Monitoring Rates of Malnutrition Risk in Outpatient Cancer Centers Utilizing the Malnutrition Screening Tool Embedded into the Electronic Health Record

Elaine B. Trujillo, MS, RDN; Alice C. Shapiro, PhD, RDN; Natalie Stephens, RDN, LD, FAND; Sarah J. Johnson, MBA, MPH, RDN; Jeannine B. Mills, MS, RDN, CSO, LD; Alexandra R. Zimmerman, RDN; Colleen K. Spees, PhD, MEd, RDN, LD, FAND

ARTICLE INFORMATION
Article history:
Submitted 2 June 2020
Accepted 10 November 2020

Key Words:
Malnutrition risk
Screening
Outpatient cancer centers
Electronic health records
Patients treated for cancer

ABSTRACT
Background The risk of malnutrition in patients with cancer is well documented. However, screening to identify patients at risk in ambulatory cancer centers is not standardized nor uniform. The 2-question Malnutrition Screening Tool (MST) is validated in the ambulatory oncology setting and endorsed by the Academy of Nutrition and Dietetics.

Objective To test the feasibility of operationalizing and standardizing malnutrition risk assessment across 2 large ambulatory cancer centers by embedding the MST into the electronic health record (EHR) with the goal of identifying and quantifying the prevalence of malnutrition risk in outpatient settings.

Design A Quality Assurance Performance Improvement project was conducted to evaluate malnutrition screening practices by leveraging the EHR. Work standards were developed, implemented, and evaluated to assess the feasibility of utilizing de-identified MST data, entered as discrete variables in an EHR flowsheet, to track monthly MST completion rates and to identify and quantify patients being treated for cancer scoring at risk for impaired nutritional status.

Participants/setting Data from 2 large adult ambulatory community cancer centers in the upper Midwest were collected between April 2017 and December 2018.

Results Over a 20-month period, the average monthly MST completion rate was 74%. Of those with completed MST screens, the average percentage of patients identified at nutritional risk (MST score ≥2) was 5% in medical oncology and 12% in radiation oncology.

Conclusion It is feasible to (1) integrate and standardize data collection of the MST into existing EHR flowsheets and (2) identify and quantify patients at risk for malnutrition on a consistent basis.

insufficient, if any, nutritional services to patients with cancer. We recently reported that ambulatory CCs have a registered dietitian nutritionist (RDN)-to-patient ratio of 1:2308, well below an adequate ratio of 1:120. Furthermore, only 50% of these CCs consistently screened for malnutrition.

Standardized and systematic nutritional screening is the first step in the early identification and treatment of patients who are malnourished or are at risk for malnutrition. Once identified, at-risk individuals should receive a comprehensive and focused nutritional assessment by a trained nutritional professional, such as an RDN. Without early and consistent malnutrition screening, the window to detect and favorably change the trajectory of a patient’s nutritional care is lost.

Although consistent malnutrition screening is recommended by many US oncology organizations, such as the American College of Surgeons’ Commission on Cancer and the Association of Community Cancer Centers, it is not a standardized component of oncology care in the United States. Yet mandatory nutritional screening has been established in some countries. For instance, the European Society of Clinical Nutrition and Metabolism Expert Guidelines recommend regular evaluation of nutritional intake, weight changes, and body mass index beginning at cancer diagnosis and repeated as indicated by the stability of the clinical situation.

Nutrition screening tools generally include dietary intake, anthropometrics, comorbid disease state, and subjective assessment of body composition. These methodologies require variable time commitments by nurses, physicians, RDNs, or other hospital staff. To be efficient, screening must be brief, inexpensive, and highly sensitive and have good specificity.

Although several validated tools for screening for malnutrition exist, there is no universal, standardized approach for screening ambulatory patients with cancer. Adult patients being treated for cancer should be screened using a screening tool validated in the setting in which the tool is intended for use. The MST is one such tool. It is a quick and easy screening tool, requiring no blood samples, anthropometric measurements, or clinical examinations. The MST has also been validated in the ambulatory oncology setting against the

