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Semi-automation of nutritional risk screening in the hospital results in systematic scoring

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SUMMARY

Background: Hospital malnutrition is a costly phenomenon as it contributes to complicate and prolong hospital stays. Optimal care of malnutrition requires the identification of patients at risk with an early screening: the latter is not systematically carried out due to lack of specific education, but also of time and user-friendly tools. The aim was to achieve a systematic nutritional screening of all hospital patients and to increase the recording of the diagnosis in the discharge letter.

Methods: Multidisciplinary work group to create nutrition protocols and equivalences between three patient assessment tools: nursing ePA-AC, nutritional risk screening (NRS) and Mini Nutritional Assessment (MNA-SF); mapping of the related variables of the 3 tools. Validation by the physician of automatically generates score triggers a dietician visit. Validation of malnutrition by the dietician prompts malnutrition diagnosis proposal for the discharge letter.

Results: After the pilot phase, NRS or MNA-SF scores are now available in all patients of the 2 first implementation sites (geriatry, surgery). Assessment of the patients stress level generated difficulties (over-scoring) that required additional teaching. Doctor validation of pathological scores has increased request for dietician visits. Economical impact of increased diagnosis in discharge letter is yet to come.

Conclusion: The semi-automation of nutritional risk screening is possible without increasing the nurse workload, by mapping their nursing activities to specific nutrition scores adapted to the patient

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age. The increased diagnosis of malnutrition within 48 h of the hospital admission should lead to better care and optimize hospital reimbursement.

1. Introduction

Hospital malnutrition is a costly phenomenon as it adds to patient suffering, complicating and prolonging hospital stays [1,2]. In 2001 the Council of Europe, of which Switzerland is a member, has issued guidelines on organization of hospitals for its prevention [3]. Among the major causes of the persistence of insufficient attention to this problem, the caregiver training gaps, the absence of defined responsibilities of each professional, and of involvement of administrators and patients were identified. Fifteen years later, neither the doctors nor the nurses still receive education on nutrition during their studies, and are therefore very little sensitive to this issue [4]: the identification of malnutrition occurs at random and is much lower than its true incidence.

The prevention and early treatment of malnutrition require the identification of patients at risk by professionals responsible for the management of nutrition, to enable the establishment of nutrition programs that are both global and individualized [3]. A European screening score was developed (NRS: Nutritional Risk Screening) [5] and validated by the European Society of Clinical Nutrition (ESPEN). In Switzerland, the situation is as critical as in the rest of Europe [6–8], remaining dependent on isolated individual initiatives for improvement. The completion of screening and nutritional therapy is extremely variable, as demonstrated by the "Nutrition Day" investigations [9]. This variability of practice and capture of the diagnosis of malnutrition was confirmed prospectively in our hospital. Among 190 internal medicine patients prospectively evaluated with the NRS, 120 (63%) had a score above 3: despite that, the mention of malnutrition as diagnosis in discharge letters occurred in less than 10% of the patients with this high score, and worse, none of these patients received nutritional treatment. This denial of malnutrition has consequences both on the patient's clinical course [10], on the costs of stays [11], but does also reduce the financial income of the hospital Indeed the encoding of malnutrition is weighting the reimbursements allocated by the DRG system (diagnosis related group): the "cost weight" of the cases increases with the inclusion of the diagnosis of malnutrition as co-morbidity in the discharge letter.

Faced with the demonstration that malnutrition was under-diagnosed and therefore undertreated, the general direction of the Hôpital du Valais (HVS) first decided to create a clinical nutrition unit. Its main objectives were to standardize screening and nutritional practices, to improve education and nutrition care. The analysis of the barriers to implementation of efficient nutrition practices showed that interdisciplinarity was a pre-requisite to the project [12], as was the implementation of a computer-assisted systematic scoring. This work aims to report the steps and professional integration levels required for semi-automation, and close to full screening of all admitted patients.

2. Methods

The Hôpital du Valais is a multisite (9 sites), bilingual hospital supporting 40,000 patients a year with more than 5000 employees: the French speaking part counts 700 beds and the German speaking part 260 beds. The patient file is fully computerized (Phoenix®, Compugroup Medical AG, Niederwangen, Switzerland).

