Predictors of cancer rehabilitation medicine referral and utilization based on the *Moving Through Cancer* physical activity screening assessment

Rachelle Brick[1,2] · Akina Natori[3] · Patricia I. Moreno[2] · Diana Molinares[4] · Tulay Koru-Sengul[2,5] · Frank J. Penedo[3,6]

Abstract

Purpose Cancer survivors experience high rates of physical inactivity that often go unaddressed. The My Wellness Check program (*MWC*) is an EHR-integrated screening and referral system that includes surveillance of physical activity and triage to cancer rehabilitation medicine services. This study examined assessment of physical activity and subsequent referrals to cancer rehabilitation medicine.

Methods A secondary analysis was performed for survivors who completed the *MWC* between April 2021 and January 2022. Univariable and multivariable logistic regression modeled determinants of qualification for a physical activity referral and provider completion of referral to cancer rehabilitation medicine. Referral was based on responses to the *Moving Through Cancer* questionnaire. Adjusted odds ratios (aOR) and corresponding 95% confidence intervals (95% CI) were calculated.

Results There were 1,174 survivors who completed the assessment, of which 46% ($n = 540$) reported physical inactivity. After controlling for group differences, individuals with moderate-severe physical dysfunction (aOR: 1.750; 95% CI: 1.137, 2.693) had higher odds, and self-reporting Hispanic or Latino ethnicity (aOR: 0.720; CI: 0.556, 0.932) had lower odds of physical inactivity. Only 31% ($n = 168$) received a completed physician referral to cancer rehabilitation medicine following identification of physical inactivity. No patient-level factors were associated with receiving a physician referral. Following referral, 8% ($n = 13$) utilized cancer rehabilitation medicine services.

Conclusions Patient-level and clinical factors may predict qualification for physical activity referrals; however, they don't appear to predict referral completion to cancer rehabilitation medicine. Future research should focus on potential provider- and organization-level factors that interact and influence access to cancer rehabilitation medicine services.

Keywords Patient-reported outcomes · Cancer rehabilitation · Oncology · Supportive care · Symptom monitoring · Physical activity

✉ Rachelle Brick
rachelle.brick@nih.gov

1 Cancer Prevention Fellowship Program, Division of Cancer Prevention, National Cancer Institute, Rockville, MD, USA

2 Department of Public Health Sciences, Miller School of Medicine, University of Miami, Miami, FL, USA

3 Division of Medical Oncology, Department of Medicine, Miller School of Medicine, FL, Miami, USA

4 Department of Physical Medicine and Rehabilitation, Miller School of Medicine, University of Miami, Miami, FL, USA

5 Sylvster Comprehensive Cancer Center, Miami, FL, USA

6 Department of Psychology, University of Miami, Miami, FL, USA

Background

Adults with a history of cancer are at risk of short-term, long-term, and late-onset physical and psychosocial impairments [1] that can limit functioning in life roles [2] and reduce quality of life [3]. Engagement in physical activity and rehabilitation services have the potential to improve individuals' functioning from cancer diagnosis through survivorship [4, 5]. Historically, assessment of these physical needs and use of rehabilitation services to improve physical activity remains limited in ambulatory oncology settings [6]. Barriers to the timely receipt of cancer rehabilitation services and exercise prescription exist at the level of the patient, provider, system, payer, and policy. Missed opportunities to prevent and manage cancer-related disability are often due to lags in early identification of functional decline, limited discussion surrounding physical activity, or lack of timely referral to cancer rehabilitation [1, 7–9]. At the patient-level, cancer survivors may have difficulty articulating or identifying pre-clinical disablement or physical inactivity [8]. Likewise, healthcare providers share reduced confidence in exercise prescription and/or may not prioritize education about physical activity. Furthermore, electronic health record (EHR) systems often lack screening and surveillance of symptoms [10], as well as algorithms to improve referral efficiency [11, 12]. A culmination of barriers at each level leads to under-reported symptoms, deteriorating function, and greater burden on health care systems such as higher rates of hospitalization [13].

The *My Wellness Check* (*MWC*) program was created in part to overcome multi-level barriers to access and delivery of quality cancer survivorship care in an urban academic medical center [14]. Initiated as a quality improvement project, *MWC* integrates patient-reported outcomes (PROs) in EHR systems to routinely assess physical and emotional symptoms associated with cancer- and cancer-related treatments. If the survivor reports a moderate-to-severe symptom, the individual will be triaged to medical and supportive care services based on best practice guidelines [14, 15]. Delivered in English and Spanish languages, it is considered the first ambulatory oncology program to capture EHR-integrated PROs such as Patient-Reported Outcomes Measurement Information System (PROMIS®) computerized adaptive tests (CATs) [16] linked with supportive care referrals for Spanish-speaking individuals [14].

MWC includes surveillance of physical activity and subsequent referral to cancer rehabilitation medicine services. Cancer rehabilitation medicine is defined as evaluation or treatment of functional decline and physical impairments by a licensed physiatrist who has completed a fellowship in cancer rehabilitation medicine or has expertise in managing impairments and disability in cancer survivors. Physical inactivity is a known risk factor for cancer development, cancer-related disability, and other adverse cancer-related outcomes [5]. Exercise or rehabilitation interventions to improve physical activity must consider the survivors' functional level to be safe and effective [17, 18]. The *MWC* program 1) identifies physical inactivity-related risk based on the *Moving Through Cancer* Oncology Clinicians' Guide to Referring Patients to Exercise two-item questionnaire [18, 19], 2) alerts the oncology care team of physical inactivity when opening a patient chart via a best practice alert (BPA), and 3) guides the clinician to select the appropriate intervention considering if an individual is suitable for exercise outside of supervision by a health care professional (Fig. 1). Since there are limited tools to aid in decision-making for cancer-related exercise or rehabilitation, *Moving Through Cancer* Oncology Clinicians' Guide to Referring Patients to Exercise was implemented based on its evidence- and stakeholder-driven development, limited response burden, and alignment to the American College of Sports Medicine physical activity guidelines [18].

After receiving the BPA, clinicians are presented with a decision tree to facilitate selection of an appropriate physical activity intervention. The clinician will review the survivors' current functional status using the Eastern Cooperative Oncology Group Performance Status Scale (ECOG) as recommended by the *Moving Through Cancer* oncology clinician guide [18, 20]. If the cancer survivor is ambulatory and capable of all self-care tasks (ECOG Scores of 0–2), the individual is suitable for exercise without supervision by a healthcare professional. In this case, the provider is encouraged to provide the cancer survivor with educational materials to promote physical activity. If the cancer survivor displays difficulty with ambulation and needs assistance withs self-care tasks (ECOG Score ≥ 3), the provider is prompted to refer the cancer survivor to cancer rehabilitation medicine for evaluation and appropriate medical clearance to a prescribed exercise program. To date, evaluation of this screening-referral pathway has not been examined to ensure appropriate access and delivery of cancer rehabilitation medicine services.

