HHS Public Access

Author manuscript

J Geriatr Oncol. Author manuscript; available in PMC 2022 July 15.

Published in final edited form as:

J Geriatr Oncol. 2022 July ; 13(6): 892–903. doi:10.1016/j.jgo.2022.03.001.

Protocol paper: Multi-site, cluster-randomized clinical trial for optimizing functional outcomes of older cancer survivors after chemotherapy

S. Yilmaz[a,b,*], **M.C. Janelsins**[a], **M. Flannery**[c], **E. Culakova**[a], **M. Wells**[b], **P.-J. Lin**[a], **K.P. Loh**[d], **R. Epstein**[e], **C. Kamen**[a], **A.S. Kleckner**[f], **S.A. Norton**[c], **S. Plumb**[b], **S. Alberti**[a], **K. Doyle**[a], **M. Porto**[a], **M. Weber**[g], **N. Dukelow**[h], **A. Magnuson**[d], **L.A. Kehoe**[a], **G. Nightingale**[i], **M. Jensen-Battaglia**[b], **K.M. Mustian**[a], **S.G. Mohile**[b,d]

[a]Division of Supportive Care in Cancer, Department of Surgery, University of Rochester Medical Center School of Medicine and Dentistry, Rochester, NY, USA

[b]Geriatric Oncology Research, James P Wilmot Cancer Institute, University of Rochester Medical Center School of Medicine and Dentistry, Rochester, NY, USA

[c]School of Nursing, University of Rochester Medical Center School of Medicine and Dentistry, Rochester, NY, USA

[d]Division of Hematology/Oncology, Department of Medicine, James P Wilmot Cancer Institute, University of Rochester Medical Center School of Medicine and Dentistry, Rochester, NY, USA

[e]Department of Family Medicine Research, University of Rochester Medical Center School of Medicine and Dentistry, Rochester, NY, USA

[f]Department of Pain and Translational Symptom Science, University of Maryland School of Nursing, Baltimore, MD, USA

[g]Department of Neurology, University of Rochester Medical Center School of Medicine and Dentistry, Rochester, NY, USA

[h]Department of Medicine, Physical Medicine and Rehabilitation, University of Rochester Medical Center School of Medicine and Dentistry, Rochester, NY, USA

[*]Corresponding author at: Department of Surgery, Division of Supportive Care in Cancer, University of Rochester Medical Center, 265 Crittenden Blvd., Rochester, NY 14642. sule_yilmaz@urmc.rochester.edu (S. Yilmaz).

Authors' Contributions

All authors provided comments and feedback for improvement the manuscript. All authors approved the final version of the manuscript and are responsible for their contributions.

Declaration of Competing Interest

The authors declare that they have no competing interests.

Ethics Approval and Consent to Participate

This protocol (URCC19178) was approved by the NCI Central Institutional Review Board, which is acting as the single Institutional Review Board of record for all study sites. The protocol is registered at clinicaltrials.gov (NCT05006482).

Consent for Publication

Not applicable.

Appendix A. Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jgo.2022.03.001.

[i]Department of Pharmacy Practice, Jefferson College of Pharmacy, Thomas Jefferson University, Philadelphia, PA, USA

Abstract

Background: Cancer survivors over the age of 65 have unique needs due to the higher prevalence of functional and cognitive impairment, comorbidities, geriatric syndromes, and greater need for social support after chemotherapy. In this study, we will evaluate whether a Geriatric Evaluation and Management-Survivorship (GEMS) intervention improves functional outcomes important to older cancer survivors following chemotherapy.

