Development of the Exercise in Cancer Evaluation and Decision Support (EXCEEDS) Algorithm

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Abstract

Purpose

Individualized triage to exercise and rehabilitation is recommended to optimize health, functioning and well-being across the cancer continuum. However, ability to identify and triage the *right* survivor to the *right* exercise or rehabilitation service at the *right* time is a barrier. We developed an evidence-based algorithm to identify survivors' need for pre-exercise medical clearance and support individualized triage to appropriate exercise/rehabilitation care.

Methods

From literature review, we synthesized defining characteristics of exercise/rehabilitation services and patient characteristics associated with safety and efficacy of each service. We developed a visual model to conceptualize need for high/low specialized care, then organized patient characteristics into a risk-stratified framework. We conducted an iterative review process with a multidisciplinary expert panel until consensus was reached for the preliminary algorithm.

Results

We describe eight defining features of the four levels of exercise/rehabilitation and provide a conceptual model of need for high/low specialized care across the cancer continuum. The preliminary Exercise in Cancer Evaluation and Decision Support (EXCEEDS) Algorithm includes a risk-stratified series of eleven dichotomous questions, organized in two sections and ten domains.

Conclusions

The EXCEEDS algorithm provides an evidence-based solution to facilitate integration of exercise into routine oncology care via a common language to describe exercise/rehabilitation services, a practical model to conceptualize an individual's need for specialized care, and step-by-step decision support guidance.

Introduction

Despite over four decades of calls to action to incorporate exercise and rehabilitation services into routine oncology care, access to and utilization of these services remain limited [1]. As a result, there are high rates of inactivity and disability among individuals living with and beyond cancer (survivors) [1, 2].

Lack of research evidence or clinical practice guidelines supporting exercise and rehabilitation is not the problem. High levels of research evidence demonstrate the role of exercise in cancer prevention and survival [3, 4], exercise prescription guidelines for common cancer-related effects (fatigue, anxiety, depression, lymphedema, etc.) have been developed [5], and 46 international professional oncology societies or organizations recommend rehabilitation or exercise services [6]; including the American Cancer Society, American Society for Clinical Oncology (ASCO) and seven different clinical practice guidelines from the National Comprehensive Cancer Network (NCCN). Leading researchers and clinical organizations agree survivors should 'avoid inactivity', and oncology clinicians should screen and refer survivors to exercise or rehabilitations programs for specialized care based on their individual needs. However, significant heterogeneity

in survivors' medical status, functional level, and goals throughout the cancer continuum play an important role in determining the safest and most efficacious intervention, and the best qualified person to supervise and prescribe exercise.

Decision making for triage to exercise or rehabilitation services is a complex process requiring clinicians to synthesize recommendations from numerous sources and rectify with each patient's individual needs, often in real-time. Without practical supports to identify the *right* patient and support decision making for triage to the *right* service at the *right* time, reliance on oncology clinicians is likely to remain a barrier to access and utilization of exercise and rehabilitation services.

To facilitate integration of exercise into routine oncology care, targeted and aligned efforts are especially needed to: improve knowledge of exercise and rehabilitation program components that influence safety and efficacy; promote understanding of survivor's needs ameliorable rehabilitation or exercise programs; and enhance efficiency of real-time clinician decision making for screening and referrals [7]. In this article we describe our efforts to address these needs via three aligned aims. To promote knowledge and understanding, we identify and describe the core elements of rehabilitation and exercise programs using a stepped care model [8] (aim 1), and provide a conceptual model of cancer-related disability and subsequent need for high vs. low specialized care (aim 2). To enhance efficiency of real-time decision making for pre-exercise medical clearance and triage to exercise/rehabilitation, we describe the development of the Exercise in Cancer Evaluation and Decision Support (EXCEEDS) Algorithm (aim 3).

Methods

Literature Review

We (KC & TM) searched PubMed and MEDLINE databases for articles published in English using key phrases including "neoplasm" or "cancer", "patient" or "survivor", "exercise", "physical activity" or "rehabilitation"; "medical clearance", "risk", or "safety"; and "guidelines" or "perspectives", "decision making", or "prescription". From these searches, we identified and reviewed 49 publications including exercise pre-participation risk-screening recommendations, relevant peer-reviewed research, and clinical practice or exercise participation guidelines.