The purpose of this study was three-fold. First, we described and analyzed the demographic, clinical characteristics, and PROs of ambulatory oncology patients who do and do not qualify for referral to cancer rehabilitation medicine based on the *Moving Through Cancer* physical activity screen. Furthermore, we examined predictive factors for cancer rehabilitation medicine referral beyond physical activity and ECOG performance status. Second, we examined patient-level factors that may influence the odds of a
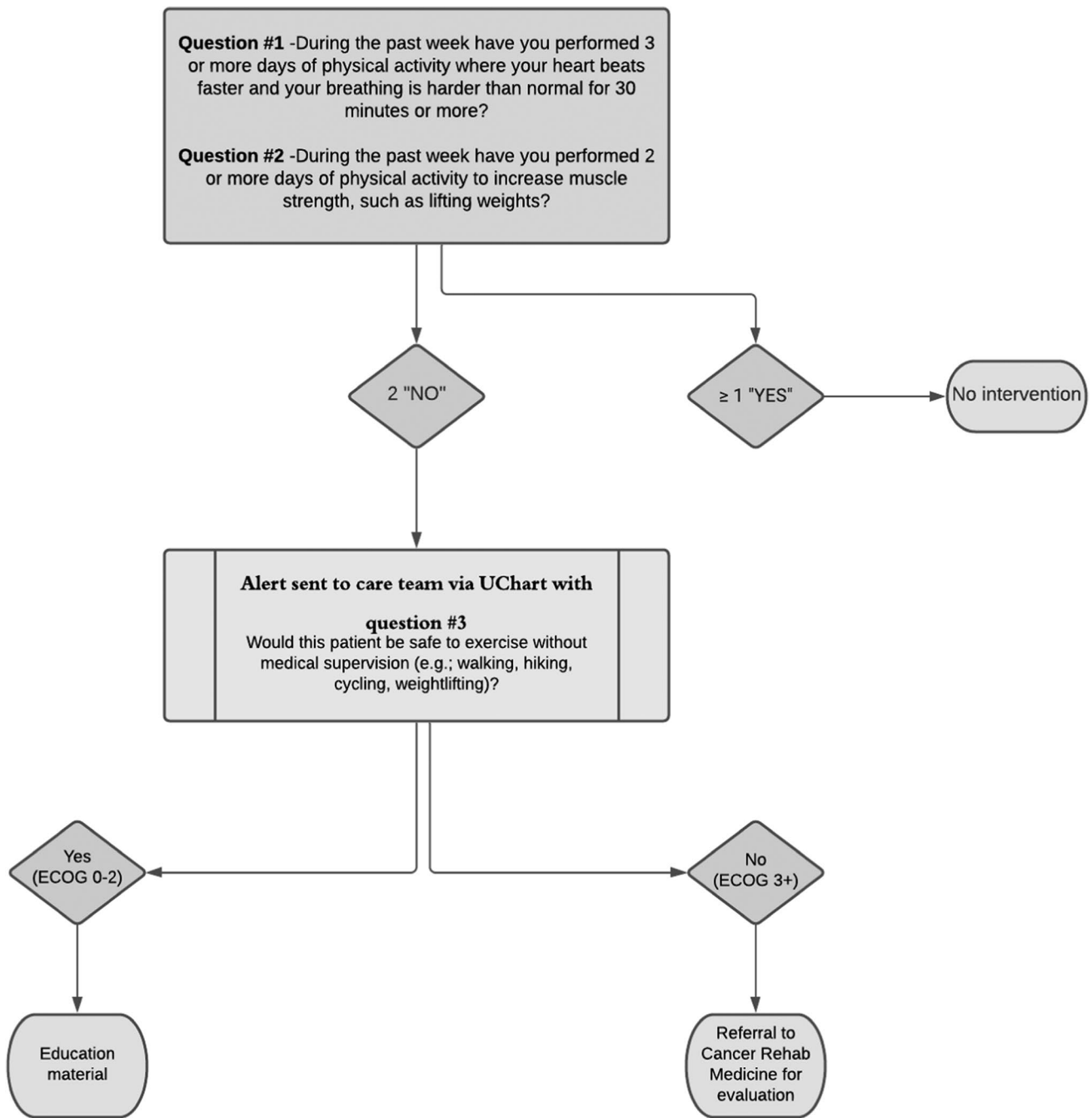
Question #1 -During the past week have you performed 3 or more days of physical activity where your heart beats faster and your breathing is harder than normal for 30 minutes or more?

Question #2 -During the past week have you performed 2 or more days of physical activity to increase muscle strength, such as lifting weights?

2 "NO"

≥ 1 "YES"

No intervention

Alert sent to care team via UChart with

question #3
Would this patient be safe to exercise without medical supervision (e.g.; walking, hiking, cycling, weightlifting)?

Yes (ECOG 0-2)

No (ECOG 3+)

Education material

Referral to Cancer Rehab Medicine for evaluation

Fig. 1 *Moving through Cancer* physical activity survey questions and electronic health record alert flow chart

cancer survivor receiving a completed cancer rehabilitation medicine referral. Lastly, we evaluated the prevalence of cancer rehabilitation medicine utilization following referral. This analysis provides important insights into access and delivery of cancer rehabilitation medicine services, including recommendations to strengthen physical activity referral pathways and system-level processes.

Methods

Program description

MWC is applicable for all patients affiliated with the academic medical center who have an International Classification of Diseases, Tenth Revision cancer diagnosis, at

least a scheduled second ambulatory oncology appointment, and who opt in for the *MWC* program. Patients were contacted through a preferred method of communication (I.e., text, e-mail, or the patient portal) 72 hours before their appointment and asked to complete the *MWC* assessments. Patients completed responses to multiple self-report questionnaires. PROMIS CATs captured symptom severity of depression, anxiety, fatigue, pain interference, and physical function in their preferred language [16]. PROMIS® CATs were treated as dichotomous variable based on the patient reporting moderate-severe symptom severity or none-mild symptom severity. Thresholds for moderate-severe severity include T-scores at a ≥ 70 for pain interference and fatigue, ≥ 65 for anxiety, ≥ 60 for depression, and ≤ 30 for physical function [21]. Quality of life was captured using the Functional Assessment of Cancer Therapy – General 7 [22]. The *Moving through Cancer* screening [18, 19] captured patient-reported physical activity levels through yes–no questions: 1) During the past week have you performed three or more days of physical activity where your heart beats faster and your breathing is harder than normal for 30 min or more?; and 2) During the past week have you performed two or more days of physical activity to increase muscles strength, such as lighting weights? If a survivor responded "no" to both questions, a BPA was sent to the medical team via electronic health record system, denoting the survivor was not meeting recommended physical activity requirements [5, 19]. Following the BPA, the clinician could respond by either 1) provide a referral to cancer rehabilitation medicine services if the individual's overall ECOG functional status was not suitable for exercise without supervision by a healthcare professional, or 2) temporarily dismiss the alert (Fig. 1).

