RESEARCH
Original Research: Brief

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

https://doi.org/10.1016/j.jand.2020.11.007

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 $\geq$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.
J Acad Nutr Diet. 2021;121(5):925-930.

MALNUTRITION SCREENING HAS BEEN IDENTIFIED as a major limitation to assessing nutrition care in outpatient oncology centers,[1] and it is the position of the Academy of Nutrition and Dietetics that, based upon current evidence, the Malnutrition Screening Tool (MST) should be used to screen adults for malnutrition (undernutrition) regardless of their age, medical history, or setting.[2] Patients with cancer are among the most malnourished of all patient groups, with up to 80% receiving multimodal therapy experiencing unintentional weight loss.[3] In outpatient settings, more than half of patients being treated for cancer exhibit nutritional impairment at their first oncology visit.[4] The etiology of weight loss and malnutrition of the patient with cancer is often multifactorial and compounded by the toxic effects of treatments, physiological changes from the tumor, and/or the patient's response to the tumor.[5] Malnutrition correlates with a reduced tolerance and efficacy of treatment, increased risk for clinical and surgical complications, reduced quality of life, lower survival rates, longer hospital stays, and a concomitant increase in health care costs.[5,6]

Despite the negative health effects of malnutrition on patients with cancer, many patients at nutritional risk go unscreened and, therefore, undetected. In a study of patients with different types of cancer in which there was a 39% prevalence of malnutrition, 42% of patients who were malnourished received no nutrition counseling or interventions.[5] Many cancer centers (CCs) provide

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.[7] 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.[8] Once identified, at-risk individuals should receive a comprehensive and focused nutritional assessment by a trained nutritional professional, such as an RDN.[9] Without early and consistent malnutrition screening, the window to detect and favorably change the trajectory of a patient's nutritional care is lost.[7]

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,[10,11] it is not a standardized component of oncology care in the United States. Yet mandatory nutritional screening has been established in some countries.[12] 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.[12]

Nutrition screening tools generally include dietary intake, anthropometrics, comorbid disease state, and subjective assessment of body composition.[13] These methodologies require variable time commitments by nurses, physicians, RDNs, or other hospital staff.[13] To be efficient, screening must be brief, inexpensive, and highly sensitive and have good specificity.[12]

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.[14,15] The MST is one such tool. It is a quick and easy screening tool, requiring no blood samples, anthropometric measurements, or clinical examinations.[16] The MST has also been validated in the ambulatory oncology setting against the

RESEARCH SNAPSHOT

Research Question: Is it feasible to leverage the electronic health record (EHR) to operationalize and standardize malnutrition risk assessment across ambulatory cancer centers to identify patients at risk for malnutrition?

Key Findings: In 2 large outpatient cancer centers, 74% of patients were screened for malnutrition using the Malnutrition Screening Tool (MST) embedded into the EHR. An average of 5% and 12% of patients with cancer being treated medically and with radiation, respectively, were identified to be at nutritional risk with an MST score of $\geq$2. Malnutrition screening is critical in identifying high-risk patients that may otherwise go undetected.

A

Have you lost weight recently without trying?	
No	0
Unsure	2
If yes, how much weight (kilograms) have you lost?	
1-5	1
6-10	2
11-15	3
>15	4
Unsure	2
Have you been eating poorly because of a decreased appetite?	
No	0
Yes	1
Total	

B

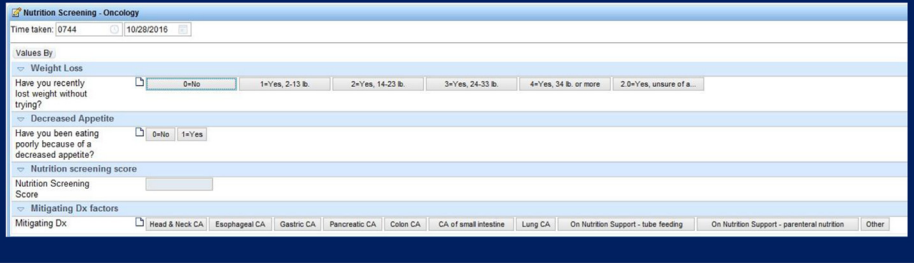

Figure 1. Malnutrition Screening Tool (MST). (A) MST; a cumulative score of 2 or more indicates patient at risk of malnutrition. (B) Screenshot of the MST questions embedded in an Electronic Health Record. Adapted with permission from: Ferguson M, Capra S, Bauer J, Banks M. Development of a valid and 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.[17,18] 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.[19]

