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SHORT COMMUNICATION

A tailored automated nutrition screening tool for rapid identification of risk in acute-care hospital settings

S Hershkovich[1], AH Stark[2], CS Levi[1,3], D Weiner[1], O Gur[4] and GS Rozen[1]

Malnourishment is prevalent in hospitalized patients and associated with adverse medical outcomes. Thus, nutrition screening to identify high-risk patients is widespread. However, no single universal tool has been shown to be suitable for all hospital departments. To address this challenge, a novel, tailored, electronic tool for nutritional screening was developed and evaluated. The Rambam Automated Nutrition Computerized Screening tool efficiently screens all newly admitted patients and does not rely on self-reported height and weight estimates. Validation was carried out in medical wards ($n = 94$), and compared to the Malnutrition Universal Screening Tool, length of stay and an independent assessment by a professional dietician. Results from this research support the use of automated, flexible tools that instantaneously incorporate relevant available data from the electronic health record. Tools that are adaptable to meet the needs of individual hospital departments, can save valuable time and ensure full screening of all admitted patients.

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INTRODUCTION

Hospital malnutrition is an independent risk factor impacting prognosis,[1] risk for disease complications, longer hospital stays and higher morbidity and mortality.[2] Consistently, a high percentage of hospitalized patients (11–49% in most departments, and as high as 74% in intensive care) are reported to be malnourished.[3] Hence, screening to identify patients that will benefit from nutritional support is universally recommended.[4] Despite consensus regarding the need for nutritional screening, no agreement exists as to which parameters should be included in a good screening tool, and tools differ in reliability according to patient population. For example, the Malnutrition Universal Screening Tool (MUST) was reported most valid for screening the elderly[5] but not sufficiently sensitive to correctly identify malnourished renal in-patients.[6] As a result there is considerable heterogeneity both in tools and methods of coding.[7] We propose that the most practical approach is to use a flexible automated tool relying on electronic data sources routinely entered in hospital records by staff, that can be tailored for specific purposes to optimize effectiveness.

Rambam Medical Center is the largest acute-care hospital in Northern Israel. Funding cut-backs led to downsizing in the Clinical Nutrition Department staff hours, which necessitated the development of the novel Rambam Automated Nutrition Computerized Screening (RANCS) system aimed to maximize use of time.

METHODS

The system, programmed by the hospital's Information Technology Unit, relies on electronically available data routinely entered at admission. Specific parameters are instantaneously transferred to the automated nutritional evaluation application. Relevant new data is incorporated into the screening evaluation as it is recorded in the electronic health record, ensuring proper nutritional support as the hospitalization progresses. An updated online-electronic-spreadsheet of all currently hospitalized patients is available at all times (Figure 1). Another advantage of the system is flexibility; parameters can be added according to specific population needs in each department. Data routinely chosen to be included in the tool were medical diagnosis according to the International Classification of Diseases 9 (ICD9) and information obtained from standardized nursing anamnesis (for example, age, vomiting, diarrhea, poor appetite). Body mass index is not essential because actual height and weight measurements for calculation are often missing.[8] Cook *et al.*[9] advocate that weight change over time together with clinical judgment are superior prognostic indicators of under nutrition than body mass index. Serum albumin measurements were included as a prognostic risk factor reflecting nutritional status and also as required by the Israeli Ministry of Health. Each RANCS parameter was assigned a score (Table 1A) and evaluated in a pilot study to better correlate with nutritional assessment by clinical nutrition staff. Any score $\geqslant 6$ indicating high risk of malnutrition warrant immediate nutritional assessment to determine nutritional support needs. Parameters considered to have less nutritional hazard impact received low scores of 1–2 points, diagnosis of diseases receive scores according to their impact on nutritional status or need for nutritional support. The most severe medical problems such as $>60\%$ burn or renal insufficiency and low albumin values at admission receive a score of 6 points, insuring immediate attention.