---

**Figure 1.** Malnutrition Screening Tool (MST). (A) MST; a cumulative score of 2 or more indicates patient at risk of malnutrition. (B) Screenshot of the MST questions embedded in an Electronic Health Record. Adapted with permission from: Ferguson M, Capra S, Bauer J, Banks M. Development of a valid and reliable malnutrition screening tool for adult acute hospital patients. *Nutrition.* 1999;15:458-464.
Patient-Generated Subjective Global Assessment as well as against computed tomography assessment of body composition. The MST consists of 2 questions—one regarding appetite and one prompting for recent unintentional weight loss (Figure 1). A summative score is assigned to each question. Subjects who score 2 to 5 are at risk of malnutrition. At many institutions, information from a patients’ electronic health record (EHR) is downloaded regularly and stored in a “data warehouse,” which is a large database where EHR data are stored in a standardized format and accessed by data analysts. These data can be extracted for analyses by various statistical programs. Data warehouses allow deidentified data to be analyzed to query patients’ EHR and track specific information over time. Structured data elements, such as vital signs, weight, and height, are “machine interpretable,” meaning these are discrete variables for which computer logic can be applied. These types of data offer potential for electronic surveillance, because they can be analyzed using algorithms applied to data located in the EHR reporting tables or in the research data warehouse. Because MST scores are structured data elements, they can be easily and fully integrated in the EHR in a flowsheet (Figure 1). By leveraging automated data collection with EHR data, real-time reports can be obtained and evaluated to more rapidly identify at-risk patients.

The purpose of this Quality Assurance Performance Improvement (QAPI) project was to test the feasibility of (1) standardizing malnutrition risk assessment across 2 large CCs using the MST embedded in a common EHR and (2) utilizing MST aggregate data reports to quantify the prevalence of patients at risk of malnutrition. Here we report data on 2 of the largest CCs in the HealthPartners (HP) health care system located in the upper Midwest of the United States.

METHODS

This QAPI project integrated the MST into the EHR system (EPIC Systems Corporation, Verona, Wisconsin) at the 2 largest community CCs in the HP system. HP is the largest consumer-governed nonprofit health care organization in the country, providing care, coverage, research, and education to its members, patients, and the community. HP serves more than 1.8 million medical and dental health plan members and more than 1.2 million patients. Deidentified data from unique monthly visits by outpatients adult patients being treated for cancer by either the medical or radiation oncology departments between April 2017 to December 2018 were collected using automated reports within the EHR data warehouse. This project was determined to be a quality assurance project by the Health Partners Institutional Review Board and did not require human subjects review oversight.

MST work standards were developed by the oncology RDNs and approved by nursing and medical staff for MST administration at every oncology provider visit with a medical doctor (MD) or nurse practitioner. Registered nurses (RNs) or medical assistants (MAs) verbally administered the MST to patients during their intake assessment in the examination room at each clinic visit. Patient responses were entered into the vital sign data collection flowsheet in the EHR. If the patient scored ≥2 on the MST, an automated Best Practice Alert was generated to initiate an approved standing MD order for a nutrition consultation with the oncology RDN. This order was automatically signed by the MD and sent to the RDN work queue. In addition, all patients who screened at risk (≥2) were provided approved oncology nutrition educational materials by the RN/MA, which was documented in the flowsheet.

Content was developed to implement MST work standard into the CCs orientation process for all staff responsible for completing patient visit intakes in the EHR. During this 20-month project, 10% of all provider visits were audited 2 days per week to evaluate if the MST was administered per the work standard (at every provider visit). If MST work standards were not met, MA and RN staff meetings were held to determine barriers to implementation and provide retraining. Reports on MST completion rates and the data on prevalence of patients identified as at risk for malnutrition were shared at multidisciplinary cancer care team meetings and nursing quality care committee meetings.

Monthly EHR data extraction was conducted by the HP programmers from the research data warehouse. Variables of interest included (1) CC clinic, (2) patient’s medical record number (MRN), and (3) MST questions with the total MST score. After extraction, data were sorted by MRN and MST cumulative score from high to low. Duplicate MRNs were deleted from the data set to identify unique provider encounters for each month. If a patient had multiple visits with an MD or nurse practitioner during a 1-month period, the visit with highest MST score was included. Cumulative MST scores were assessed to identify rates of malnutrition risk across the 2 CCs. The percentage of MST completion was calculated by dividing the unique number of patients with a completed MST (defined as 2 MST questions asked and answered plus a total MST score generated) divided by all unique outpatients who had a provider visit within each monthly increment. The case mix of oncology diagnoses were obtained through the Cancer Registrar for the corresponding 20-month data collection period.