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.[13] 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 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. De-identified data from unique monthly visits by outpatient 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 $\geq$2 on the MST, an automated Best Practice Alert was generated to initiate an approved standing MD order for a nutrition consultation with the oncology RDN. This order was automatically signed by the MD and sent to the RDN work queue. In addition, all patients who screened at risk ($\geq$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 $\geq$2 on MST. Specifically, 5% of patients treated in medical oncology departments and 12% of patients treated in radiation oncology departments scored $\geq$2 on MST (Table and Figure 3).

The trends over time for MST completion rate and number of patients with MST $\geq$ 2 also are reflected in Figures 2 and 3, respectively. A linear rise in MST completion rate was noted

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

Variables	All patients	Medical oncology	Radiation oncology
	←——— *n* ———→		
Unique patients	68,119	63,108	5011
	←——— *n (%)* ———→		
Completed MST screen	50,672 (74)	47,165 (75)	3507 (70)
MST ≥2	2752 (5)	2333 (5)	419 (12)
	←——— *n* ———→		
Mean MST ≥2/mo	131	111	20

[a]MST = Malnutrition Screening Tool.

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).

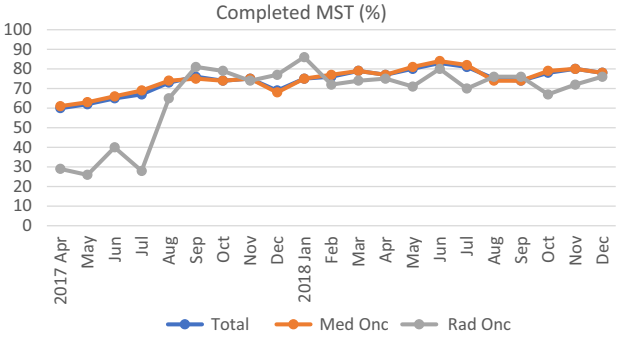

Figure 2. Malnutrition Screening Tool (MST) completed screening trends over a 20-month period. The average monthly MST completion rate was 74%, and the range was 60% to 80%.

DISCUSSION

The Academy of Nutrition and Dietetics supports the use of a single, validated tool, the MST, to screen adults for malnutrition.[2] This QAPI found that incorporating the MST into the EHRs to standardize malnutrition screening is feasible across 2 community CCs. Additionally, the high MST completion rates of almost 75% over a 20-month period indicates that once embedded in the EHR, completion of this tool is sustainable in outpatient CCs.

Following administrative and medical staff approval, the integration of the MST into the EHR patient intake assessment was easily accomplished by the EHR team and provided the opportunity to examine the need and capacity for full integration of nutritional care into ambulatory CCs. Based on the high MST completion rate, 131 patients per month were identified as at risk for malnutrition in these 2 large CCs. Extrapolated to an ideal setting in which 100% of the patients obtained MST screening, approximately 175 patients per month (or 8.7 patients per day based on a 5-day workweek) would be at risk for malnutrition. Based on our previous findings that oncology RDNs evaluate or counsel an average of 7.4 patients in an 8-hour workday,[7] 1.2 RDN full-time equivalents would be required to provide proactive nutritional counseling to those patients identified at risk for malnutrition. Note this conservative estimate does not account for ongoing or follow-up nutritional services.

In this project, we found the average rate of malnutrition risk was 5% in patients treated in medical oncology departments and 12% of patients treated in radiation oncology departments. These rates differ from other data reported in the literature. In adult outpatient settings receiving oncology-specific treatment for malignant neoplasms, the MST detected 28% of patients to be at risk of malnutrition.[6] The prevalence of malnutrition is associated with tumor type, and the documented range is 62% in upper gastrointestinal cancer to 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.[20] 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.