Using a research protocol approved by the Rambam Helsinki Committee, 94 patients from internal and surgical wards were

[1]Department of Clinical Nutrition, Rambam Medical Center, Haifa, Israel; [2]School of Nutritional Sciences, The Robert H. Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot, Israel; [3]Department of Biotechnology and Food Engineering, Laboratory of Chemistry of Foods and Bioactives, Technion – Institute of Technology, Haifa, Israel and [4]Information Technology Unit, Rambam Medical Center, Haifa, Israel. Correspondence: Dr GS Rozen, Department of Clinical Nutrition, Rambam Medical Center, Haifa 31096, Israel.
E-mail: rgeila@rambam.health.gov.il
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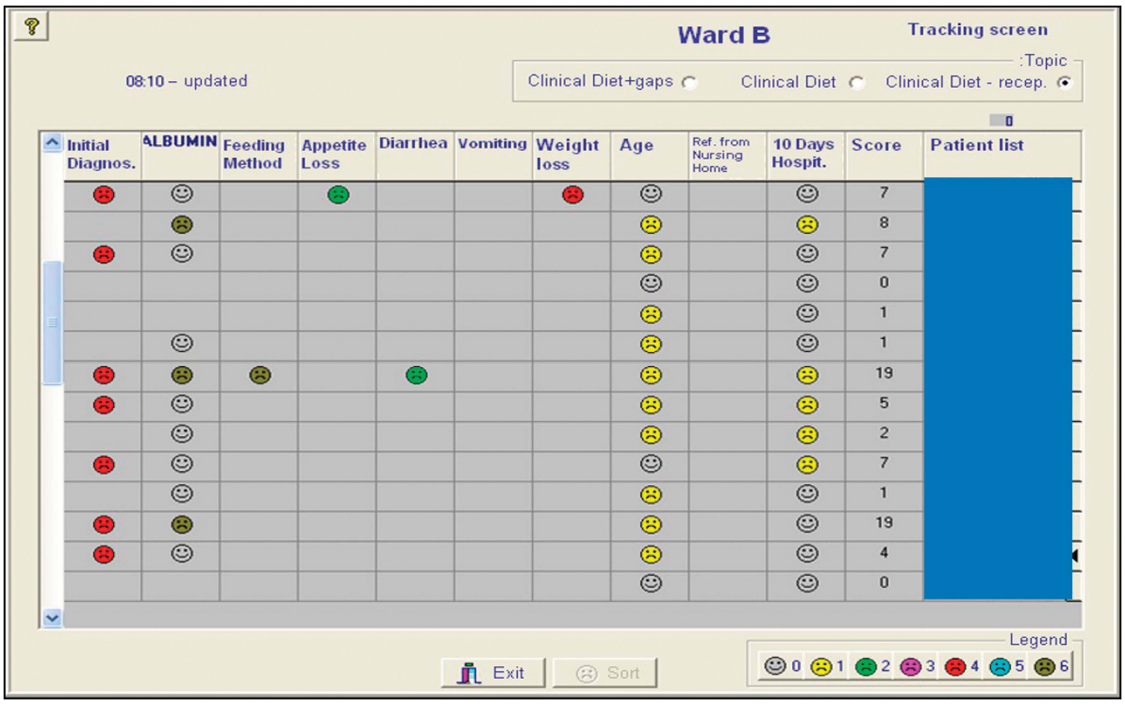

Figure 1. Sample computer screen for tailored screening tool RANCS – Internal department. High-risk patients score is defined as ⩾ 6.