2.1. Project development

Although strongly supported by the General Direction of the HVS, the project required the search for external funding resources to hire a dedicated dietician. Upon her engagement in June 2014, numerous

meetings interdisciplinary groups (nurses, doctors, pharmacists, physio- and ergo-therapists, hotel-restoration, dieticians) were organized. While screening was originally considered to be based on the sole NRS score, the development of the geriatric protocol quickly highlighted the need for a specific score, leading to the choice of the MNA-SF (Mini Nutritional Assessment Short Form) for patients aged > 65 years [5,13,14].

2.2. Funding

The project costs were mainly generated by specialized team (0.6 FTE dietician and 0.2 FTE nutrition physician), but also by time dedicated to meetings by the staff involved in the multidisciplinary project. Funding was constituted by a private–public combination: a dedicated fund was created, powered by an unrestricted grant donated by the industry (4 companies: Nestlé Suisse AG, BBraun Schweitz, Abbott Schweitz, Fresenius Kabi AG Schweiz) that financed 1.5 years of the project, with a full relay by the hospital in 2016. These companies have specializations in terms of their nutritional products (oral products, enteral and/or parenteral) enabling a fair purchase distribution of the product during the feeding product reorganisation.

2.3. Steps

1) listening to the needs, literature search by specialty, 2) writing of successive versions of a protocol draft integrating the roles of each profession, 3) selection of a short list of nutritional products (reduction from over 200 products to 15), 4) equivalence determination between the scores, and computer mapping, 5) validation of the screening tool, procedures for additional investigations and treatment, 6) training “field” by profession (Fig. 1), and yet to come 7) economic evaluation and adjustments if necessary.

2.4. Integration of patient data

nursing work is guided by the ePA-AC tool (Ergebnisorientiertes PlegeAssessment für Acute Care = result oriented nurse assessment fo acute care) [15]. Many variables linked to nutrition are entered in the computerized patient record. After each admission, the patient's overall condition should have been assessed within the first 12–48 h. The variables entered by nurses in the ePA-AC lead to automated calculation of the scores proposed to the physicians.

2.5. IT

The customisation of the various scores from the activity of nursing records and patient data, including switching from the NRS to the MNA-SF depending on the patient's age (under or over 65 years) the creation of an integrated dietary record, required specialized skills and many hours of work.

2.6. Quality and communication procedures

Once the protocol was approved by the interdisciplinary working group, it was inserted on the intranet, in collaboration with the Quality Department, via the electronic management software documents (DOC Intraqual®, QualNet, France). A pocket size “Practical Guide to Nutrition” by department was created in collaboration with the communication service: logo and colour (nurse-blue, dietician-green, doctor-red) of text by profession were used for rapid identification of roles and practices in the memos.

2.7. Score validation and medical diagnosis

An alert was created to inform the doctor of completion of the automated score, requesting its validation. An additional warning was created in case of pathological MNA-SF/NRS. If the doctor confirms the nutritional risk, his validation triggers the dietary counselling. The dietician then assesses