Although consistent nutritional screening is critical for the early identification and treatment of patients who are at risk for malnutrition or who are already malnourished, a recent national survey indicated that only 53% of CCs routinely screened for malnutrition; of the 53% who screened, approximately 35% used unvalidated tools.[7] 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.[2]

The MST has demonstrated good validity and reliability in identifying patients at risk of malnutrition in the oncology setting.[17] 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.[6,14,18,21-23] Of these tools, the MST is the quickest and easiest.[16] The MST requires a clinician to interview the patient without altering the verbiage of the 2 questions nor the scoring system for referrals as originally presented. Adding items, modifying questions, or interpreting scores differently must be avoided, as any changes invalidate the MST tool.[2]

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.[7] In a study of patients with cancer in which half were being treated as an outpatient, 70% 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

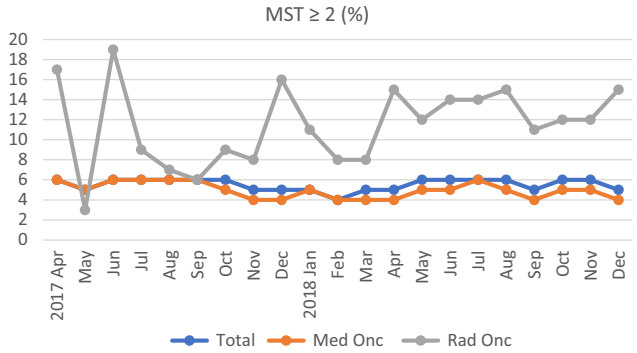

Figure 3. Trend of percentage of patients scoring ≥2 on the Malnutrition Screening Tool (MST) over a 20-month period. On average, 5% of the total patient population scored ≥2 on MST; 5% of patients treated in medical oncology (Med onc) departments and 12% of patients treated in radiation oncology (Rad onc) departments scored ≥2 on MST.

significantly more outpatients were more likely to have missed earlier referral opportunities.[24]

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.[25] 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.[4] 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.[25] 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.[24]

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

1. National Academies of Sciences Engineering and Medicine. *Examining Access to Nutrition Care in Outpatient Cancer Centers: Proceedings of a Workshop*. Washington, DC: The National Academies Press; 2016.
2. Skipper A, Coltman A, Tomesko J, et al. Position of the Academy of Nutrition and Dietetics: Malnutrition (undernutrition) screening tools for all adults. *J Acad Nutr Diet*. 2020;120:709-713.
3. Ryan AM, Power DG, Daly L, Cushen SJ, Ni Bhuachalla E, Prado CM. Cancer-associated malnutrition, cachexia and sarcopenia: the skeleton in the hospital closet 40 years later. *Proc Nutr Soc*. 2016;75:199-211.
4. Muscaritoli M, Lucia S, Farcomeni A, et al. Prevalence of malnutrition in patients at first medical oncology visit: The PreMiO study. *Oncotarget*. 2017;8:79884-79896.
5. Hebuterne X, Lemarie E, Michallet M, Beauvillain de Montreuil C, Schneider SM, Goldwasser F. Prevalence of malnutrition and current use of nutrition support in patients with cancer. *JPEN J Parenter Enteral Nutr*. 2014;38:196-204.
6. Arribas L, Hurtos L, Sendros MJ, et al. NUTRISCORE: A new nutritional screening tool for oncological outpatients. *Nutrition*. 2017;33:297-303.
7. Trujillo EB, Claghorn K, Dixon SW, et al. Inadequate nutrition coverage in outpatient cancer centers: Results of a national survey. *J Oncol*. 2019;2019:1-8.
8. Kruizenga HM, Van Tulder MW, Seidell JC, Thijs A, Ader HJ, Van Bokhorst-de van der Schueren MA. Effectiveness and cost-effectiveness of early screening and treatment of malnourished patients. *Am J Clin Nutr*. 2005;82:1082-1089.
9. Phillips W, Zechariah S. Minimizing false-positive nutrition referrals generated from the malnutrition screening tool. *J Acad Nutr Diet*. 2017;117:665-669.
10. American College of Surgeons. Optimal Resources for Cancer Care 2020 Standards. American College of Surgeons Commission on Cancer; Chicago, IL. https://www.facs.org/quality-programs/cancer/coc/standards/2020. Accessed December 7, 2020.
11. Association of Community Cancer Centers. Rockville, MD: Association of Community Cancer Centers; April 4, 2020. https://www.accc-cancer.org/. Accessed November 30, 2020.
12. Arends J, Bachmann P, Baracos V, et al. ESPEN guidelines on nutrition in cancer patients. *Clin Nutr*. 2017;36:11-48.
13. Phillips CA, Bailer J, Foster E, et al. Implementation of an automated pediatric malnutrition screen using anthropometric measurements in the electronic health record. *J Acad Nutr Diet*. 2019;119:1243-1249.

