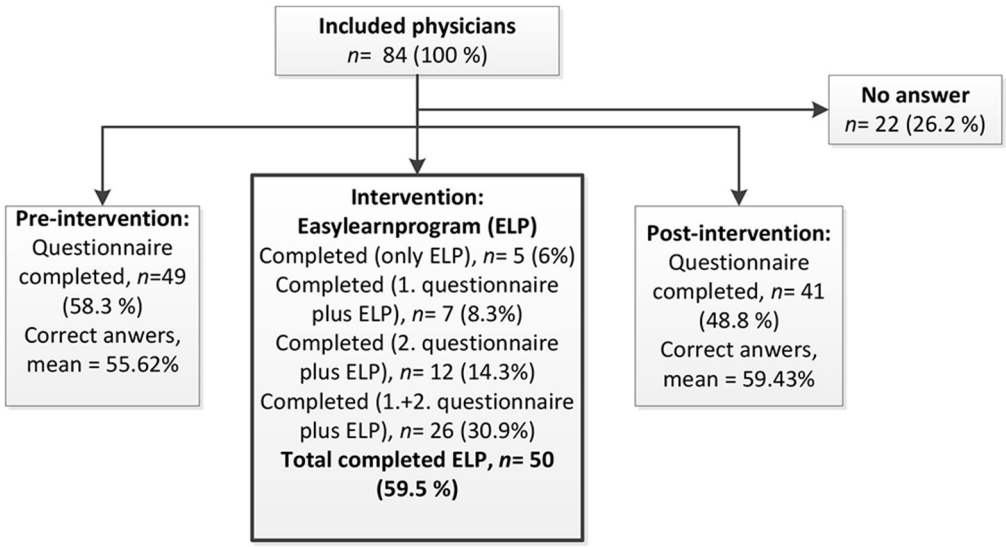

Fig. 4. Physicians' intervention flow chart and results of the multiple-choice questions (MCQ) test.

program, together with a ready-to-use pocket card, for residents enables an increase in their basic knowledge of nutritional management and would lead to more prescriptions for nutritional therapies for malnourished patients. The main finding was that this intervention had no significant effect on the number of prescribed nutritional therapies. We had two almost comparable patient groups in the pre- and postintervention phases, and we found a high percentage of malnourished patients in both groups. However, the percentage of prescribed nutritional support for these patients was remarkably low.

In teaching hospitals, 30% to 50% of GIM patients have been found to be at risk for DRM [19–22]. This study confirmed this high prevalence in elderly people in a Swiss GIM referral center along with the increased hospital stay of malnourished patients. To fight against DRM, the Public Health Committee of the Council of Europe adopted a resolution for preventing and treating DRM in hospitals [23], which outlined the importance of awareness of DRM. Nutritional knowledge at all levels of physicians is insufficient, and therefore DRM is not treated, as several studies have demonstrated [24–28]. Our data showed that a very high proportion, 42.4% of the patients (pre- and postintervention), suffered from DRM. The awareness of DRM in patients with overweight and obesity, a population per se at high risk of sarcopenia, is very low. We found a large portion of malnourished patients with normal body weight and malnourishment presenting even in overweight (20.61%) or obesity (11.84%). Considering that palliative patients and the patients with strong, uncontrolled pain—who are even more prone to DRM—were excluded, the number of malnourished patients could well be much higher. Furthermore, malnourished patients showed a longer length of hospital stay, which was statistically significant. Imoberdorf et al. [5] found only 18.2% of newly admitted internal medicine patients to be malnourished, probably because the included hospitals were to a great extent peripheral hospitals and not tertiary referral centers, such as the university hospital of Berne in this case. Such referral hospitals usually have higher rates of polymorbid patients with complex pathologies and complications, which could explain the higher prevalence of DRM found in our study.

Despite the high rates of malnourished patients, there is no universal screening program for nutritional assessment in our hospital that has been established to the extent necessary as indicated by other international findings, which implies that 21% to 73% of the hospital wards screen patients for nutritional risk on admission to the hospital on a standard-of-care basis [29]. This finding confirms the necessity of a routinely performed nutritional risk screening upon admittance of the patients, to not delay the necessary intervention.

The outcome in our study was measured with the prescribed nutritional therapies: only 18.7% and 17%, respectively, of malnourished patients (NRS 2002 $\geq$3) received nutritional support in the pre- and postintervention phases. The number of nutritional prescriptions as a marker for malnutrition management might be challenged, but the use of nutritional products correlates with the nutritional support actions in the hospital that influence the subsequent NRS 2002 monitoring of the patient. This low level of nutritional therapies correlates with the poor awareness of the treating residents. They lack the basic training of clinical nutrition during their medical traineeships, which is again not specific to Switzerland [20,30,31]. The lack of nutritional support measures was strengthened by the poor results in the nutrition knowledge test, even after the educational intervention with online education and pocket cards (55.6% versus 59.4% correct answers).