Literature synthesis and algorithm development

From each article we abstracted information pertaining to the three aims of this project. To accomplish aim 1, we synthesized and grouped the defining characteristics of each level of stepped care service (cancer rehabilitation; clinically supervised exercise; supervised, cancer-specific community-based exercise; and unsupervised, or generic, community-based exercise). For aim 2, we drew upon a multidisciplinary conceptual framework, the International Classification of Disability and Functioning (ICF), to develop a multidisciplinary conceptual model of cancer-related disability and subsequent need for specialized care [9]. To develop the algorithm (aim 3), we first synthesized and grouped criteria associated with need for pre-exercise medical clearance. Next, we synthesized criteria associated with need for high- vs. low- specialized care and aligned each criteria with one level of stepped care defined in aim 1. Guided by the ICF, we grouped criteria into broad domains (disease side effects, functional factors, behavioral factors, etc.) then sorted each domain by

decreasing need for specialized care, rehabilitation care, or exercise supervision. For example, cancer-specific side effects associated with high need for specialized care and supervision were grouped together and sorted above domains that require less specialized care.

The criteria and resulting stepped care triage recommendations of each domain were established through an iterative consensus-building process with a multidisciplinary team of expert stakeholders representing the following disciplines: exercise physiology, nursing, occupational therapy, physiatry, physical therapy, behavioral science, medical oncology, and patient-advocacy. Each stakeholder reviewed and provided feedback on the rationale for all proposed criteria and recommendations (pre-exercise medical evaluation and level of stepped care). During this process we decided to stratify side effect and functional domains into criteria that indicate high (level 2) vs. moderate (level 1) specialized care needs to further differentiate triage recommendations for each level of stepped care. For example, fatigue is a common side effect of cancer treatment; our literature review indicates those with moderate-high levels of fatigue need specialized rehabilitation, while patients with mild or well-controlled fatigue are likely to benefit equally from supervised community-based exercise. Through ongoing consultation with reviewed literature and the stakeholder team, we refined the EXCEEDS algorithm until consensus was reached for all algorithm factors and triage recommendations among all stakeholders.

Results

Defining Characteristics of Exercise and Rehabilitation Stepped Care Services

Using a stepped care framework from the highest intensity care to the lowest, rehabilitation and exercise services recommended for cancer survivors include: cancer rehabilitation; clinically supervised exercise; supervised, cancer-specific community-based exercise; and unsupervised, or generic, community-based exercise [8, 10]. Characteristics that differentiate each level of stepped care are summarized in Table 1, including: level of care as described previously by Alfano & colleagues [8]; minimum requirements of delivery personnel; facility characteristics; focus of service; short and long term goals of service; cost and functioning considerations; caveats; and general patient qualifiers synthesized during our literature review.

Conceptual model of the multidimensional factors that influence stepped care needs

Figure 1 depicts how the ability of an individual with cancer to transcend the levels of stepped care services (part b) is a function of multidimensional factors (part a), described previously by the International Classification of Function, Disability and Health [9] and the work of Alfano & Pergolotti [11]. Throughout the cancer care continuum these factors interact to increase or decrease risk of exercise-related adverse events and need for specialized care. Thus, Figure 1 is designed to represent the multitude of factors that can influence stepped care need at any cross section of time along the cancer continuum. Accordingly, the EXCEEDS algorithm is designed to be used at any time to guide triage decision making based on an individual's risk of exercise-related adverse events and need for specialized care.

The EXCEEDS preliminary algorithm

The EXCEEDS preliminary algorithm is a two-part tool designed to identify exercise-related risk and provide appropriate triage recommendations. In the EXCEEDS algorithm, risk-stratified branching logic is used in each section and domain to minimize the amount of information necessary to make medical clearance and triage

recommendations. See Figure 2 for the EXCEEDS algorithm flow chart. Patients should be re-evaluated at each stage of the cancer care continuum [12] as part of prospective surveillance [13, 14] and in the presence of any adverse event, change in health status, or exercise motivation.

Section 1 of the algorithm includes three domains (Physical Activity Level, Presence of Chronic Disease, and Medical Follow-Up questions) that determine need, or no need, for pre-participation medical clearance. Pre-exercise medical clearance is only indicated for individuals who are not sufficiently active (i.e., <30 minutes moderate intensity exercise, 3x per week for 3 months [15]) and have a positive ("yes") response to at least one question in the chronic disease or medical follow-up domains. Section 2 includes seven domains: cancer-specific factors, functional factors (level 1 & 2), side effects (level 1 & 2), presence of catheter, and exercise self-efficacy. Stop logic is used in each domain so that a recommendation can be provided immediately when risk/specialized care need is identified. For example, if a positive ("yes") response is provided for any question in the cancer-specific factors domain, referral to cancer rehabilitation will be immediately recommended and no additional questions will be prompted. See Table 2 for additional detail on the criteria and references for each domain.