Methods: A cluster-randomized trial will be conducted in approximately 30 community oncology practices affiliated with the University of Rochester Cancer Center (URCC) National Cancer Institute Community Oncology Research Program (NCORP) Research Base. Participating sites will be randomized to the GEMS intervention, which includes Advanced Practice Practitioner (APP)-directed geriatric evaluation and management (GEM), and Survivorship Health Education (SHE) that is combined with Exercise for Cancer Patients (EXCAP©®), or usual care. Cancer survivors will be recruited from community oncology practices (of participating oncology physicians and APPs) after the enrolled clinicians have consented and completed a baseline survey. We will enroll 780 cancer survivors aged 65 years and older who have completed curative-intent chemotherapy for a solid tumor malignancy within four weeks of study enrollment. Cancer survivors will be asked to choose one caregiver to also participate for a total up to 780 caregivers. The primary aim is to compare the effectiveness of GEMS for improving patient-reported physical function at six months. The secondary aim is to compare effectiveness of GEMS for improving patient-reported cognitive function at six months. Tertiary aims include comparing the effectiveness of GEMS for improving: 1) Patient-reported physical function at twelve months; 2) objectively assessed physical function at six and twelve months; and 3) patient-reported cognitive function at twelve months and objectively assessed cognitive function at six and twelve months. Exploratory health care aims include: 1) Survivor satisfaction with care, 2) APP communication with primary care physicians (PCPs), 3) completion of referral appointments, and 4) hospitalizations at six and twelve months. Exploratory caregiver aims include: 1) Caregiver distress; 2) caregiver quality of life; 3) caregiver burden; and 4) satisfaction with patient care at six and twelve months.

Discussion: If successful, GEMS would be an option for a standardized APP-led survivorship care intervention.

Trial Registration: ClinicalTrials.gov NCT05006482, registered on August 9, 2021.

Keywords

Geriatric assessment; Geriatric evaluation; Survivorship health education; Cluster-randomized trial; Cancer survivor; Caregiver; Chemotherapy; Curative-intent; Survivorship

1. Background

The population of older cancer survivors is increasing. These are older patients who have completed curative-intent (i.e., adjuvant) chemotherapy for any solid tumor malignancy.

Currently, 64% of cancer survivors are aged 65 years and older; by 2040, approximately 50% will be aged 75 years and older with approximately 18% aged 85 years and older [1,2]. Older cancer survivors are at a higher risk for adverse outcomes and experience physical and cognitive impairments following curative-intent chemotherapy [3,4]. The National Cancer Institute (NCI) [5,6], American Society of Clinical Oncology (ASCO) [7,8], and the Cancer and Aging Research Group (CARG) [9,10] recommend aging-sensitive interventions for older cancer survivors and their caregivers.

The National Academy of Medicine (NAM; previously Institute of Medicine) reported that older cancer survivors have unique needs due to the higher prevalence of functional and cognitive impairment, comorbidities, geriatric syndromes, and greater need for social support following treatment [11,12]. Older patients report more interference with function from symptomatic toxicities (e.g., fatigue, pain) than younger patients and are at higher risk for unplanned hospitalizations and mortality [13]. Hence, older patients with cancer consistently place a high priority on the recovery of their physical and cognitive function after chemotherapy [14–20]. Yet, the majority of older patients with cancer are treated based on extrapolations of evidence derived from clinical trials enrolling mainly younger adults or fit older adults (e.g., those without other health status conditions). Extrapolating data on the safety and efficacy from these trials for use in vulnerable or frail older adults increases their risks for long-term complications in survivorship [21].

The ASCO guidelines recommend survivorship care plans (SCPs) for all older adult patients transitioning out of active treatment [22]. However, a recent systematic review [23] found: 1) Current SCPs do not adequately improve physical and psychosocial outcomes, 2) few studies facilitated follow-up with advanced practice practitioners (APPs) or other clinicians, 3) only two studies included a significant number of cancer survivors over age 65 [24,25], and 4) none of these studies addressed aging-related conditions through the use of specialized assessment and management of problems for older adults. Research suggests that, for SCPs to be effective, in addition to survivorship care plan summaries, cancer survivors need explicit help to implement the survivorship care plan recommendations (e.g., to schedule and attend referral appointments, modify lifestyle via health education) [26–32]. The survivorship care plans need to be individually tailored and feasible for older cancer survivors and incorporate their caregivers.

Caregivers experience distress and low satisfaction with care when the cancer survivor’s function is poor [33,34]. The NCI and experts recommend that interventions engage caregivers as partners in survivorship care [35–38]. When cancer survivors experience physical and cognitive impairment, caregivers become distressed and less satisfied with the survivors’ care because they are burdened with increased caregiver work, more responsibility to communicate with providers, and increased need to access services necessary for the cancer survivors [36,39,40].