Table 1A. Scoring scale of screening tool used in an Internal Medicine Department

Parameter	*Score (RANCS points)*
Hospital stay > 10 days	1
Referral from a nursing home	1
Age over 65	1
Involuntary weight loss	
More than 10% of body weight in 6 months	4
5% in 1 month	4
Vomiting	2
Diarrhea	2
Appetite loss	2
Feeding method	
Per Oz independent with swallowing problems	2
Per Oz with assistance needed	4
Feeding tube	5
I.V nutrition	6
Albumin < 3 mg per dl	6
Initial diagnosis examples	
Controlled disease such as celiac	1
Malignant neoplasm of thymus	2
Cachexia	3
Ulcerative colitis	3
Renal insufficiency	6
Severe burns (⩾ 60%)	6

randomly chosen and validation of the RANCS tool was performed comparing automated screening results with MUST nursing staff score (96% data based on self-report, not measurements). In addition, for 50 patients from this group a trained dietitian performed the MUST again using actual measurements of weight and height and evaluated charts to determine the need for nutritional treatment according to professional criteria. Results from both screening tools were also correlated to Length of Stay (LOS). Statistical analysis was performed using a non-parametric Mann–Whitney U-test ($P < 0.05$) and Kappa–Cohen`s for cross tabulation between MUST and RANCS.

RESULTS

From 94 patients, both tools successfully recognized 13 as high risk; however, the MUST tool identified an additional 5 patients while the RANCS identified 16 different patients that were under diagnosed by the MUST criteria (Table 1B- Step 1). The sensitivity of RANCS compared with MUST was 72.2% while the Specificity was 78.9%. When using actual body mass index measurements for 50 patients (Table 1B- Step 2), validation improved dramatically. There was 100% correlation between patients identified by the MUST and RANCS as high-risk with an additional seven patients identified by RANCS. Time consumed for manually screening patients for MUST ($n = 50$) took on average 12.2 ± 5.3 min per patient, including measurement of height and weight and recording information to the electronic database. The RANCS system required no additional time as data automatically transfer from the previously recorded electronic input. Patient scores for both tools were significantly correlated with LOS. MUST categorized 19% of the patients at high risk of malnutrition (score ⩾ 2) and LOS was 13 ± 9 days, which was significantly higher than patients with MUST score of < 1 ($P = 0.01$). According to the RANCS, 30% of the patients were categorized as high risk (score ⩾ 6) and LOS of 8.8 ± 4.75 days, which was significantly higher than patients with RANCS score of < 6 ($P = 0.0001$).

CONCLUSION

In conclusion, this article does not attempt to present pros and cons of a particular screening method, but suggests a tailored approach to be optimal as widespread use of electronic medical records makes this easy and cost-effective. A recent systematic review[10] evaluating 32 screening tools designed for the hospital setting, suggested that no single tool could consistently classify

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Table 1B. Step 1: cross tabulation between RANCS and MUST Scores in identifying high-risk patients ($n = 94$) with data from patient electronic files. Step 2: cross tabulation between RANCS and MUST Scores in a subgroup of patients with actual height and weight measurements—accurate body mass index ($n = 50$)

	RANCS SCORE					
	< 6	*⩾ 6*	*Total*	*< 6*	*⩾ 6*	*Total*
MUST SCORE						
0–1	60	16[a]	76	30	13	43
2	5	13[a]	18	0	7[b]	7
Total	65	29	94	30	20	50
	Step 1 ($n = 94$)			Step 2 ($n = 50$)		

Sensitivity of RANCS compared with MUST—72.2%. Specificity of RANCS compared with MUST—78.9%. [a]Patients that were identified as a high risk by RANCS and MUST. [b]Number of high-risk patients identified by the RANCS but under diagnosed by the MUST.

patients' nutritional status. Our project evaluated an automated electronic nutrition screening system that continuously provides information for any group of patients and ranks individuals by greatest need of nutritional intervention. This time saving approach allows dietitians to deal with a larger number of patients and prioritize needs. Furthermore, correlation of nutritional risk to LOS implies the need of treatment for these patients, and the higher identification rate of RANCS may therefore be another advantage. For now, taking advantage of the automated electronic medical record is a realistic cost-effective method for identifying malnourished and at-risk patients. Ideally, a gold-standard screening tool would ensure best patient outcomes rather than just identifying patients at risk.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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