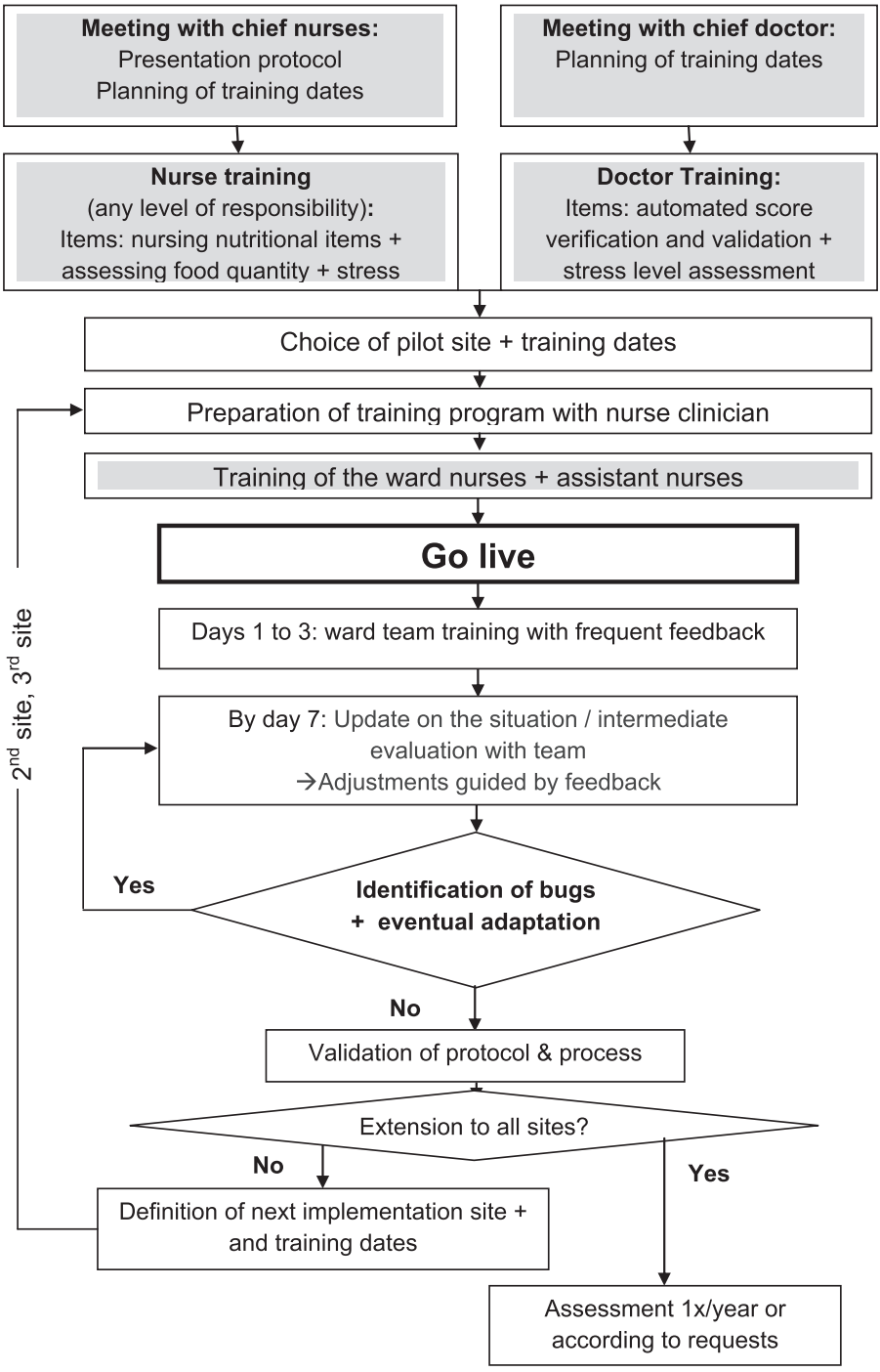

Fig. 1. Teaching procedure in the geriatric department.

the patient and prescribes the nutritional intervention. They document the NRS and nutritional factors (computerized form) and if relevant, suggest the diagnosis of malnutrition, the proposal being automatically remounted to the doctor via a computerized form. When preparing the patient's discharge report, the doctor validates, or not, the malnutrition diagnosis. The coding team finds the diagnosis and NRS score required by the Swiss-DRG system in the output of this letter.

3. Results

During the first year of the project, areas at high risk were identified and protocols were developed for the top ranking risk areas: geriatric department (about 50% of all patients are aged >65 years), intensive care, nephrology, and surgery (ERAS colorectal and thoracic protocols are active). The protocols were first developed in geriatrics, intensive care, and surgery. They were written in 2 languages, validated and put into production.

Equivalences were proposed between nursing assessments ePA-AC and the MNA-SF (Table 1), based on group discussions about the complete meaning of each nursing item. Mapping was then agreed between the various levels of the MNA-SF and NRS (Table 2). The IT department mapped the variables of patient records to the scores at latest 48 h after admission. This mapping avoided that the already overloaded nurses had to do double entries in the computer (no score calculation by nurses): this implied developing bridges/mapping between this tool and the NRS score [16] and MNA-SF [17]. The IT customized their recovery of the malnutrition diagnosis validated by the dieticians in the preconfigured medical letter-form.