Team-based care (by at least two clinicians), where clinicians work collaboratively with patients and caregivers to accomplish shared goals within and across settings to achieve coordinated high quality care, is recommended for the provision of health services to older adults and families [41]. As shown in Fig. 1, interventions guided by physical and/or

occupational therapists [42–48], clinical exercise physiologists [28,30,31,49,50], cognitive specialists [51–54], psychologists [55–57], and pharmacists [58–60] are associated with improved outcomes in older patients with cancer. However, a standardized approach to surveillance and management of aging-related conditions by teams is not often employed [61].

An APP is a health care provider who has completed advanced training and education that qualifies them to 1) manage medical problems and 2) prescribe and manage treatments within their scope of training. In the United States regulations, licensure and scope of practice vary based on state law and regulations. It most commonly refers to a nurse practitioner (NP) or physician assistant (PA), as well as other licensed, nonphysician providers, including certified clinical nurse specialists and certified nurse anesthetists. NPs are registered nurses with additional education and clinical training at the master's or doctoral degree level. Nurses must complete at least 1000 h of clinical practice in a focused area, such as pediatric, adult, or geriatric medicine, to earn an NP degree. A PA, on the other hand, trains for two years—frequently alongside medical students. Physician assistant students complete at least 2000 h of supervised practice before graduation [62]. Despite differences in training and licensure, APPs in oncology clinics play an essential role in the transition period after chemotherapy by facilitating surveillance and management of symptomatic toxicities and coordination of care [63–66]. In geriatric medicine, APPs direct shared care and train other disciplines in aging [67–70]. While experts have advocated for APPs to play a key role in oncology [37,65,71], gaps remain regarding the efficacy of aging-sensitive APP-directed survivorship interventions [23].

To our knowledge, this is the first cluster randomized trial evaluating whether a standardized intervention—APP-directed Geriatric Evaluation and Management (GEM) combined with Survivorship Health Education (SHE) and Exercise for Cancer Patients (EXCAP©®)—can optimize outcomes important to older cancer survivors and their caregivers following curative-intent chemotherapy. We hypothesize that Geriatric Evaluation and Management-Survivorship (GEMS), compared to usual care, will significantly improve physical function and, secondarily, cognitive function at six months. We also hypothesize that GEMS, compared to usual care, will improve satisfaction with care, completion of referral appointments, and hospitalizations in older cancer survivors, and will improve oncology APP communication with primary care physicians (PCPs) as well as reduce distress and improve satisfaction with care in caregivers.

2. Methods

2.1. Aims, Design, and Setting

2.1.1. Aims—Our specific aims are as follows: The primary aim is to compare the effectiveness of GEMS for improving patient-reported physical function at six months. The secondary aim is to compare effectiveness of GEMS for improving patient-reported cognitive function at six months. Tertiary aims include comparing the effectiveness of GEMS for improving: 1) Patient-reported physical function at twelve months; 2) objectively assessed physical function at six and twelve months; and 3) patient-reported cognitive function at six and twelve months. Exploratory health care aims include: 1) Survivor

satisfaction with care, 2) APP communication with PCPs, 3) completion of referral appointments, and 4) hospitalizations at six and twelve months. Exploratory caregiver aims include: 1) Caregiver distress; 2) caregiver quality of life; 3) caregiver burden; and 4) satisfaction with patient care at six and twelve months.

2.1.2. Design and Setting of the Study—This clinical trial uses a cluster-randomized design and will be conducted in at least 30 community oncology practice clusters within the NCI Community Oncology Research Program (NCORP) Research Base network; the University of Rochester Cancer Center (URCC) NCORP Research Base will serve as the coordinating site.

The NCI's Central Institutional Review Board approved the study on June 11, 2021. All participants will provide informed consent. We will enroll all groups (practice clusters, oncologists, APPs, SHE instructors, older cancer survivors, caregivers) using inclusion and exclusion criteria (Table 1, see Appendix) until the target cancer survivor enrollment number is met (See Table 2).