These data were securely e-mailed from the data warehouses to the lead project RDN. The RDN sorted these data using the custom data option, sorted by MRN, then ranked the MST score from high to low. The sorted data were simplified using the data tab and duplicated MRNs were removed.

RESULTS

Data are presented for the 20-month study period. The cancer site case mix was 22% breast, 16% gastrointestinal, 11% prostate, 10% lung and bronchus, 10% hematology, 9% skin, 7% genitourinary, 6% head and neck, 6% gynecological, and 3% other. Over the 20-month period, the average monthly MST completion rate was 74% (range = 60%-80%) (Table and Figure 2). Overall, 5% of the patients screened scored ≥2 on MST. Specifically, 5% of patients treated in medical oncology departments and 12% of patients treated in radiation oncology departments scored ≥2 on MST (Table and Figure 3).

The trends over time for MST completion rate and number of patients with MST ≥2 also are reflected in Figures 2 and 3, respectively. A linear rise in MST completion rate was noted...
The Academy of Nutrition and Dietetics supports the use of a Malnutrition Screening Tool (MST) to screen patients for malnutrition risk. A QAPI at our institution found that incorporating the MST into the electronic health record (EHR) was feasible across 2 community cancer centers (CCs). Additionally, the MST completion rate was 74%, and the range was 60% to 80%.

DISCUSSION

Although consistent nutritional screening is critical for the early identification and treatment of patients at risk for malnutrition or who are already malnourished, a recent national survey indicated that only 53% of CCs routinely screen for malnutrition; of the 53% who screened, approximately 35% used unvalidated tools. The Academy of Nutrition and Dietetics advocates abandoning all unvalidated MSTs, including tools that were validated, then modified without rigorous validation against a standard definition of malnutrition.

The MST has demonstrated good validity and reliability in identifying patients at risk of malnutrition in the oncology setting. Other MSTs validated in the outpatient cancer setting include Patient-Generated Subjective Global Assessment Short Form, NUTRISCORE, Nutrition Risk Index, and Short Nutritional Assessment Questionnaire. Of these tools, the MST is the quickest and easiest.

Despite the MST's ability to quickly and easily identify high-risk patients with cancer for subsequent referrals to trained clinicians, nutrition screening is often not prioritized in outpatient settings. Barriers to implementing nutritional screening practices include nonstandardized referral processes, limited administrative support, inadequate staffing or competing time constraints, lack of consensus on screening tool implementation, and limited frontline or nursing support. This results in late identification and referral delays that impact health outcomes. In a study of patients with cancer in which half were being treated as an outpatient, 78% of patients had more than 2 nutritional barriers, screening was used in 35% of patients, nutrition referrals should have occurred sooner in nearly half of the patients, and 13% in breast cancer. The cancer types with the highest prevalence of malnutrition are of the upper gastrointestinal, head and neck, lung, hematological, gynecological, and colorectal. The lower rates of malnutrition risk in our population may be due to the diverse oncology populations, including more tumor types that typically do not develop malnutrition, such as breast, prostate, skin, genitourinary, and others, which represented 52% of our population case mix.

Table. Average MST completion rates and malnutrition risk rates in 2 large ambulatory cancer centers: Data results over a 20-month period

<table>
<thead>
<tr>
<th>Variables</th>
<th>All patients</th>
<th>Medical oncology</th>
<th>Radiation oncology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique patients</td>
<td>68,119</td>
<td>63,108</td>
<td>5011</td>
</tr>
<tr>
<td>Completed MST screen</td>
<td>50,672 (74)</td>
<td>47,165 (75)</td>
<td>3507 (70)</td>
</tr>
<tr>
<td>MST ≥ 2</td>
<td>2752 (5)</td>
<td>2333 (5)</td>
<td>419 (12)</td>
</tr>
<tr>
<td>Mean MST ≥ 2/mo</td>
<td>131</td>
<td>111</td>
<td>20</td>
</tr>
</tbody>
</table>

*MST = Malnutrition Screening Tool.

Figure 2. Malnutrition Screening Tool (MST) completed screening trends over a 20-month period. The average monthly MST completion rate was 74%, and the range was 60% to 80%.