Study design

This is a secondary data analysis of cancer survivors who participated in the *MWC* program as part of their ambulatory oncology care between April 15, 2021 through January 31, 2022. Additional details of the survey design, recruitment procedures, and implementation of the program were published in earlier work [14, 23–25]. Ethical approval of this study was provided by the University of Miami Institutional Review Board (Protocol#20211220; PI: Penedo).

Participants and procedures

To assemble the study sample, we included individuals who participated in the broader *MWC* program with the following criteria: 1) Partial or full completion of at least one *MWC* program PRO assessment battery; and 2) Complete data responses on the 2-item *Moving Through Cancer*

questionnaire between April 2021 and January 2022. Complete data on the *Moving Through Cancer* questionnaire was required as the combination of responses triggered the specific physical activity BPA for intervention. For participants who had a record of more than one survey submission during the course of their cancer care, the first survey submission was selected for analysis.

Potential determinants of rehabilitation medicine referral

A combination of sociodemographic, clinical characteristics, and PROs were extracted as explanatory variables. Self-reported sociodemographic information extracted from EHR includes age, sex, race, ethnicity, preferred language, marital status, the NCI Comorbidity Index [21, 22], and insurance coverage. Clinical characteristics of survivors included initial cancer diagnosis, time since diagnosis (years), and history of cancer-related treatments. Initial cancer diagnosis was categorized in two ways: 1) solid tumor or hematologic; and 2) cancer type (breast, colorectal, genitourinary, gynecological, head and neck, hematologic, lung, melanoma, prostate, stomach and esophagus, thyroid, other). Patient reported outcomes of survivors accounted for cancer-related pain, fatigue, physical function, depression, anxiety, and quality of life.

Outcome variables

Each study objective had a different outcome of interest (Fig. 1). The first outcome of interest was based on reported physical activity levels from the screening. The second outcome of interest was cancer rehabilitation medicine referral completion. Lastly, we reviewed the number of individuals that utilized cancer rehabilitation services following referral. Utilization of cancer rehabilitation medicine services was a dichotomous variable based on whether the patient received a cancer rehabilitation medicine consult, evaluation, or treatment at Sylvester Comprehensive Cancer Center following physician referral through *MWC* program.

Data analysis

Data for the *MWC* program was extracted from the electronic data warehouse at the University of Miami Miller School of Medicine. Service utilization was based on national provider identifiers and medical claims associated with the two cancer physiatrists affiliated with the health care system. For each objective, demographic and clinical characteristics were analyzed by t-test and chi-squared test, or non-parametric alternative as appropriate. Models were developed using forward stepwise selection techniques based on the Akaike Information Criterion to examine determinants of both outcomes of interest with

prespecified level of significance for univariate models ($p \leq 0.30$) and multivariate ($p \leq 0.05$). Furthermore, the multivariable model was then tested to evaluate regression estimates while controlling for significant groups differences. The odds ratio (OR) with 95% confidence intervals (95% CI) were computed as well. All statistical analyses were performed using SAS version 9.4 statistical software (SAS Institute, Cary, NC).

Results

Between April 15, 2021 and January 31, 2022, there were 1,461 cancer survivors who completed at least one *MWC* survey in either Spanish or English. Due to incomplete data on the physical activity questionnaire, 287 survivors were excluded. The final sample included 1,174 individuals (Table 1). More than half of the sample was composed of individuals identifying as male (59%, $n = 695$) or who were greater than or equal to 65 years old (57%, $n = 668$). The sample was predominantly White (89%, $n = 1,044$) and 35% was Hispanic or Latino ($n = 413$). Patients primarily had a solid tumor as an initial cancer diagnosis (79%, $n = 929$) inclusive but not limited to lung (17%, $n = 207$), prostate (15%, $n = 178$), head and neck (12%, $n = 143$), and colorectal (9%, $n = 99$). Seventeen percent ($n = 203$) of the sample had an initial diagnosis of hematologic origin. Most patients received chemotherapy (58%, $n = 679$) as a part of their cancer-related treatment. Patients received healthcare coverage through commercial insurance plans (62%, $n = 728$), public or government-assisted programs (36%, $n = 425$, or self-pay (2%, $n = 21$). Overall, the sample had an average NCI Comorbidity Index Score of 1.7 (Standard Deviation (SD) = 2.0).

Physical activity alerts

Based on responses to the physical activity screening, 540 (46%) triggered a physical activity alert (Table 1). There were significant differences between the group of individuals reported adequate physical activity and those did not. Patients who triggered an alert had a higher proportion of individuals reporting moderate-severe depressive symptoms ($p = 0.0167$), moderate-severe pain ($p = 0.005$), moderate-severe fatigue (p < 0.001), moderate-severe physical function (p < 0.001), and worse reported health-related quality of life (p < 0.001). The group who did not trigger an alert had a significantly higher proportion of males (p < 0.0017) and individuals who preferred Spanish as a primary language ($p = 0.0002$).

Univariate analysis of baseline characteristics associated with qualifying for a physical activity referral are found in Table 2. Sex, depressive symptoms, fatigue, pain interference, physical function, and quality of life were significantly associated with qualifying for a physical activity referral. After adjusting for group differences, the model revealed two factors that were independently associated with qualifying for a physical activity alert: physical function and ethnicity (Table 2). Individuals who reported moderate-severe physical function were 75% more likely to trigger a physical activity alert (Adjusted odds ratio [aOR]: 1.75; 95% CI: 1.137, 2.693). Individuals who identified as Hispanic or Latino were approximately 78% less likely to report physical inactivity (aOR = 0.720, 95% CI: 0.556, 0.932) compared to individuals identifying as Non-Hispanic or Latino.

Cancer rehabilitation referral completion

Of the 540 individuals that prompted a physical activity alert, only 168 (31%) were provided with a completed physician referral for a cancer rehabilitation medicine consultation. Completed referrals originated from 57 unique providers across the medical center. Frequency of referral by provider ranged 1 – 12 times. Interestingly, there were no significant differences regarding demographic or clinical characteristics, or PROs between those who received a completed referral and those who had the physical activity alert dismissed (Table 3).

In univariable analyses, there were no significant predictors associated with receiving a completed referral to cancer rehabilitation medicine services (Table 4). When conducting the forward stepwise multiple logistic regression with parameters of p < 0.3 for entry and p < 0.05 for factors to remain in the model, there were no factors that significantly predicted completion of referral versus cancellation (Table 4). As an exploratory analysis, we enlarged the stay parameter to p < 0.1. In this model, moderate-severe pain interference (OR:0.446, 95% CI: 0.179, 1.110), older age (OR: 0.705, 95% CI: 0.478, 1.039), and history of radiation therapy (0.737, 95% CI: 0.494, 1.100) provided good model fit ($\chi^2 = 0.0089$, df = 1, $p = 0.9250$); however, these factors only trended toward significance (Table 4).