2.1.3. Description of Arms and Intervention—Practices will enroll, on average, 26 cancer survivors per practice cluster for a total of 780 cancer survivors and up to 780 caregivers (estimated number of caregivers is 500). A practice cluster is defined as any practice location where staff (oncology physician, APPs, coordinators) work independently and do not cross over into another practice location. Each practice cluster will be randomly assigned to the GEMS intervention arm or the usual care arm in a 1:1 ratio.

In the intervention arm, the APPs, cancer survivors, and caregivers will complete and review GA-guided management recommendations. Cancer survivors and caregivers will also participate in the SHE combined with EXCAP©® sessions. In the usual care arm, cancer survivors and caregivers will participate in routine follow-up care without restrictions at their practices. Coordinators will capture routine survivorship care practices.

2.1.4. Geriatric Evaluation and Management for Survivorship (GEMS) Intervention—This is an innovative, standardized intervention based on the ASCO guidelines [7] and expert consensus for evaluating and managing the care of older cancer survivors. GEMS intervention triages and manages the critical aging- and treatment-related medical, physical, and psychosocial issues that arise for older cancer survivors at the end of chemotherapy as they transition into long-term survivorship. The intervention engages the caregiver to foster better outcomes for both the cancer survivor and caregiver [34]. GEMS is a multi-level intervention that facilitates coordination of care between the older cancer survivor, caregiver, APPs, oncology physicians, PCPs, and other relevant clinicians to effectively address aging-related conditions and survivorship needs.

The APP-directed GEMS intervention consists of three major components: 1) geriatric assessment (GA) that evaluates the medical, physical, and psychosocial effects of treatment; 2) specific GA-guided management recommendations including referrals to relevant clinical disciplines/services; and 3) SHE program combined with an individually tailored exercise program EXCAP©® for cancer survivors and caregivers. All intervention components will

be offered in-person (or via tele-health, if it is not convenient or feasible to participate in-person).

2.1.4.1. Geriatric Assessment (GA).: The GA measures are validated tools with established scoring thresholds, described in the Supplementary Tables 1–3 (see Appendix). Scores signifying impairment to trigger management recommendations are summarized in Table 3. The measures were selected based upon extensive data in the geriatric literature demonstrating predictive value as well as feasibility data in multiple studies of older patients with cancer as well as the ASCO guidelines. In the intervention arm, either the coordinator or the APP can administer a standardized GA to the cancer survivor, which includes patient-reported and objective measures to evaluate eight geriatric domains (Table 3).

2.1.4.2. GA-Guided Management Recommendations.: The APPs and/or coordinators can enter cancer survivors' test results into a password-protected portal, which automatically generates a summary that includes tailored evidence-based management recommendations and suggestions for referrals. Then, APPs will review the results with the cancer survivors and caregivers during a one-hour clinic visit in-person (or via tele-health); in collaboration with the cancer survivors and caregivers, the referrals will be prioritized and the top three scheduled. The APPs will provide the summary of the cancer survivors' GA results and management recommendations and referrals to cancer survivors, caregivers, and PCPs. In addition, APPs will have 30-min visits in-person (or via tele-health) with cancer survivors and caregivers at three and six months to determine if referrals and SHE- EXCAP*©®* sessions are being completed. The APPs will triage and facilitate ongoing completion of management recommendations as needed, as well as discuss management plans with oncology physicians and PCPs and document communications in the medical chart. The cancer survivor and caregiver (if available) will meet with the APP in-person (or via tele-health) at three and six months (30 min minimum) to review the completion of referrals and provide ongoing symptom management. After each visit, the APP will send all information (including the GA summary and list of management recommendations) to the cancer survivor's PCP and also call the primary care team to provide updates.

2.1.4.3. Survivorship Health Education (SHE) Combined with Exercise for Cancer Patients (EXCAP©®).: Although SHE and EXCAP*©®* are explained individually for the purposes of detailed description of each, they will be delivered as a joint component of the GEMS intervention.