Justification of Triage Recommendations for Each Level of Stepped Care

Cancer Rehabilitation

Cancer rehabilitation services are delivered by licensed healthcare professionals with expertise in therapeutic interventions to maintain or restore function, reduce symptom burden, improve quality of life, and maximize independence by improving a patient's ability to participate fully in work, leisure, and other life roles [8, 11]. Randomized trials and practice-based evidence have demonstrated many of these benefits throughout the cancer care continuum, including enhanced physical health or functioning [16, 17], reduced symptom burden [17], enhanced quality of life and participation [17–20]. Physical and occupational therapists (PT/OT) are the primary recipients of triage recommendations from the EXCEEDS algorithm due to the exercise-related nature of the tool and PT/OT services; however, additional members of the cancer rehabilitation team are noted in Table 1 because many patients will have needs outside the PT/OT scope of practice. Using the EXCEEDS algorithm triage to cancer rehabilitation is recommended for individuals who have at least one cancer-specific factor, level 2 functional factor, or level 2 side effect.

Clinically Supervised Exercise Services

Clinically supervised services may be a pragmatic and accessible supplement to cancer rehabilitation for some individuals with comorbidities (e.g., patient with cardiac instability but no other functional limitations) or those with limited accessibility to rehabilitation for geographic or financial reasons (i.e., no local cancer-specific rehabilitation clinicians; no or limited insurance, high out-of-pocket costs). Intervention is typically led by an exercise clinician with oversight from a rehabilitation or other clinical specialist including nursing. Although the effectiveness of these programs has not been reviewed exclusively, many studies have demonstrated positive effects and impacts for cancer survivors, including improved fatigue [21–23], function [21, 22, 24, 25], quality of life [22], symptom management [25], fitness [22], physical activity level [23], and health-care utilization [25]. However, we recommend a minimum requirement of an evaluation by a qualified cancer rehabilitation practitioner prior to initiating such exercise programs to ensure the patient's safety and maximum benefit. Clinically supervised exercise is the minimum level of care recommended for individuals who are currently

inactive and have at least one response in the chronic disease or medical follow-up domains. Using Section 2 of the EXCEEDS algorithm, we recommend triage to clinically supervised exercise for individuals with at least one level 1 functional factor or level 1 side effect.

Supervised, Cancer-Specific Community-based Exercise

Many cancer-specific and supervised programs exist across the US (see Table 1), and the ACSM has recently led efforts to consolidate information about these programs into a publicly available database directed toward clinician and individual use. The reach, effectiveness, implementation, impact (on quality of life) and maintenance of cancer-specific community-based programs have been recently summarized [26]. In general, they have been determined to be safe and effective to improve quality of life [26, 27] and physical function [28]. Many individual programs have demonstrated improvements on cancer-specific outcomes [29, 30] and long-term sustainability [23, 31–34], including the Livestrong® at the YMCA program [32], which was available in 791 YMCAs across the US (as of April 2020).[1] Supervised, cancer-specific community-based exercise is the minimum level of care recommended for individuals who are currently active and have at least one positive response in the medical follow-up domain. Using section 2 of the EXCEEDS algorithm, we recommend that individuals who have a catheter (due to NCCN guidelines [35]) and/or low exercise self-efficacy[2] be triaged to supervised, cancer-specific community-based exercise interventions.

Unsupervised or Generic, Community-Based Exercise

Unsupervised community-based exercise includes self-directed exercise in any setting, often community- or home-based. For the purposes of this article we include generic (i.e., non-cancer specific) community-based services with this category due to lack of cancer-specific supervision. Generic exercise includes traditional fitness classes, SilverSneakers®, worksite wellness, and personal training with a non-specialized trainer. Due to the evidence that supervised exercise is superior to unsupervised exercise for cancer survivors [36], we have based triage recommendations on a survivor's level of exercise self-efficacy. Although home-based exercise is often preferred by individuals living beyond a diagnosis of cancer [37–39], research has demonstrated only mixed effects on function, cancer-specific outcomes, and quality of life [28, 40, 41]. Therefore, recommendations for home-based exercise should be made with caution, based on the needs of the patient, and accompanied by personal support and local resources. Using the EXCEEDS algorithm, only survivors with all negative responses and high exercise self-efficacy will be recommended to start/continue independent or generic community-based exercise exclusively. At the discretion of the appropriate rehabilitation or exercise professional, survivors may be encouraged to participate in independent or generic community-based exercise as a complement to specialized services.

Discussion

Through a collaborative effort led by multidisciplinary stakeholders, we have begun to address critical gaps needed to enhance clinical decision making and integrate exercise and rehabilitation as a routine component of cancer care. The EXCEEDS algorithm is an innovative solution to determine the safest and most efficacious intervention and make patient-centered referrals throughout the cancer continuum in alignment with current

recommendations. To optimize utility and adaptability of the algorithm, we have combined risk stratification[1] and health-care need decision-making processes[2] [13] into one step-by-step research-based decision-making process to maximize the utility of the EXCEEDS algorithm. Watson, Stout, and colleagues (2012) [13, 14] have previously emphasized the importance of this dual approach for surveillance during cancer survivorship and provided a prospective surveillance framework to guide timing of evaluation that can be integrated into clinical pathways [42].