Utilization of Cancer Rehabilitation Medicine Following Referral. Of the 168 individuals received a physician referral, 13 (8%) utilized cancer rehabilitation medicine services. Six additional individuals had been scheduled for an evaluation, however, five cancelled the appointment and did not reschedule, and one individual did not show to the appointment.

Table 1 Patient characteristics of individuals who completed the physical activity questionnaire in *My Wellness Check* program

Variable	Total Sample (n=1174)	No Physical Activity Alert (n=634, 54%)	Trigger Physical Activity Alert (n=540, 46%)	p-value
Sex, Male, n (%)	695 (59)	397 (63)	298 (45)	**0.0017**
Age (years), n (%)				0.8818
< 65 years	506 (43)	272 (43)	234 (43)	
≥ 65 years	668 (57)	362 (57)	306 (57)	
Mean (SD)	65.8 (12.1)	65.6 (11.9)	66.0 (12.3)	
Median (Minimum, Maximum)	67 (20 – 96)	67 (20–93)	67 (21–96)	
Race, n (%)				0.4267
White	1044 (89)	567 (89)	477 (88)	
Black or African American	112 (10)	60 (10)	52 (10)	
Asian or Other	18 (1)	7 (1)	11 (2)	
Ethnicity, n (%)				**0.0330**
Hispanic or Latino	413 (35)	240 (38)	173 (32)	
Non-Hispanic or Latino	714 (61)	368 (48)	346 (64)	
Missing	47 (4)	26 (4)	21 (4)	
Preferred Language, n (%)				**0.0002**
English	222 (19)	489 (77)	463 (86)	
Spanish	952 (81)	145 (23)	77 (14)	
Marital Status, n (%)				0.2172
Single	173 (15)	89 (14)	84 (16)	
Married or Partnered	792 (68)	425 (67)	367 (68)	
Divorced, Widowed, or Separated	197 (17)	116 (18)	81 (15)	
Other/Unknown	12 (1)	4 (1)	8 (1)	
Insurance, n (%)				0.8157
Commercial or Non-Governmental	728 (62)	394 (62)	334 (62)	
Public or Governmental	425 (36)	227 (36)	198 (37)	
Self-Pay	21 (2)	13 (2)	8 (1)	
Initial Cancer Diagnosis, n (%)				0.6933
Solid Tumor	922 (79)	492 (78)	430 (80)	
Hematologic Tumor	203 (17)	115 (18)	88 (16)	
Unknown or Missing	49 (4)	27 (4)	22 (4)	
Cancer Therapies Received:				
Radiation, n (%)	449 (38)	240 (38)	209 (39)	0.7655
Chemotherapy, n (%)	679 (58)	351 (55)	328 (60)	0.4686
Surgery, n (%)	554 (47)	293 (46)	261 (48)	0.0629
PROMIS® Anxiety, Moderate-Severe, n(%)	82 (7)	46 (4)	36 (3)	0.6932
PROMIS® Depression, Moderate-Severe, n(%)	109 (9)	47 (4)	62 (5)	**0.0167**
PROMIS® Fatigue, Moderate-Severe, n(%)	93 (8)	31 (5)	62 (12)	**<.0001**
PROMIS® Pain, Moderate-Severe, n(%)	50 (4)	15(1)	35 (3)	**0.0005**
PROMIS® Physical Function, Moderate-Severe, n(%)	143 (12)	53 (8)	90 (17)	**<.0001**
Quality of Life	19.2 (5.7)	19.8 (5.6)	18.4 (5.8)	**<.0001**
Time Since Initial Diagnosis (years)	3.0 (3.13)	3.04 (3.10)	2.84 (3.14)	0.3003
NCI Comorbidity Index	1.7 (2.0)	1.59 (1.97)	1.82 (2.11)	0.0534

Patient-reported outcomes of moderate-severe threshold are based T-scores at ≥ 70 for pain interference and fatigue, ≥ 65 for anxiety, ≥ 60 for depression, and ≤ 30 for physical function. Not all respondents had complete data on PRO data. PROMIS® measures, Time since Initial Diagnosis, and Quality of Life are based on the following sample sizes (n): PROMIS® Anxiety: 1133; PROMIS® Depression: 1133; PROMIS® Fatigue: 1150; PROMIS® Pain: 1139; PROMIS® Physical Function: 1149; Time Since Initial Diagnosis: 1157; Quality of Life: 1122

Abbreviations: PROMIS®: Patient-Reported Outcomes Measurement Information System; NCI: National Cancer Institute; SD: standard deviation

Bold font represents statistically signficiant findings

Table 2 Risk factors associated with a physical activity alert among *My Wellness Check* participants

Unadjusted Univariable Risk Factor	OR (95% CI)	p-value
Sex: Female vs. Male	1.360 (1.077,1.719)	**0.0099**
Age: ≥ 65 years vs. < 65 years	0.983 (0.779, 1.239)	0.8818
Race:		
Black or African American vs. White	1.030 (0.697, 1.523)	0.8814
Asian or Other vs. White	1.868 (0.718, 4.856)	0.1999
Ethnicity: Hispanic or Latino vs. Non-Hispanic or Latino	0.767 (0.600, 0.979)	**0.0331**
Marital Status:		
Married or Partner vs. Single	0.915 (0.658, 1.272)	0.5699
Divorced, Widowed, or Separated vs Single	0.740 (0.490, 1.117)	0.1514
Insurance: Public or Governmental Insurance vs. Private or Non-Governmental Insurance	1.029 (0.809, 1.308)	0.8157
Treatments Received:		
Chemotherapy vs. No Chemotherapy	1.247 (0.988, 1.575)	0.0631
Surgery vs. No Surgery	1.089 (0.865, 1.370)	0.4686
Radiation vs. No Radiation	1.037 (0.819, 1.313)	0.7654
PROMIS® Anxiety: Moderate-Severe vs. None-Mild	1.095 (0.697, 1.721)	0.6943
PROMIS® Depression: Moderate-Severe vs. None-Mild	1.620 (1.088, 2.411)	**0.0175**
PROMIS® Fatigue: Moderate-Severe vs. None-Mild	2.523 (1.613, 3.947)	**< 0.001**
PROMIS® Pain: Moderate-Severe vs. None-Mild	2.859 (1.544, 5.294)	**0.0008**
PROMIS® Physical Function: Moderate-Severe vs. None-Mild	2.192 (1.528, 3.146)	**< 0.001**
FACT-G7 Quality of Life	0.957 (0.938, 0.977)	**< .0001**
Time Since Diagnosis (years)	0.975 (0.939, 1.012)	0.1791
NCI Comorbidity Index	1.057 (0.999,1.118)	0.0540
Stepwise logistic regression adjusting for group differences		
PROMIS® Fatigue: Moderate-Severe vs. None-Mild	1.619 (0.937, 2.795)	0.0840
PROMIS® Physical Function: Moderate-Severe vs. None-Mild	1.750 (1.137, 2.693)	**0.0109**
FACT-G7 Quality of Life	0.981 (0.956, 1.007)	0.1515
Ethnicity: Hispanic or Latino vs. Non-Hispanic or Latino	0.720 (0.556, 0.932)	**0.0126**
PROMIS® Depression: Moderate-Severe vs. None-Mild	1.000 (0.621, 1.610)	0.9989
PROMIS® Pain: Moderate-Severe vs. None-Mild	1.674 (0.810, 3.461)	0.1645
Sex: Female vs. Male	1.232 (0.958, 1.585)	0.1041