2.1.5. SHE—The SHE program (Table 4) is a standardized didactic and experiential component of the intervention that builds on ASCO survivorship recommendations and reinforces GEM recommendations. The SHE program consists of eight face-to-face, 75-min group sessions delivered twice a week over four weeks by a SHE instructor. All SHE participants will receive the "*ASCO® Answers Cancer Survivorship*" booklet in the first session. The participants will attend SHE sessions in a group setting either in-person or virtually via tele-health. Each participating NCORP practice cluster will be responsible for identifying qualified SHE instructors and medical interpreters for Spanish-speaking participants. All qualified SHE instructors will complete a one-on-one interview, go through

training, and use the provided SHE materials as a guide for delivering SHE group sessions. The third SHE session will be video-recorded to assess intervention fidelity.

2.1.6. SHE- EXCAP©®—EXCAP©® is a home-based, individually tailored exercise program combining aerobic walking and resistance band exercises. The EXCAP©® program will be introduced and individually prescribed in the third SHE session, "Exercise Behavioral Change." During the third session, the SHE instructor will provide an EXCAP©® kit containing an EXCAP©® manual and resistance bands to SHE participants. In addition, a pedometer will be provided to participants at the first SHE session to collect daily steps for the following six days. During the third SHE session, the SHE instructor will demonstrate each resistance band exercise and provide the individually tailored walking and resistance band exercise prescriptions.

2.2. Fidelity of GEMS Intervention

Fidelity will be ensured through: 1) Review of GEM implementation for the first two enrolled cancer survivors for each APP and ongoing checks for GA scoring and 2) video-taping of the third SHE session for evaluation of content and quality. Both APPs and SHE instructors may be subject to re-training if the content and quality criteria are not met.

2.3. RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) Framework

While this is an efficacy study, hypothesis-generating data will be collected to guide the design of future effectiveness or implementation studies and efforts for scaling-up the GEMS intervention if study results are positive. Pilot data collection to inform future scalability efforts is guided by the RE-AIM [72] framework, which is used in dissemination and implementation research to enhance the quality and speed of efforts to translate research into the "real world." In the intervention arm, APPs and coordinators will complete the online RE-AIM tool at baseline (prior to enrolling their first cancer survivor at the practice cluster), six months, and twelve months to assess implementation progress and fidelity of the implementation strategy. Responses will be discussed during separate 60-min focus groups with the staff of each of the practices randomized to the intervention arm. The focus groups will be audio-recorded for subsequent transcription and qualitative analysis.

2.4. Measures

Questionnaires for each of the aims are listed in the Tables and include information on which assessments are available in Spanish and which assessments will be administered/translated using medical interpreters for Spanish-speaking cancer survivors and caregivers.

2.4.1. Cancer Survivor and Caregiver Questionnaires—Cancer survivors will complete questionnaires at run-in/baseline, three months, six months, and twelve months. Caregivers will complete questionnaires at the same time points as cancer survivors. Cancer survivors and caregivers (if available) will be asked to complete questionnaires at home, in-person, or via tele-health (for those that can be completed virtually). All questionnaires can be mailed to be completed at home prior to in-person visit.

2.4.2. APP and Oncology Physician Questionnaires—Advanced practice practitioners and oncology physicians will complete a baseline Research Electronic Data Capture (REDCap) questionnaire prior to their first cancer survivor consenting to the study. This questionnaire will provide a study overview, confirm acknowledgment of participation, and capture demographics, comfort with geriatrics, and survivorship care practices. The APPs and oncology physicians will also complete a brief follow-up questionnaire at the end of the study.

2.4.3. Chart Abstraction and Claims—All clinic visit notes from the APP visit, summary notes sent to APPs and PCPs, referral visit notes, phone call information between site staff and cancer survivors or site staff and PCPs, medical records, emergency room/ hospitalization visit notes and discharge summaries, and all APP communication with PCPs and other providers will be requested to validate the collected data. If there is missing information or conflicting medical information from the questionnaires, we will also obtain medical records in order to verify information about disease location, pathology, and stage from charts.