Limitations and Next Steps

This manuscript presents the preliminary EXCEEDS algorithm; the tool is not yet widely available and additional research and validation are required prior to widespread dissemination. A Delphi study is underway (2020) by some of the authors of this manuscript to gain consensus for the EXCEEDS algorithm acceptability and strategic implementation, including needs for adaptation and integration with existing digital and clinical platforms. Following the Delphi study, the algorithm will need to be adapted by the development team using an iterative process similar to described in this article. Finally, validation and clinical implementation effectiveness trials of the algorithm will need to be formulated, ideally based on results of the Delphi study. The sensitivity and specificity of the algorithm will also need to be determined in comparison to current recommendations. Following examples from the ACSM and PAR-Q collaboration [43–45], prior to prospective testing we plan to test the efficacy of the algorithm retrospectively in a large clinical registry sample and compare recommendations to those made by the PAR-Q and ACSM.

Conclusion

The EXCEEDS algorithm is designed to facilitate integration of exercise into routine oncology care by providing a common language to describe stepped care services, a practical model to conceptualize an individual's need for specialized care, and a step-by-step evidence-based algorithm that can support the decision making of a multitude of different users with a common goal: connect the *right* patient, to the *right* service, at the *right* time. Once finalized following the current Delphi study, integration of this tool in both provider-facing and patient-facing platforms (ex. electronic medical record, patient portal, smartphone application, print material, etc.) has the potential to optimize patient care via improved decision making about the safest and most efficacious exercise referral to improve patients' long-term health, function, and quality of life across the cancer continuum.

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Tables

Table 1. Defining features of Rehabilitation and Exercise Stepped Care Services

-	Cancer Rehabilitation	Clinically Supervised Exercise	Supervised, Cancer-Specific Community-Based	Generic or Unsupervised Community-Based
Level of care [1]	"Impairment-driven care, complicated"	"Impairment-directed care, uncomplicated"	"General conditioning activities, specialized"	"General conditioning, unspecified"
Delivery personnel (minimum requirements) [1–8]	Rehabilitation clinician(s) with cancer-specific training or experience/master's-level clinical degree (minimum) and board certification. May include occupational or physical therapist, physiatrist, speech and language pathologist, nurse, certified lymphedema specialist. [a]	Exercise clinician with a master's-level degree and relevant clinical certification (preferably cancer-specific)[b,c] or training. Supervision or evaluation may be led by rehabilitation therapist, or other clinician(s).[a]	Exercise professional(s) with a Bachelor's-level degree in Exercise Physiology (or related field), relevant certification(s) from ACSM[d] (or comparable organization), and cancer-specific certification or training.	Generic: Exercise professional(s) with high school degree and site-required certification. Unsupervised: Exercise prescription/support may be provided by 3rd party via asynchronous platform (educational resource, peer support, mobile application, etc.)
Facility [2, 4–7]	Outpatient rehabilitation clinic	Outpatient location; typically affiliated with university, cancer center or other medical clinic	Community sites, not typically affiliated with medical institution	Home-based or any community-based setting
Focus of service [1, 2, 4, 6, 8]	Interdisciplinary assessment and therapeutic exercise to address specific clinical outcomes (i.e., impairment, functional limitations, side effects)	Discipline-specific assessment and intervention to address specific clinical outcomes	Individualized and supervised exercise prescription or instruction including aerobic, resistance, flexibility and balance/coordination exercise	Guideline concordant physical activity and improved fitness [e]
Goals of service [4, 5, 7–11]	Short term: Improve physical function (ability to complete daily activities), reduce symptom burden, maximize independence and improve QOL. Improve exercise knowledge via education. Long-term: Enhanced functional status and quality of life to	Short term: Improve fitness, participation in life activities, physical activity level and exercise self-efficacy; symptom management; improve exercise knowledge and expectations via education and reflection. Long-term: Ability to self-	Short term: Improve fitness, ability to complete ADL's/IADLS, and self-efficacy. Minimize exercise barriers. Find enjoyable types/modalities of exercise. Long-term: transition to unsupervised, build guideline-accordant physical	Short term: continue to improve fitness, function, exercise self-efficacy and QOL. Reduce barriers associated with center-based exercise Long term: maintain or enhance guideline-accordant physical activity/exercise habits [e]