The process was tested on a geriatric pilot site in February–March 2016. The main difficulty came from the estimate/interpretation of the stress levels that weighs heavily in both the MNA-SF and the NRS: stress levels had to be clarified with a long list of examples. Similarly, a rapid assessment of the food process was developed with the team to allow a daily estimate of the dietary intakes.

Reinforcement of the dedicated ePA-AC tool segments and nutritional teaching to reach all the nurses and assistants of the services proved to be time consuming. This step was considered essential for adherence of the teams to the process (Fig. 1).

Scoring: the NRS (or MNA-SF) is now calculated automatically via the ePA-AC for any hospitalized patient (geriatric service, surgery department) and the NRS can also be manually documented for ambulatory patients. During the first 6 weeks after the go-live, 129 patients were admitted to geriatric ward: 124 patients (96.1%) were scored with the MNA-SF during the stay (265 scores were attempted, resulting in 124 validations, which indicated recalculation after adjustment of the stress level). A dietitian visit was requested in 41 patients (31.8% of admission). The diagnosis of malnutrition validated by the dietician is now available to doctors for the discharge form. The economic data are not yet available.

4. Discussion

Nutrition screening is rarely performed outside of a research protocol, either by doctors or nurses [2]. Not detecting active malnutrition early during the hospital course entails late and therefore insufficient care. The main result of the semi-automated process we have developed is a systematic risk assessment of malnutrition at latest within 48 h of admission with 96% of patients being scored, leading to increased nutritional relevant interventions with 32% of patients receiving a targeted dietician visit. The integration of the professional activity of various stakeholders around the patient, reduced to a minimum the additional actions required to trigger a nutrition intervention. The advantages are fast signalling of a possible malnutrition to the dietetics team, improving their support in the context of predefined protocols.

Protein-energy malnutrition although known to be present in about 40% of hospitalized patients [3], can be coded in the DRG grouper only when a procedure such as a dietician visit (2 sessions), dietary treatment, or enteral or parenteral nutrition for at least 5 days, is realized [18]. The coding implies that 'there has been an action". The dieticians, frequently the only caregivers with nutrition training, can propose correct diagnosis of malnutrition to the physicians, which results at the end of the

Table 1
Mapping between ePA-AC (nurse score) and MNA-SF scores.

ePA-AC item	ePA-AC score	MNA-SF score	Correspondence between ePA-Ac/MNA-SF
A Feeding: appetite, chewing, swallowing	Food intake, documented in ePA-AC **Quantity of oral feeding** 1 = very little 2 = little 3 = sufficient 4 = correct **Swallowing disorder** 1 = yes 2 = no/does not apply	**Has the patient eaten less during the last 3 months (loss of appetite, digestive problems, chewing or swallowing difficulties)?** 0 = strong reduction 1 = modest reduction 2 = no reduction	**Quantity of food** ePA-AC 1 or 2 = MNA 0 ePA-AC 3 = MNA 1 ePA-AC 4 = MNA 2 + **Swallowing disorder** ePA-AC: swallowing disorder 1 = MNA 1 ePA-AC: No swallowing disorder = MNA 2
B Recent weight loss	**Assessed as « additional variables »** Weight loss during last 3 months, Last 2 months, Last month	**Weight loss during last 3 months?** 0 = weight loss> 3 kg 1 = does not know 2 = weight loss 1–3 kg 3 = no weight loss	Nurse documents anamnestic weight + actual weight + time elapsed • Variable “weight loss” « no »: 3 points • Variable “time”, “actual weight” not known = 1 point • Variables time and weight loss: no loss = 3 points Loss 1–3 kg = 2 points Loss > 3 kg = 0 points
C Mobility	**Self-care ability, activity/mobility, ability to move** 1 = incapacity to move/bedridden 2 = capacity strongly reduced 3 = modestly reduced 4 = full capacity	**Mobility** 0 = bed or chair bound 1 = able to get out of bed/chair but does not go out 2 = goes out	ePA-AC 1 or 2 = MNA 0 ePA-AC 3 = MNA 1 ePA-AC 4 = MNA 2
D Metabolic Stress	**Energy/nutrition needs** 1 = strongly increased 2 = increased 3 = slightly increased 4 = normal	**Stress during the last 3 months** 0 = yes 2 = no	ePA-AC 1 or 2 or 3 = MNA 0 ePA-AC 4 (normal requirements) = MNA 2
E Neuro-psychological problems	**Cognition and perception « daily life competence »** 1 = inexistent 2 = strongly reduced 3 = modestly limited 4 = normal	**Neuropsychological problems?** 0 = severe dementia or depression 1 = mild dementia 2 = no problem	ePA-AC 1 or 2 = MNA 0 ePA-AC 3 = MNA 1 ePA-AC 4 = MNA 2
F Body mass index (BMI kg/m^2)	**Weight and height,** →BMI automatically calculated	**BMI**: 0 = <19 1 = 19 ≤ BMI<21 2 = 21 ≤ BMI <23 3 = IMC ≥ 23	MNA mapping: 0 = IMC < 19 1 = 19 ≤ IMC < 21 2 = 21 ≤ IMC < 23 3 = IMC ≥ 23