2.5. Study Procedures

2.5.1. Practice-Based Phase—The URCC NCORP Research Base staff will review completed Practice Cluster Interest Forms and interview interested staff to confirm practice eligibility. Once the practice cluster has been approved by the URCC NCORP Research Base to participate, APPs and oncology physicians will complete a questionnaire that provides an overview of the study and captures information on demographics and Comfort with Survivorship Care Practices for Older Adults. Once at least one APP is enrolled and coordinators complete training, the practice cluster will be randomized. If assigned to the intervention arm, the practice cluster's personnel (APP, coordinator) will receive training on the intervention prior to enrolling their first cancer survivor.

2.5.2. Patient-Based Phase: Cancer Survivor (and Caregiver if Available)—Coordinators, with oversight from the oncology team, can screen for patients aged 65 and older who are either currently receiving or have recently completed curative-intent (i.e., adjuvant) chemotherapy for any solid tumor malignancy. Eligible cancer survivors will undergo informed consent (in-person or via tele-health). Run-in study procedures can occur during the last four weeks of adjuvant chemotherapy but no later than four weeks after the completion of adjuvant chemotherapy. After the cancer survivor has consented, the first assessment that the coordinator will administer is the Blessed-Orientation-Memory-Concentration test (BOMC) [73]; cancer survivors with a BOMC score of ≥11 will not move forward with study procedures. Cancer survivors with BOMC score of <11 can continue participation and can identify one caregiver to participate; cancer survivors without an available caregiver are still eligible if approved by URCC NCORP. The coordinator will enroll the eligible cancer survivor and caregiver and provide them the patient-reported assessments to complete; all can be completed via tele-health or in-person. The cancer survivor's patient-reported assessments should be completed prior to baseline registration. At the baseline visit, coordinator-administered assessments will be completed for the cancer survivor and caregiver. The Six Minute Walk Test (6MWT) [74,75] and Trail Making Tests

(TMT A/B) [76] will be completed in-person, while the Mini-Cog [77–79], Short Physical Performance Battery (SPPB) [80,81], and Controlled Oral Word Association (COWA) [82–84] can be completed via tele-health or in-person. If assessments that require in-person data collection are unable to be completed due to COVID-19, other health-related concerns, or personal factors, they will be documented as missing.

In the GEMS intervention arm, APPs will deliver GEM. The APPs and/or coordinators will provide cancer survivors with the GA forms to be completed during run-in/baseline and will schedule a clinic visit (baseline, one hour minimum) to occur in-person to be conducted within four weeks of completing chemotherapy. At the baseline visit, APPs will complete and score the GA and enter the scores into a password-protected web portal to create a tailored summary and list of management recommendations, including referrals to relevant clinicians. The APP will review this information with the cancer survivor and their caregiver in conjunction with a review of the medical and treatment history. The APP will review the recommendations for GA impairments, symptom management, and health education. In collaboration with the cancer survivor and caregiver, the APP will triage the referrals so the top three referrals will be completed first; referrals will be prioritized by the APP through discussions with the cancer survivor and caregiver. The APP will oversee scheduling of all referrals, including the SHE and EXCAP sessions, andwill discuss a care plan with the oncology physician and ensure that appropriate clinical documentation is completed and disseminated. All intervention components, including all SHE sessions, will be completed by the six-month assessment. To collect data to inform future scalability efforts, the URCC NCORP Research Base team will conduct focus groups with staff in the intervention arm at baseline, six, and twelve months.

In the usual care arm, cancer survivors and caregivers will continue to receive routine survivorship follow-up care at their practices. Cancer survivors will complete GA in-person (or via tele-health) during run-in/baseline, but no GA summary score or list of management recommendations will be provided to the oncology teams to review with the cancer survivor and their caregivers. We will however, provide information regarding clinically significant depression (i.e., score of ≥11 on the Geriatric Depression Scale [GDS] [85] via completing the Physician Notification of the Depression Symptoms Form).

In both arms, cancer survivors and caregivers will complete assessments at three, six, and twelve months in-person (or via tele-health). The coordinators will collect information about APP communication with PCPs, the number and completion of referrals, and healthcare utilization (e.g., emergency department visits and hospitalizations).