	support transition to less specialized service.	monitor during exercise and set/achieve exercise goals. Transition to less specialized service.	activity/exercise habits [e]	
Cost/funding [4, 5, 8, 12, 13]	Services covered by most 3rd party payers; may be subject to patient copayments and payer medical necessity criteria.	Not typically subsidized by 3rd party payers. May be offered at no additional charge to the patient in some cancer care settings.	Not typically subsidized by 3rd party payers. May be subsidized alternatively (e.g., workplace wellness, scholarships or donations)	Not typically subsidized by 3rd party payers (except Silver Sneakers). May be subsidized alternatively.
Caveats [5, 8, 14]	Limited availability or accessibility due to costs, location, 3rd party reimbursement, etc. Likely not reimbursable for survivors without diagnosable impairments Insufficient workforce of rehabilitation clinicians with cancer specific training Growing, but limited evidence of efficacy and effectiveness	Limited accessibility and reimbursement Challenging for health care providers to recognize need and make referral Insufficient workforce of clinicians with cancer-specific training Cost for services may be high Services may not be cancer-specific (e.g., combined with cardiac rehabilitation or other services) Growing, but limited evidence of efficacy and effectiveness Recommended [11], but lack of agreed upon and mandated minimal standards for implementation	Limited availability or accessibility due to cost, location, 3rd party reimbursement, etc. (especially in rural areas) Lack of sustainable funding model and program accreditation standards Insufficient workforce of exercise professionals with cancer-specific training Services vary in eligibility criteria, participant fees, design, content and ability to provide specialized care. Growing, but limited evidence of effectiveness	May increase risk of exercise-related adverse event for those with more serious health conditions or those at risk for moderate-to-severe cancer treatment-related impairments Generic exercise programs and self-guided resources are widely available but rarely evidence-based or delivered with clinical expertise Individuals must be motivated to maintain activity and seek out/use additional resources (i.e., high self-efficacy)
General patient qualifiers (synthesized	Presence (or signs/symptoms) of a health condition that indicates high	Presence (or signs/symptoms) of a health condition that	No health condition (or signs/symptoms) that indicate greater than low risk of an	No health condition (or signs/symptoms) that indicate greater

from literature review) [2, 3, 15–17]	risk for exercise-related adverse event, or need for specialized rehabilitation care (e.g., difficultly managing lymphedema; lung/bone/brain diagnosis or metastasis) Inability to complete most ADL/IADL independently Functional limitations or conditions that require a specialized rehabilitation program to address specific needs (e.g., ataxia, surgical restrictions, severe pain or fatigue, myopathy)	indicates moderate risk for an exercise-related adverse during unsupervised exercise, or need for specialized clinical care during exercise (e.g., weakened immune system, bowel or gastrointestinal issues, history of falls) Difficulty completing some ADL independently Functional limitations or conditions that require clinical supervision and/or professional exercise guideline to address specific needs (e.g., impaired balance due to neuropathy, mild fatigue, managing treatment side effects)	exercise-related adverse during supervised exercise, or need for specialized clinical care during exercise Presence of a catheter Low exercise self-efficacy May have completed cancer rehabilitation or clinically-supervised intervention	than low risk of an exercise-related adverse during unsupervised exercise High exercise self-efficacy May have completed cancer rehabilitation, clinically-supervised intervention, or community-based

Note: ACSM= American College of Sports Medicine (ACSM), QOL = Quality of Life, IADL= Instrumental Activity of Daily Living; ADL = Activity of Daily Living.

[a] *Other rehabilitation clinicians include: dietician/nutrition, psychology, social work, lymphedema or pelvic floor specialists, etc.*

[b] Certifications: Clinical Exercise Physiologist (CEP; https://www.acsm.org/get-stay-certified/get-certified/cep) or Registered Clinical Exercise Physiologist

[c] Certification: ACSM/American Cancer Society Cancer Exercise Specialist (https://www.acsm.org/get-stay-certified/get-certified/specialization/cet)

[d] Certifications: Exercise Physiologist (https://www.acsm.org/get-stay-certified/get-certified/health-fitness-certifications/exercise-physiologist), Personal Trainer (https://www.acsm.org/get-stay-certified/get-certified/health-fitness-certifications/personal-trainer), Group Exercise Instructor (https://www.acsm.org/get-stay-certified/get-certified/health-fitness-certifications/gei)

[e] Exercise Guidelines for Cancer Survivors [15]