Unadjusted univariable logistic regression used all observations except for the following variables due to missing data PROMIS® Anxiety: 1133; PROMIS® Depression: 1133; PROMIS® Fatigue: 1150; PROMIS® Pain: 1139; PROMIS® Physical Function: 1149; Time Since Initial Diagnosis: 1157; Quality of Life: 1122. Adjusted multivariable models excluded a total of 192 individuals due to missing data on explanatory variables

Abbreviations: PROMIS®: Patient-Reported Outcomes Measurement Information System; CI: Confidence Interval; NCI: National Cancer Institute; OR: Odds Ratio

Bold font represents statistically signficiant findings

Discussion

There has been a call to action to test models of care that enhance access to survivorship services, such as cancer rehabilitation medicine [26, 27]. The *MWC* program was responsive to this call by creating an EHR-integrated screening and referral system to facilitate patient-provider conversations about physical activity, as well as generate cancer rehabilitation medicine referrals. This study was one of the first studies to implement the *Moving Through Cancer* screening and triage tool in an academic medical center to promote compliance with physical activity guidelines [18, 19]. Our findings revealed that nearly half of cancer survivors reported physical inactivity and that these individuals were likely to report moderate-to-severe fatigue and physical dysfunction. Furthermore, only 31% of individuals received a completed referral to cancer rehabilitation medicine, yet there were no significant determinants that predicted this relationship. These findings present an opportunity to refine existing pathways and overcome barriers to rehabilitation access and utilization.

Table 3 Patient characteristics of individuals who received a completed referral to cancer rehabilitation following physical activity alert in *My Wellness Check* program

Variable	Total Sample (n = 540)	Referral Cancelled (n = 372)	Referral Completed (n = 168)	*p*-value
Sex, Male, n (%)	298 (55)	205 (55)	93 (55)	0.9569
Age (years), n (%)				0.0557
< 65 years	234 (43)	151 (41)	83 (49)	
≥ 65 years	306 (57)	221 (59)	85 (51)	
Mean (SD)	66.0 (12.3)	66.1 (11.9)	65.8 (13.1)	
Median (Minimum, Maximum)	67 (21–96)	68 (21–90)	65 (26 – 96)	
Race, n (%)				0.5591
White	477 (88)	325 (87)	152 (91)	
Black or African American	52 (10)	38 (10)	14 (8)	
Asian or Other	11 (2)	9 (3)	2 (1)	
Ethnicity, n (%)				0.3150
Hispanic or Latino	176 (33)	114 (31)	59 (35)	
Non-Hispanic or Latino	346 (64)	243 (65)	103 (61)	
Missing	21 (3)	15 (4)	6 (4)	
Preferred Language, n (%)				0.7995
English	463 (86)	318 (85)	145 (86)	
Spanish	77 (14)	54 (15)	23 (14)	
Marital Status, n (%)				0.5782
Single	84 (16)	57 (15)	27 (16)	
Married or Partnered	367 (68)	252 (68)	115 (69)	
Divorced, Widowed, or Separated	81 (15)	59 (16)	22 (13)	
Other/Unknown	8 (1)	4 (1)	4 (2)	
Insurance, n (%)				.1770
Commercial or Non-Governmental	334 (62)	222 (60)	112 (67)	
Public or Governmental	198 (37	143 (38)	55 (32)	
Self-Pay	8 (1)	7 (2)	1 (1)	
Initial Cancer Diagnosis, n (%)				0.9273
Solid Tumor	430 (81)	295 (79)	135 (80)	
Hematologic Tumor	88 (17)	62 (17)	26 (16)	
Unknown or Missing	15 (2)	15 (4)	7 (4)	
Cancer Therapies Received:				
Radiation, n (%)	209 (39)	152 (41)	57 (33)	0.1258
Chemotherapy, n (%)	328 (61)	228 (61)	100 (59)	0.6972
Surgery, n (%)	261 (48)	175 (47)	86 (51)	0.3719
PROMIS® Anxiety, Moderate-Severe, n (%)	36 (7)	27 (7)	9 (5)	0.4123
PROMIS® Depression, Moderate-Severe, n (%)	62 (12)	47 (12)	15 (9)	0.2111
PROMIS® Fatigue, Moderate-Severe, n (%)	62 (12)	42 (11)	20 (12)	0.8357
PROMIS® Pain, Moderate-Severe, n (%)	35 (7)	27 (7)	8 (5)	0.2754
PROMIS® Physical Function, Moderate-Severe, n (%)	90 (17)	69 (18)	21 (13)	0.0808
Quality of Life	18.4 (5.8)	18.2 (5.8)	19.0 (5.8)	0.5745
Time Since Initial Diagnosis (years)	2.9 (3.14)	2.9 (3.2)	2.8 (3.1)	0.1552
NCI Comorbidity Index	1.8 (2.1)	1.8 (2.12)	1.8 (2.08)	0.5858

Patient-reported outcomes of moderate-severe threshold are based T-scores at ≥ 70 for pain interference and fatigue, ≥ 65 for anxiety, ≥ 60 for depression, and ≤ 30 for physical function. Not all respondents had complete data on PRO data. PROMIS® measures, Time since Initial Diagnosis, and Quality of Life are based on the following sample sizes (n): PROMIS® Anxiety: 523; PROMIS® Depression: 521; PROMIS® Fatigue: 531; PROMIS® Pain: 522; PROMIS® Physical Function: 528; Time Since Initial Diagnosis: 533; Quality of Life: 517

Abbreviations: PROMIS®: Patient-Reported Outcomes Measurement Information System; NCI: National Cancer Institute; SD: Standard Deviation

Table 4 Risk factors associated with a completed referral to cancer rehabilitation medicine following physical activity alert from the *My Wellness Check*