2.6. Statistical Analysis

2.6.1. Primary Outcome—The primary outcome will be the change in patient-reported physical function as assessed by Physical Well-Being (PWB) [86–88] subscale score of Functional Assessment of Chronic Illness-Fatigue (FACIT-F) scale as measured from baseline to six months. The primary aim of this study will test the efficacy of the GEMS intervention on self-reported physical function at six months (primary outcome) by calculating the average between-arm difference in change in the FACIT-PWB subscale score from baseline to six months.

2.6.2. Sample Size—We plan to enroll at least 30 practices (15 per arm) with a minimum of 10 and maximum of 40 cancer survivors per practice. For the sample size and power calculation, we consider a within-patient correlation of $p = 0.50$ between baseline and the six-month assessment of PWB. We assume an intra-cluster correlation coefficient (ICC) of 0.05, indicating the influence of practice cluster on FACIT-PWB. Under these model assumptions, the minimum detectable between arms difference (Δ) can be estimated as $\Delta = \left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right) \cdot \sqrt{\frac{2 * DE * \left(1-\rho^2\right) * \sigma^2}{N}}$, where N is number of cancer survivors per arm; α and β are type I and II error rates; DE corresponds to the design effect penalty due to randomization of clusters, DE = 1 + (k−1) × ICC, where k is the number of cancer survivors per cluster; and $(1-\rho^2) \times \sigma^2$ corresponds to the analysis of covariance (ANCOVA) adjustment to variance σ^2 due to the within-patient pre-post correlation ρ of the outcome measure. Given the above assumptions, a sample of 600 evaluable cancer survivors ($N = 300$ per arm, 20 per practice) will provide 86% power at the two-sided significance level (α) of 0.05 to detect an effect size (standardized [$\sigma^2 = 1$] mean between arm difference) of 0.30. To account for the potential drop-out based on previous studies (approximately 23%) [89]; we plan to enroll 780 cancer survivors (26 per practice).

2.6.3. Statistical Analysis for Aims—To estimate the intervention effects, we will use an ANCOVA model with an additional random effect term to account for clustering. The model will include PWB at six months as the outcome and study arm, baseline value of PWB, and rural vs. non-rural practice cluster (stratification factor in randomization) as fixed effects. Practice cluster will be included as a random effect. Estimation will be performed using the restricted maximum likelihood (REML) method, and fixed effects inferences will be performed using an F-test. To compare long-term effects of the intervention on PWB at twleve months we will use a longitudinal linear mixed model (LMM). The model outcome (dependent variable) will be PWB with measures repeated at three, six, and twelve-month assessments. We will apply the same analytical approach as for the primary aim to assess the intervention effect on other patient-reported outcome measures, for example perceived cognitive impairment measured using the Functional Assessment of Cancer Therapy-Cognitive Function (FACT-COG) questionnaire, Perceived Cognitive Impairment subscale (secondary outcome). To compare the effect of the GEMS intervention vs. usual care arm on survivor care satisfaction, APP communication with PCPs, cancer survivor completion of referral appointments, and health care utilization, we will use LMM for continuous outcomes or generalized LMMs (GLMM) for binary outcome measures. For all models we will evaluate goodness of fit and, if necessary, apply a transformation. To explore the efficacy of the GEMS intervention for improving caregiver distress and care satisfaction and communication, caregiver quality of life and caregiver burden, we will follow a similar statistical plan. In addition, we will collect hypothesis-generating data to inform future scalability efforts. Open-ended questions on the participant feedback forms and the RE-AIM tool, and audio-recorded interviews will be transcribed and coded by study team members, using a qualitative content analysis approach to interpret the content of text data through the systematic classification process of coding and identifying themes or patterns.

3. Discussion

A growing population of older cancer survivors are at a higher risk for poor functional outcomes following curative-intent chemotherapy, and current survivorship care plans are not tailored to address the unique needs and health disparities among older cancer survivors and their caregivers [23]. Using large data sets, we have shown that curative-intent chemotherapy leads to a high prevalence of toxicity in older patients [89]. GA-identified impairments in domains including function, nutrition, comorbidity, mental health, and cognition are associated with increased hospitalizations and mortality, suggesting the need for better management. Studies of GA-guided management recommendations in older patients with cancer demonstrate a trend toward improved function and more appropriate healthcare utilization [90]. Our APP-directed GEMS intervention provides an opportunity to go beyond routine survivorship care plans to improve physical and cognitive function, increase satisfaction of care, and reduce hospitalizations, and may be efficacious for improving outcomes important to older cancer survivors and caregivers.