In our preintervention test, the residents were asked for the reason "why physicians pay little attention to nutritional issues." The two most reported reasons were insufficient knowledge and that the manifest malnutrition of the patient was overlooked or not recognized. The same reasons were also identified by a Danish research group [32]. Interestingly, a survey of Mowe et al. [33] in Scandinavia described that nearly 40% of the medical staff lacked techniques for identifying malnourished patients, and more than 50% found it difficult to prescribe adequate nutritional therapy. Those who assumed their nutritional knowledge to be good also showed better nutritional management practice. Furthermore, Mowe et al. [33] found that low knowledge was associated with difficulties in performing nutritional risk screening and nutritional assessments and in prescribing adequate nutritional therapies. Clinical nutrition or nutrition in general is usually neglected in medical schools. This finding was also confirmed by Adams et al. [17], who called for more and better training in nutritional

assessment and intervention options for physicians, residents, and medical students.

The same authors reported on a new initiative that offers a free online education program for residents and other physicians. The lessons are practice-based and can be completed in 15 min or less. The modules contain detailed recommendations for nutritional assessments and appropriate therapies as well as practical applications and interactive case studies to reinforce the instructions and allow the residents to apply the newly learned skills immediately with patients [17]. Our study found that an online intervention of 20 to 30 min with an easyLEARN educational program did not cause a significant increase in correct answers in the MCQ knowledge test and in prescriptions of nutritional therapies. The residents who completed the whole program showed better scores in the second MCQ test, but this finding was not followed by an increase in nutritional prescriptions. Only offering training through a recommended e-learning tool and the distribution of a memo card was not successful in significantly changing the behavior of the young residents to the point of resulting in better malnutrition management.

An interdisciplinary nutrition team and different educational strategies are needed for better education in clinical nutrition, detection, and management [34]. A call for a multimodal and more compulsory educational intervention arises. Rasmussen et al. [35] conducted a study with a comprehensive nutritional action plan in two internal medicine departments (e.g., introduction of a screening system, nutrition sheet for physicians, nutrition record for nurses, and implementation of guidelines), which was able to increase the screening for nutritional risk from 3% to 50%, while 26% more patients (20%–46%) received a nutrition intervention within 1 week [35]. A study conducted in Brazil on the ICU concluded that a multifaceted educational nutritional intervention improved the quality of nutritional therapies. The intervention included nutritional therapy protocols, workshops for the physicians, and bedside clinical case discussion [36].

To our knowledge, this study is the first prospective pre-post intervention study that uses the validated NRS 2002 as a screening instrument. The study group of GIM residents from a large tertiary hospital center represents also the national educational status for this physician group. The study was conducted in a university hospital and addressed complex and multimorbid patients. All of the patients were screened. Another strength of this study is the use of a multifaceted intervention program: an online learning tool, which was created on purpose by experts in clinical nutrition and medical education, included a pre- and postintervention knowledge test, and printed material was distributed (a pocket card).

There are limitations to the study. Only half of the residents completed the whole program (first and second questionnaires and the easyLEARN program), because of the high turnover of the medical staff in a tertiary resident trainee center. Moreover, the main clinical decision maker (the attending physician) was not involved in the program. In addition, it was not possible to correlate the prescribed nutritional therapies with the prescribing physicians to obtain more information at the individual physician level.

Conclusions

This study found that a recommended educational online program together with the distribution of printed "pocket" materials alone was not effective at increasing the nutritional knowledge that should be accompanied by improved malnutrition management in a large university GIM clinic despite the high rate of malnourished patients. Our simple online educational intervention via Internet combined with a ready-to-use pocket card of the NRS 2002 with information on malnutrition management showed improvement in nutritional knowledge in the subgroup of residents who participated in the whole program. Nevertheless, there was no increase in the number of nutritional interventions, as assessed by nutritional prescriptions, which confirms the insufficient awareness and behavioral changes of the involved physicians. More sophisticated educational systems to fight malnutrition are necessary. Certainly, a compulsory multimodal training approach for residents in clinical nutrition is mandatory to successfully identify and manage malnourished patients and to create awareness and responsibility of the treating physicians. Further research is needed to explore the specifics of the multifaceted educational activities, including the format of the well-structured educational program, targeted at local circumstances, and interdisciplinary efforts to significantly improve knowledge in nutritional basics and malnutrition management skills of physicians and other healthcare professionals.

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