Table 2. EXCEEDS algorithm domains, criteria, and supporting references

Algorithm Domain	Criteria	Reference(s)
Section 1: Medical Clearance Recommendation		
Physical activity level	Yes or No: currently meeting exercise guidelines (Guidelines: ≥30 minutes of moderate intensity exercise on ≥3 days per week for ≥3 months)[a]	American College of Sports Medicine guidelines for exercise testing and prescription [19] Acvtiv Onco Model [20]
Chronic disease	Yes or No: presence of ≥1 chronic disease or related complications, including: heart failure kidney failure (or other renal disease) diabetes metastatic cancer to bones or brain, or another major organ Unstable angina Dizziness resulting in loss of balance or consciousness Major surgery with restrictions in past 3 months History of cardio toxic treatment	Physical Activity Readiness Questionnaire (PAR-Q) [21] American College of Sports Medicine guidelines for exercise testing and prescription [19] Cancer-specific exercise risk screening tool [22] National Comprehension Cancer Network (NCCN): Survivorship Clinical Practice Guidelines V1.2020 (National Comprehensive Cancer Network, 2020) [23] Macmillan Cancer Rehabilitation pathways [24]
	Yes or No: New, worsening or difficulty managing any of the following conditions: lymphedema, ostomy, significant weight fluctuations, infection, ataxia, malnourishment, severe fatigue, bone/back/neck pain and unusual weakness	Acvtiv Onco Model [20] Macmillan Cancer Rehabilitation pathways [24]
High risk signs/symptoms	Yes or No: presence of ≥1 complication or high-risk signs/symptoms associated with the following diseases: Cardiovascular or respiratory disease Previous stroke, neurological condition, or spinal cord injury Musculoskeletal injury or degenerative conditions Recent steroid injection and potential for steroid-induces myopathy Uncontrolled diabetes mellitus	Physical Activity Readiness Questionnaire (PAR-Q) [21] National Comprehension Cancer Network (NCCN): Survivorship Clinical Practice Guidelines V1.2020 [23] Macmillan Cancer Rehabilitation pathways [24] Cancer-specific exercise risk screening tool [22] Acvtiv Onco Model [20]
Section 2: Triage Recommendations		
Cancer-specific factors	Yes or No, presence of ≥1 of the following factors:	Acvtiv Onco Model [20]

	Cancer Type (Head & Neck, Lung Myeloma, sarcoma, or metastasis to bones, brain or other organ) Fracture risk or severe osteoporosis or osteopenia History of blood clot, deep vein thrombosis, or pulmonary embolism Lymphedema high risk or difficulty managing	Macmillan Cancer Rehabilitation pathways [24] National Comprehension Cancer Network (NCCN): Survivorship Clinical Practice Guidelines V1.2020 [23] Focused review of safety considerations in cancer rehab [17] The Interdisciplinary Rehabilitation Care Team and the Role of Physical Therapy in Survivor Exercise [6]
Level 2 functional factors	Yes or No, presence of ≥1 of the following factors: Mobility aid required to complete daily activities Able to mobilize 1 block of less Limited upper extremity range of motion ADL or IADL dependency Moderate-severe general mobility pain (hip knee, back, etc.) Ataxia or unusual weakness Moderate cognitive declines that impair function Peripheral neuropathy that is painful or limits function	National Comprehension Cancer Network (NCCN): Survivorship Clinical Practice Guidelines V1.2020 [23] National Comprehension Cancer Network (NCCN): Older Adult Oncology Clinical Practice Guidelines V1.2019 [25] Exercise in Medicine in Oncology: ACSM 2019 Roundtable [2] Macmillan Cancer Rehabilitation pathways [24] Acvtiv Onco Model [20] Cancer-specific exercise risk screening tool [22] Association of Clinical Oncology (ASCO) Management of Older Adults Guideline [26] The Interdisciplinary Rehabilitation Care Team and the Role of Physical Therapy in Survivor Exercise [6] International Society of Geriatric Oncology (SIOG) recommendations for management of cancer-related cognitive decline [27]
Level 2 side effects	Yes or No, presence of ≥1 of the following factors: Moderate to severe fatigue (4+) Neurological symptoms (dizziness/lightheaded; disorientation) Blurred vision	Macmillan Cancer Rehabilitation pathways [24] Acvtiv Onco Model [20] The Interdisciplinary Rehabilitation Care Team and the Role of Physical Therapy in Survivor Exercise [6]