Unadjusted Univariable Risk Factor	OR (95% CI)	*p*-value
Sex: Female vs. Male	0.990 (0.686, 1.428)	0.9569
Age: ≥ 65 years vs. < 65 years	0.7 (0.485, 1.009)	0.0562
Race:		
Black or African American vs. White	0.562 (0.129, 2.438)	0.5034
Asian or Other vs. White	0.804 (0.424, 1.524)	0.4413
Ethnicity: Hispanic or Latino vs. Non-Hispanic or Latino	1.221 (0.827, 1.803)	0.3153
Marital Status:		
Married or Partner vs. Single	0.787 (0.403, 1.539)	0.4842
Divorced, Widowed, or Separated vs Single	0.963 (0.403, 1.539)	0.8857
Insurance: Public or Governmental Insurance vs. Private or Non-Governmental Insurance	0.762 (0.519, 1.121)	0.1673
Treatments Received:		
Chemotherapy vs. No Chemotherapy	0.929 (0.640, 1.347)	0.6972
Surgery vs. No Surgery	1.181 (0.820, 1.700)	0.3721
Radiation vs. No Radiation	0.743 (0.508, 1.087)	0.1263
PROMIS® Anxiety: Moderate-Severe vs. None-Mild	1.382 (0.635, 3.008)	0.4142
PROMIS® Depression: Moderate-Severe vs. None-Mild	0.678 (0.368, 1.251)	0.2135
PROMIS® Fatigue: Moderate-Severe vs. None-Mild	1.062 (0.602, 1.871)	0.8385
PROMIS® Pain: Moderate-Severe vs. None-Mild	0.639 (0.284, 1.438)	0.2792
PROMIS® Physical Function: Moderate-Severe vs. None-Mild	0.627 (0.371, 1.063)	0.0829
FACT-G7 Quality of Life	1.024 (0.991, 1.057)	0.1553
Time Since Diagnosis (years)	0.995 (0.938, 1.055)	0.8699
NCI Comorbidity Index	0.976 (0.892, 1.065)	0.5852
Stepwise logistic regression adjusting for group differences		
PROMIS® Pain: Moderate-Severe vs. None-Mild	0.446 (0.179, 1.110)	0.0828
Age: ≥ 65 years vs. < 65 years old	0.705 (0.478, 1.039)	0.0772
Radiation vs. No Radiation	0.737 (0.494, 1.100)	0.1354

Adjusted multivariable model excluded a total of 59 individuals due to missing data on explanatory variables

Abbreviations: PROMIS®: Patient-Reported Outcomes Measurement Information System; CI: Confidence Interval; NCI: National Cancer Institute; OR: Odds Ratio

Individuals reporting moderate-to-severe fatigue or physical function were significantly associated with increased odds of qualifying for a physical activity referral. Fatigue and physical function represent two modifiable risk factors that are amenable to cancer rehabilitation medicine interventions [28–30]. Fatigue and physical function tend to have a bidirectional as well as multiplicative influence on physical activity engagement. Individuals with this combination of multiple moderate-severe symptoms will likely experience significant limitations in physical activity compared to those with fewer or mild symptoms, and vice versa [31]. Given and colleagues (2007) recommend that the most efficient and effective way to manage symptoms clusters is by offering a multi-purpose intervention that yields the greatest benefit [31]. Cancer rehabilitation medicine services present an opportunity to efficiently address co-occurring symptoms. Future pathway refinement may consider testing cancer rehabilitation medicine as the unified solution for individuals who trigger alerts for physical function, fatigue, and physical activity simultaneously. Furthermore, the individual physical function and fatigue assessments trigger multiple intervention options, inclusive of referral to cancer rehabilitation medicine. Future work may consider how referral patterns to rehabilitation medicine in these symptom pathways compare the physical activity pathway findings.

Our findings also identified that individuals identifying as Hispanic or Latino were approximately 25% less likely to qualify for a physical activity referral even after adjusting for key covariates. Features of Hispanic or Latino ethnicity and healthcare culture may influence responsivity to the physical activity survey questions [32]. Individuals with intersectional identities may experience barriers to cancer care that adversely impact screening [33]. Additional stakeholder engagement may reveal multi-level factors that underlie these findings.

Less than one-third of individuals who qualified for cancer rehabilitation medicine services received a completed referral. However, there were no patient-level factors that significantly predicted the differences in referral. Access to services stems beyond patient-level factors alone. Provider- or organization-level barriers may be the root of differences between those who did and did not receive a referral. It was encouraging to see that 57 unique providers were involved across the 168 referrals. Nonetheless, as EHR systems are used to optimize patient care, providers may experience "alert fatigue" associated with desensitization to notifications and challenges distinguishing between informative and uninformative alerts. Likewise, referring providers may be unaware of the benefits of physical activity, cancer rehabilitation, and their role in survivorship care [7, 8, 15, 34]. Use of focus groups to engage key stakeholders associated with the referral process may provide greater insight into the decision-making process. Application of qualitative methods may also reveal organizational processes that influence referral [35, 36] including alert communication between cancer rehabilitation medicine and standard cancer care delivery, and barriers to appointment scheduling.

Lastly, our findings revealed that only 8% of individuals who received a referral utilized cancer rehabilitation medicine services. These results justify the need for expanded efforts to better understand utilization and delivery of these services. Recent evidence suggests that 2% [37]—10% [2, 6] utilize cancer rehabilitation services, inclusive of physical therapy, occupational therapy, speech language pathology, etc. Although our findings report similar utilization, data were specific to services delivered by a *physiatrist only*. This decision to direct physical activity-related intervention to a physiatrist was based on availability of services within the medical center. Given the growing evidence that highlight the benefits of rehabilitation, the medical center has since developed a robust multidisciplinary team including exercise physiology, physical therapy, and occupational therapy services. Future research should evaluate how the PROs captured in the *MWC* program influence utilization of physical therapy and occupational therapy, including assessing the variation in service referral to these rehabilitation professionals using the physical activity pathway. Access to these services may have higher rates of utilization following *MWC* program alerts given widespread accessibility within community-based outpatient settings, additional provider availability, patient familiarity, and treatments for mild impairments or activity limitations. Initial referral to non-pharmacological intervention methods of physical therapy or occupational therapy may also be prioritized before a provider considers use of cancer physiatry as a specialty service. Qualitative exploration of survivors' decision-making processes to access cancer rehabilitation medicine services is warranted to fully understand patient-, provider-, and system-level barriers that underlie low utilization rates such as perception of physical activity, alternate screening approaches, or cost of care.

The results from this study made evident the value of modifiable risk factors, captured by PROs, to justify need for cancer rehabilitation services. It also highlighted the need to investigate provider- and organization-level factors that may influence referral and utilization. However, study limitations may influence our findings. This study analyzed referral and utilization data at a single cancer center that may not detect delivery of services outside the single institution. Analyses did not include education or stage of disease as these variables had greater than 50% missing data in the original sample. Education might provide insight into socioeconomic factors that may be associated with referral and/or utilization. Future studies may also consider incorporating stage of disease into the analysis as need for and interest in rehabilitation increases with the presence of metastasis or advanced cancer stage [37, 38].