14. Academy of Nutrition and Dietetics. Evidence Analysis Library. Oncology. https://www.andeal.org/topic.cfm?menu=529. Accessed November 21, 2018; 2013.
15. Thompson KL, Elliott L, Fuchs-Tarlovsky V, Levin RM, Voss AC, Piemonte T. Oncology evidence-based nutrition practice guideline for adults. *J Acad Nutr Diet*. 2017;117:297-310.e247.
16. van Bokhorst-de van der Schueren MA, Guaitoli PR, Jansma EP, de Vet HC. Nutrition screening tools: Does one size fit all? A systematic review of screening tools for the hospital setting. *Clin Nutr*. 2014;33:39-58.
17. Isenring E, Cross G, Daniels L, Kellett E, Koczwara B. Validity of the malnutrition screening tool as an effective predictor of nutritional risk in oncology outpatients receiving chemotherapy. *Support Care Cancer*. 2006;14:1152-1156.
18. Ni Bhuachalla EB, Daly LE, Power DG, Cushen SJ, MacEneaney P, Ryan AM. Computed tomography diagnosed cachexia and sarcopenia in 725 oncology patients: Is nutritional screening capturing hidden malnutrition? *J Cachexia Sarcopenia Muscle*. 2018;9:295-305.
19. 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.
20. Marshall KM, Loeliger J, Nolte L, Kelaart A, Kiss NK. Prevalence of malnutrition and impact on clinical outcomes in cancer services: A comparison of two time points. *Clin Nutr*. 2019;38:644-651.
21. Abbott J, Teleni L, McKavanagh D, Watson J, McCarthy AL, Isenring E. Patient-Generated Subjective Global Assessment Short Form (PG-SGA SF) is a valid screening tool in chemotherapy outpatients. *Support Care Cancer*. 2016;24:3883-3887.
22. Kim JY, Wie GA, Cho YA, et al. Development and validation of a nutrition screening tool for hospitalized cancer patients. *Clin Nutr*. 2011;30:724-729.
23. Harada K, Ochi K, Taguchi T, et al. Validity of the short nutritional assessment questionnaire for Japanese patients with cancer undergoing outpatient chemotherapy. *J Med Invest*. 2017;64:117-121.
24. Lorton CM, Griffin O, Higgins K, et al. Late referral of cancer patients with malnutrition to dietitians: A prospective study of clinical practice. *Support Care Cancer*. 2020;28:2351-2360.
25. Mendes NP, Barros TA de, Rosa C de OB, Franceschini S do CC. Nutritional screening tools used and validated for cancer patients: A systematic review. *Nutr Cancer*. 2019;71:898-907.

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 Frauenshuh 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

A. C. Shapiro, S. J. Johnson, and A. R. Zimmerman collected the data. N. Stephens, S. J. Johnson, A. R. Zimmerman, A. C. Shapiro, and C. K. Spees analyzed the data. E. B. Trujillo wrote the first draft with contributions from A. C. Shapiro, N. Stephens, J. B. Mills, S. J. Johnson, A. R. Zimmerman, and C. K. Spees. All authors reviewed and commented on the subsequent drafts.