	▯ Dyspnea	
Level 2 functional factors	Yes or No, presence of ≥1 of the following factors: ▯ Fall in previous six months ▯ Other mobility issues, including: Decreased balance, Decreased gait speed, Mild bodily pain when moving, difficulty with ADL/IADL	▯ Macmillan Cancer Rehabilitation pathways [24] ▯ Association of Clinical Oncology (ASCO) Management of Older Adults Guideline [26] ▯ Cancer and Aging Research Group Fall Risk Model [28] ▯ Exercise in Medicine in Oncology: ACSM 2019 Roundtable [2] ▯ The Interdisciplinary Rehabilitation Care Team and the Role of Physical Therapy in Survivor Exercise [6]
Level 1 side effects	Yes or No, presence of ≥1 of the following factors: ▯ Active treatment or surgery in past 3 months ▯ Treatment side effects, including: § Daily mild fatigue § Mild neuropathy § Occasional cognitive difficulty § Orthostatic hypotension § Gastrointestinal (severe nausea; vomiting/diarrhea; dehydration; inadequate food/fluid intake) § Urinary or fecal incontinence § Managed lymphedema § Weakened immune system: thrombocytopenia (low platelets), anemia (low hemoglobin) or neutropenia (low white blood cell count)	▯ The Interdisciplinary Rehabilitation Care Team and the Role of Physical Therapy in Survivor Exercise [6] ▯ Macmillan Cancer Rehabilitation pathways [24] ▯ Acvtiv Onco Model [20] ▯ National Comprehension Cancer Network (NCCN): Survivorship Clinical Practice Guidelines V1.2020 [23]
Presence of a catheter	Yes or No, current or planned upcoming presence of catheter (Including but not limited to: peripherally Inserted Central Cather (PICC), intraperitoneal catheter, or ostomy)	▯ National Comprehension Cancer Network (NCCN): Survivorship Clinical Practice Guidelines V1.2020 [23] ▯ Macmillan Cancer Rehabilitation pathways [24]
Exercise self-efficacy	Yes or No, high confidence in ability to exercise at least 3 times per week for at least 30 minutes per day over the next 3 months without support from an exercise professional.	▯ Macmillan Cancer Rehabilitation pathways [24] ▯ National Comprehension Cancer Network (NCCN): Survivorship Clinical Practice Guidelines V1.2020 [23]

	The Interdisciplinary Rehabilitation Care Team and the Role of Physical Therapy in Survivor Exercise [6]

[a]Measure: Physical Activity Vital Sign (PAVS) [29]