Discrepancies in referral completion may also be due to most patients having a ECOG scores ≤ 2. However, were unable to evaluate the influence of ECOG scores on referral completion and utilization statistics as the ECOG score was not documented in the dataset. Of note, the current *Moving though Cancer* screening and triage pathway assumes that survivors with ECOG ≤ 2 have less medical complexity and are ambulatory, thus, they do not require a specialized evaluation or exercise prescription from cancer rehabilitation medicine services. However, the research has noted lack of sensitivity to estimate functional status using the ECOG [39]. Future work should consider the interaction of physical activity and various ECOG performance score cut-offs on referral and utilization of rehabilitation patterns to ensure the pathway does not artificially exclude individuals who may need cancer rehabilitation medicine services. Although ECOG was recommended as a part of the tool's triage pathway, additional research is needed to see if other time efficient and inexpensive measures of function may be more sensitive for the referral pathway. Lastly, univariable and multivariable modeling incorporated fewer observations than total sample size for each objective due to missing data across demographic, clinical characteristics, and patient-reported outcomes. For all analyses, missing data was less than 1% to 4% on any given variable and did not follow a pattern. Utilization rates do not capture patients who may have received services outside of the medical institution.

Conclusion

To the best of our knowledge, this is the first study to examine access to and utilization of cancer rehabilitation medicine services using EHR-integrated PRO assessments. There is preliminary evidence that physical activity screenings can assist in triaging patients to cancer rehabilitation medicine services. Findings revealed that provider- and system-level barriers may influence discussion about physical activity as well as referral to and utilization of cancer rehabilitation medicine services. Future work should examine provide decision-making processes, response to multiple symptom alerts, and system-level changes that more efficiently triage patients to supportive care services.

Author contributions Study concepts and design were developed by all authors. Data acquisition and assembly was conducted by RB, AN, and FP. Quality control of data was completed by RB and AN. Data analysis was completed by RB, AN, and TKS. Data interpretation was completed by all authors. Manuscript writing and accountability of work was completed by all authors.

Data availability Deidentified data from this study are not available in a public archive. Deidentified data from this study will be made available (as allowable according to institutional IRB standards) by e-mailing the corresponding author.

Code availability Availability of the coding is available upon request to the corresponding author.

Declarations

Ethics approval This study was approved by the University of Miami Institutional Review Board (IRB#20211220) and certifies that the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments.

Consent to participate This study was part of a performance improvement project within standard of care; therefore and was deemed exempt from institutional review board review, and informed consent was waived.

Consent for publication Not applicable.

Competing interests Dr. Frank J Penedo is a paid consultant for Blue Note Therapeutics. All other authors declares no conflicts of interests.

References

1. Alfano CM, Kent EE, Padgett LS, Grimes M, de Moor JS (2017) Making Cancer Rehabilitation Services Work for Cancer Patients: Recommendations for Research and Practice to Improve Employment Outcomes. PM&R 9(9, Supplement 2):S398–S406. https://doi.org/10.1016/j.pmrj.2017.06.019

2. Brick R, Bender C, Skidmore E (2020) Impact of cancer and cancer-related treatments on participation restrictions. British J Occup Therapy 2021;84(4):222–229. https://doi.org/10.1177/0308022620923858

3. Newman RM, Alfano CM, Radomski MV, Pergolotti M, Wolf TJ, Sleight AG et al (2019) Catalyzing research to optimize cancer survivors' participation in work and life roles. OTJR : occupation, participation and health 39(4), 189–196. https://doi.org/10.1177/1539449219844749

4. Alfano CM, Leach CR, Smith TG, Miller KD, Alcaraz KI, Cannady RS et al (2019) Equitably improving outcomes for cancer survivors and supporting caregivers: A blueprint for care delivery, research, education, and policy. CA Cancer J Clin 69(1):35–49. https://doi.org/10.3322/caac.21548

5. Ligibel JA, Bohlke K, May AM, Clinton SK, Demark-Wahnefried W, Gilchrist SC et al (2022) Exercise, diet, and weight management during cancer treatment: ASCO Guideline. J Clin Oncol 40(22):2491–2507. https://doi.org/10.1200/JCO.22.00687

6. Pergolotti M, Deal AM, Lavery J, Reeve BB, Muss HB (2015) The prevalence of potentially modifiable functional deficits and the subsequent use of occupational and physical therapy by older adults with cancer. J Geriatr Oncol 6(3):194–201. https://doi.org/10.1016/j.jgo.2015.01.004

7. Cheville AL, Mustian K, Winters-Stone K, Zucker DS, Gamble GL, Alfano CM et al (2017) Cancer rehabilitation: an overview of current need, delivery models, and levels of care. Phys Med Rehabil Clin N Am. 28(1):1–17. https://doi.org/10.1016/j.pmr.2016.08.001

8. Brick R, Lyons KD, Bender C, Eilers R, Ferguson R, Pergolotti M et al (2021) Factors influencing utilization of cancer rehabilitation services among older breast cancer survivors in the USA: a qualitative study. Support Care Cancer. https://doi.org/10.1007/s00520-021-06678-9

9. Alfano CM, Cheville AL, Mustian K (2016) Developing High-Quality Cancer Rehabilitation Programs: A Timely Need. Am Soc Clin Oncol Educ Book 35:241–249. https://doi.org/10.14694/EDBK_156164

10. Alfano Catherine M, Oeffinger K, Sanft T, Tortorella B (2022) Engaging TEAM Medicine in Patient Care: Redefining Cancer Survivorship From Diagnosis. Am Soc Clin Oncol Educ Book 42:921–931. https://doi.org/10.1200/EDBK_349391

11. Alfano CM, Pergolotti M (2018) Next-Generation Cancer Rehabilitation: A Giant Step Forward for Patient Care. Rehabil Nurs 43(4):186–194. https://doi.org/10.1097/rnj.0000000000000174

12. Stout NL, Silver JK, Raj VS, Rowland J, Gerber L, Cheville A et al (2016) Toward a National Initiative in Cancer Rehabilitation: Recommendations From a Subject Matter Expert Group. Arch Phys Med Rehab 97(11):2006–2015. https://doi.org/10.1016/j.apmr.2016.05.002

13. Panattoni L, Fedorenko C, Greenwood-Hickman MA, Kreizenbeck K, Walker JR, Martins R et al (2018) Characterizing Potentially Preventable Cancer- and Chronic Disease-Related Emergency Department Use in the Year After Treatment Initiation: A Regional Study. J Oncol Pract 14(3):e176–e185. https://doi.org/10.1200/JOP.2017.028191

14. Penedo FJ, Medina HN, Moreno PI, Sookdeo V, Natori A, Boland C et al (2022) Implementation and feasibility of an electronic health record–integrated patient-reported outcomes symptom and

needs monitoring pilot in ambulatory oncology. JCO Oncol Pract 18(7):e1100–e1113. https://doi.org/10.1200/OP.21.00706

15. Pergolotti M, Alfano CM, Cernich AN, Yabroff KR, Manning PR, de Moor JS et al (2019) A health services research agenda to fully integrate cancer rehabilitation into oncology care. Cancer 125(22):3908–3916. https://doi.org/10.1002/cncr.32382

16. Cella D, Choi S, Garcia S, Cook KF, Rosenbloom S, Lai J-S et al (2014) Setting standards for severity of common symptoms in oncology using the PROMIS item banks and expert judgment. Qual Life Res 23(10):2651–2661. https://doi.org/10.1007/s11136-014-0732-6