Abbreviations: ePA = objective oriented nursing score, MNA-SF = mini nutrition assessment – short form.

stay in a more systematic encoding. This systematic approach should in turn lead to optimization of the billing for inpatients.

Unconditional support of the administration is essential to enable such a process [3], to gather the working groups as required to adapt international guidelines to local possibilities, as this constitutes a significant internal resource consumption that only the Direction can decide. Indeed, to anchor the project to the hospital management also enables prioritizing the necessary IT developments. Despite this, financial problems may persist in a public hospital: this project would not have been possible without the support of industry. The expected benefit for the latter is an increased consumption of nutrition products, and for the patients, a better outcome. We also expect a reduction of nosocomial infections, postoperative complications, and length of stay, but these indicators are much harder to

Table 2
Mapping between NRS and ePA-AC (nurse score) variables.

NRS item	NRS score	MNA-SF score	ePA-AC variables
Feeding* Food intake adequacy	0 = >75% of needs 1 = 50–75% 2 = 25–50% 3 = < 25%	Variable « quantity of oral feeding »	**« Quantity of food »** ePA-AC 1 = NRS 3 ePA-AC 2 = NRS 2 ePA-AC 3 = NRS 1 ePA-AC 4 = NRS 0
Recent weight loss*	1 = >5% in 3 months 2 = >5% in 2 months 3 = >5% in 1 months	0 = weight loss> 3 kg 1 = does not know 2 = weight loss between 1 and 3 kg 3 = no weight loss	**« Additional variables »** Code weight loss (kg) Code time elapsed in months
BMI* kg/m^2	0 = BMI > 20.5 2 = BMI 18.5 to 20.5 3 = BMI < 18.5	0 = BMI < 19 kg/m^2 1 = 19 ≤ BMI <21 kg/m^2 2 = 21 ≤ BMI <23 kg/m^2 3 = BMI ≥ 23 kg/m^2	BMI > 20.5 kg/m^2 = not coded (0) BMI 18.5–20.5 kg/m^2 = NRS 2 BMI < 18.5 kg/m^2 = NRS 3
Severity of disease: Acute disease or metabolic stress	0 = no stress 1 = mild stress 2 = moderate stress 3 = severe stress	Yes = 0 points No = 2 points	Variable **« Increased requirements »** ePA-AC 1 = NRS 3 ePA-AC 2 = NRS 2 ePA-AC 3 = NRS 1 ePA-AC 4 = NRS 0

document. The increased documentation of the diagnosis of malnutrition will therefore be the main indicator of the success of the process. It is also likely that the increased awareness of the frequency of malnutrition will generate more demands and required more dietitians to meet the demand.

In conclusion, a semi-automated screening of patients at risk of malnutrition is possible without increasing the nurse workload, and should help address the persistence of the lack of specific training for doctors and nurses to the problem of malnutrition, and prompt professional dietician care. Computerized information systems make this facilitation possible.

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Conflict of interest

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.yclnex.2016.05.001.

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