Figures

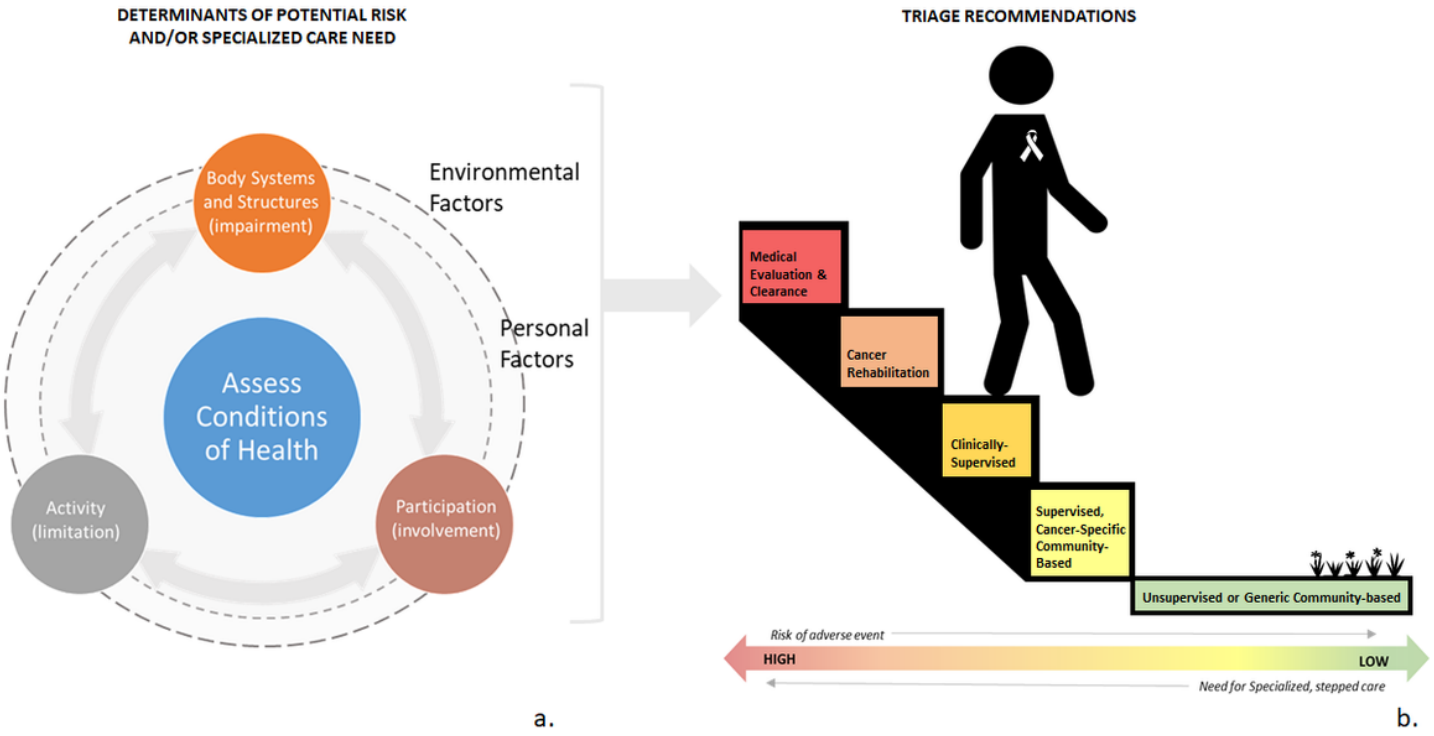

Figure 1

Conceptual Model of the Multidimensional Factors that Influence Stepped Care Triage Needs. The ability of an individual with cancer to transcend the levels of stepped care (b) is a function of multidimensional factors (a), described previously by the International Classification of Function, Disability and Health [13], and Alfano & Pergolotti et al. 2018 [18]. Throughout the cancer care continuum these factors transact to increase or decrease risk of exercise-related adverse event and need for specialized care. Figure a. used with permission from Alfano and Pergolotti 2018[18]

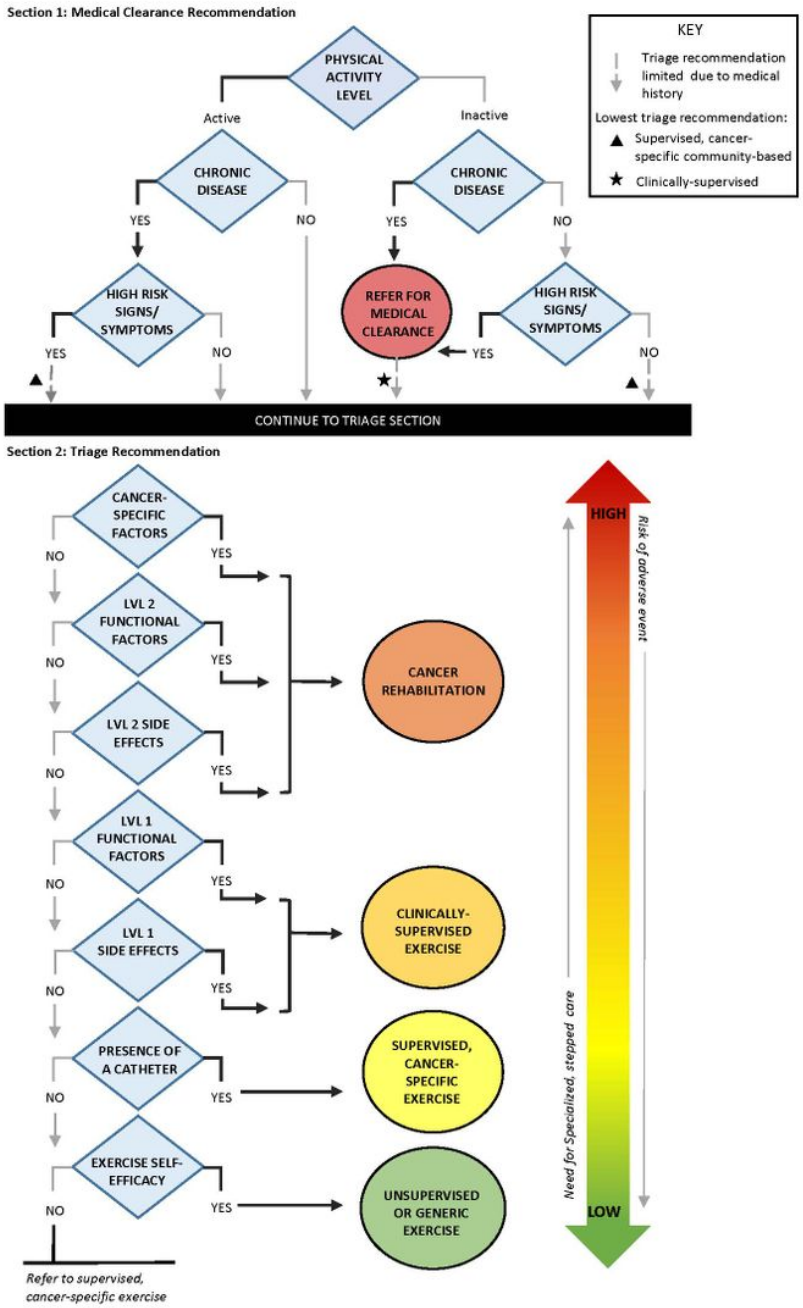

Figure 2

EXCEEDS Algorithm Preliminary Flow Chart.

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