17. Covington KR, Marshall T, Campbell G, Williams GR, Fu JB, Kendig TD et al (2021) Development of the Exercise in Cancer Evaluation and Decision Support (EXCEEDS) algorithm. Support Care Cancer 29(11):6469–6480. https://doi.org/10.1007/s00520-021-06208-7

18. Schmitz KH, Campbell AM, Stuiver MM, Pinto BM, Schwartz AL, Morris GS, et al (2019) Exercise is medicine in oncology: Engaging clinicians to help patients move through cancer. CA: A Cancer J Clin 69(6):468–84. https://doi.org/10.3322/caac.21579

19. Schmitz KH, Stout NL, Maitin-Shepard M, Campbell A, Schwartz AL, Grimmett C et al (2021) Moving through cancer: Setting the agenda to make exercise standard in oncology practice. Cancer 127(3):476–484. https://doi.org/10.1002/cncr.33245

20. Oken MM, Creech RH, Tormey DC, Horton J, Davis TE, McFadden ET et al (1982) Toxicity and response criteria of the Eastern Cooperative Oncology Group. Am J Clin Oncol 5(6):649–656

21. Garcia SF, Wortman K, Cella D, Wagner LI, Bass M, Kircher S et al (2019) Implementing electronic health record–integrated screening of patient-reported symptoms and supportive care needs in a comprehensive cancer center. Cancer-Am Cancer Soc 125(22):4059–4068. https://doi.org/10.1002/cncr.32172

22. Cella DF, Tulsky DS, Gray G, Sarafian B, Linn E, Bonomi A et al (1993) The Functional Assessment of Cancer Therapy scale: development and validation of the general measure. J Clin Oncol 11(3):570–579

23. Natori A, Sookdeo VD, Koru-Sengul T, Schlumbrecht M, Calfa C, MacIntyre J et al (2021) Predictors of adherence to patient reported outcomes and psychosocial needs questionnaire in a culturally diverse ambulatory oncology setting: The My Wellness Check Program. J Clin Oncol 39(28_suppl):173. https://doi.org/10.1200/JCO.2020.39.28_suppl.173

24. Penedo FJ, Oswald LB, Kronenfeld JP, Garcia SF, Cella D, Yanez B (2020) The increasing value of eHealth in the delivery of patient-centred cancer care. Lancet Oncol 21(5):e240–e251. https://doi.org/10.1016/S1470-2045(20)30021-8

25. Natori A, Sookdeo VD, Koru-Sengul T, Schlumbrecht M, Calfa CL, MacIntyre J et al (2022) Symptoms and Needs Monitoring in Diverse Ambulatory Oncology Patients: Usage Characteristics and Impact on Emergency Room Visits and Hospitalization. J Clin Oncol 41(2):285–294. https://doi.org/10.1200/JCO.22.01038

26. Hewitt M, Greenfield S, Stovall E (2006) From cancer patient to cancer survivor: Lost in translation. National Academies Press, Washington D.C.

27. Alfano CM, Zucker DS, Pergolotti M, Ness KK, Jones LW, Price ND et al (2017) A Precision Medicine Approach to Improve Cancer Rehabilitation's Impact and Integration with Cancer Care and Optimize Patient Wellness. Curr Phys Med Rehabil Rep 5(1):64–73. https://doi.org/10.1007/s40141-017-0145-x

28. Hunter EG, Gibson RW, Arbesman M, D'Amico M (2017) Systematic Review of Occupational Therapy and Adult Cancer Rehabilitation: Part 1. Impact of Physical Activity and Symptom Management Interventions. Amer J Occup Ther 71(2):7102100030p1-p11. https://doi.org/10.5014/ajot.2017.023564

29. Harrington SE, Stout NL, Hile E, Fisher MI, Eden M, Marchese V et al (2020) Cancer Rehabilitation Publications (2008–2018) With a Focus on Physical Function: A Scoping Review. Phys Ther 100(3):363–415. https://doi.org/10.1093/ptj/pzz184

30. Sleight A, Gerber LH, Marshall TF, Livinski A, Alfano CM, Harrington S et al (2022) Systematic review of functional outcomes in cancer rehabilitation. Arch Phys Med Rehab 103(9):1807–1826. https://doi.org/10.1016/j.apmr.2022.01.142

31. Given BA, Given CW, Sikorskii A, Hadar N (2007) Symptom Clusters and Physical Function for Patients Receiving Chemotherapy. Semin Oncol Nurs 23(2):121–126. https://doi.org/10.1016/j.soncn.2007.01.005

32. Yanez B, McGinty HL, Buitrago D, Ramirez AG, Penedo FJ (2016) Cancer outcomes in Hispanics/Latinos in the United States: An integrative review and conceptual model of determinants of health. Educ Pub Found 114–29

33. Kelly-Brown J, Palmer Kelly E, Obeng-Gyasi S, Chen JC, Pawlik TM (2022) Intersectionality in cancer care: A systematic review of current research and future directions. Psychooncology 31(5):705–716. https://doi.org/10.1002/pon.5890

34. Cheville AL, Kornblith AB, Basford JR (2011) An examination of the causes for the underutilization of rehabilitation services among people with advanced cancer. Am J Phys Med Rehabil 90(5 Suppl 1):S27–S37. https://doi.org/10.1097/PHM.0b013e31820be3be

35. Urquhart R, Jackson L, Sargeant J, Porter GA, Grunfeld E (2015) Health System-Level Factors Influence the Implementation of Complex Innovations in Cancer Care. Health Policy 11(2):102–118

36. Taplin SH, Anhang Price R, Edwards HM, Foster MK, Breslau ES, Chollette V et al (2012) Introduction: Understanding and Influencing Multilevel Factors Across the Cancer Care Continuum. JNCI Monographs 2012(44):2–10. https://doi.org/10.1093/jncimonographs/lgs008

37. Cheville AL, Rhudy L, Basford JR, Griffin JM, Flores AM (2017) How Receptive Are Patients With Late Stage Cancer to Rehabilitation Services and What Are the Sources of Their Resistance? Arch Phys Med Rehab 98(2):203–210. https://doi.org/10.1016/j.apmr.2016.08.459

38. Kim YM, Kim D-Y, Chun MH, Jeon J-Y, Yun GJ, Lee MS (2011) Cancer Rehabilitation: Experience, Symptoms, and Needs. J Korean Med Sci 26(5):619–624

39. Repetto L, Fratino L, Venturino A, Gianni W, Vercelli M, Parodi S, Dal Lago D, Gioia F, Monfardini S, Aapro MS, Serraino D, Zagonel V (2002) Comprehensive Geriatric Assessment adds inofrmation to Eastern Cooperative Oncology Group Performance Status in Elderly Cancer Patients: An Italian Group for Geriatric Oncology Study. J Clin Oncol 20(2):494–502