Over the 20-month period, beginning with a 60% completion rate in April 2017 and concluding with a 78% completion rate in December 2018 (Figure 2).
In the absence of nutritional screening, malnutrition may be neglected, particularly in patients who are overweight or obese, in which the excess body fat may mask loss of weight and lean body mass and malnutrition. As mentioned previously, more than 50% of patients with cancer exhibit signs of malnutrition at their initial oncology visit, even prior to initiation of cancer treatment. Thus, screening should be performed early in the treatment regimen and repeated at regular intervals to identify high-risk patients needing subsequent referrals for a more comprehensive nutritional assessment and management plan. There is consensus that nutritional intervention should be introduced at a point when the aim is maintenance or improvement in nutritional status. Full nutritional assessments for every patient with cancer is not realistic due to constraints on resources. Thus, screening is recommended to identify people at nutritional risk who need further assessment.

The reimbursement structure for oncology nutrition counseling by RDNs varies widely across outpatient CCs. Although screening may trigger an MD order for a nutrition consultation, the Center for Medicare and Medicaid Services and many other insurers do not reimburse for medical nutrition therapy and thus, although screening may be successfully implemented, many patients decline nutrition consultations due to lack of insurance coverage.

The strengths of this study are the relatively large sample size, successful implementation of the MST work standards, support from RN and MD CC leadership, and ongoing evaluation of adherence to MST administration. Additionally, there were excellent participant response rates.

There were certain limitations of this study. The MST is a screening tool and is only the initial step in identifying patients that require a more thorough nutritional assessment. The MST is not intended, in isolation, to diagnose malnutrition, hence our results reflect this fact. Although patients scoring ≥2 on MST automatically triggered a standing MD order for a nutrition consultation, it was beyond the scope of this project to follow up on completion of nutritional consultations. Other limitations include generalizability to oncology clinics in other geographic locations and to other CCs with more acute cancer case mix that includes patients at greater risk for malnutrition. Additionally, there is a lack of knowledge related to the patients’ physical, mental, and social characteristics.

It is recommended that clinics that implement and utilize the MST should consistently monitor data to compare patient populations, predict adequate clinic resources for screening and subsequent treatment, and support ongoing research to inform future studies.

CONCLUSIONS

Standardized malnutrition risk screening is feasible by embedding the MST into a common EHR across ambulatory CCs. Once implemented, malnutrition screening using the MST can be completed on a high percentage of patients. Furthermore, the aggregate data can be utilized to identify the prevalence of malnutrition risk. Future considerations may be how the consistent use of the MST in the EHR and leveraging data on MST completion rates may be used to inform staff adherence to MST work standards, consistency in care, RDN staffing needs and patterns, cost-benefit analysis, and health outcomes for patients being treated for cancer.

References


AUTHOR INFORMATION
E. B. Trujillo is a nutritionist, Division of Cancer Prevention, National Cancer Institute, National Institutes of Health, Rockville, MD. A. C. Shapiro is a research scientist consultant, Health Partners Institute, Cancer Care Delivery Research of the Metro-Minnesota Community Oncology Research Consortium, and associate adjunct professor at University of Minnesota, Minneapolis, MN. N. Stephens is the assistant director of nutrition services, The Ohio State University Wexner Medical Center, Columbus, OH. S. J. Johnson is the manager clinical nutrition, St Paul Regions Cancer Center, St Paul, MN. J. B. Mills is an oncology dietitian, clinical manager, Norris Cotton Cancer Center, Dartmouth Hitchcock Medical Center, Lebanon, NH. A. R. Zimmerman is an oncology dietitian, Health Partners Fraunshuh Cancer Center, Minneapolis, MN. C. K. Spees is an associate professor, Division of Medical Dietetics, School of Health and Rehabilitation Sciences, College of Medicine, The Ohio State University, Columbus, OH.

Address correspondence to: Elaine B. Trujillo, MS, RDN, Nutritionist, Division of Cancer Prevention, National Cancer Institute, National Institutes of Health, 9609 Medical Center Drive, Rockville, MD 20850. E-mail: trujille@mail.nih.gov

STATEMENT OF POTENTIAL CONFLICT OF INTEREST
No potential conflict of interest was reported by the authors.

FUNDING/SUPPORT
Support was provided by Park Nicollet Foundation and the Shoulak Breast Festival Funds; Oncology Dietetic Practice Group, Academy of Nutrition and Dietetics.

ACKNOWLEDGEMENTS
Analytic support: Jennifer A. Haberman; Cancer Registry: Jane E. Siekkinen; RCC Oncology: Kimberly J. Duffy RDN; Oncology Dietetic Practice Group, Academy of Nutrition and Dietetics Leadership.

AUTHOR CONTRIBUTIONS