While studies have shown GEM is valued by oncologists [61,90], without leadership from APPs, adherence to management recommendations is not optimal [91–94]. Research shows that providing older adults with survivorship care plan summaries does not improve functional outcomes [95]; older patients need additional help from APPs to implement aging-sensitive referrals and services (Fig. 1) as part of their transition to long-term survivorship. Using expert consensus and guidelines [96,97], we developed and tested the GEM intervention with community oncology practices in two large trials (URCC 13070, “Communicating about Aging and Cancer Health” or “COACH” and URCC 13059, “Geriatric Assessment for Patients 70+” or “GAP”), demonstrating feasibility and benefits for older patients with cancer and their caregivers [89]. In COACH [89], among 541 eligible patients (mean age 77; 48.8% female) and 414 caregivers (mean age 67; 74.9% female), we showed that there were more aging-related conversations in the intervention arm (difference 3.59 conversations, $p < 0.001$), and more conversations were higher quality and led to higher number of recommendations. On average, there were four GA-guided referrals per patient (range 0–6). In COACH [89], aging-related conditions and symptom burden independently explained variance in FACIT-PWB [98–100]. Also, older patients reported that their preference would be to forego survival benefits if treatment would impair function (42%) or memory (57%) [89].

ASCO recommends that cancer survivors receive comprehensive information regarding their diagnosis, treatments, and health education [22]. The Cancer and Aging Research Group provided information related to COVID-19 and cancer care delivery for older patients with cancer [101]. Based on the existing data, it is clear that older adults with cancer, especially those with comorbidities and perhaps those who have had recent treatment, are at much higher risk for adverse outcomes (including hospitalization, intubation, intensive care unit admission, and death). During COVID-19, we optimized our ability to conduct GEM through tele-health using a team-based approach [102].

These data suggest that older cancer survivors have a high prevalence of aging-related impairments and physical and functional decline, which persist into long-term survivorship

after curative-intent chemotherapy. Caregivers experience distress and dissatisfaction with care when older patients with cancer have functional impairments [34]. We hypothesize that our APP-directed GEMS intervention will be beneficial for improving outcomes important to older cancer survivors and caregivers. Hence, with this study, we will evaluate whether providing the GEMS intervention to older cancer survivors (within four weeks of completing curative-intent chemotherapy) and their caregivers can improve the physical and cognitive functions of cancer survivors, when compared to usual care. We hypothesize that providing a multidimensional, interdisciplinary, aging-sensitive survivorship care intervention focused on triaging and managing an older cancer survivor's medical, physical, and psychosocial need will optimize outcomes for older cancer survivors and their caregivers during the period immediately following chemotherapy.

3.1. Strengths and Potential Limitations

There are number of strengths to this study. This is one of the few studies [89] that includes older cancer survivors aged 65 years and older and the first study to address the unique needs and health disparities among older cancer survivors (especially those aged 75 years and older). We combined our two previously successful interventions, GEM and SHE-EXCAP©® to create GEMS, and herein will test its efficacy to improve physical and cognitive functions among older cancer survivors. Second, we include caregivers as study participants. Over 60% of the individuals caring for older cancer survivors are older themselves and have a high prevalence of their own comorbid conditions. Caregivers experience additional distress and low satisfaction with care when the cancer survivor's function is poor [34]. The NCI and other experts recommend that survivorship interventions should be tailored and feasible not only for older cancer survivors, but also should engage their caregivers as partners in survivorship care [35–38]. In addition, this is the first study to challenge the current survivorship care paradigm by using an APP-directed intervention to guide team-based care with other clinicians and engage caregivers. Last, but not least, this study will be conducted in community practices (including those that are rural), where the majority of older adults receive care, as opposed to academic medical centers, and therefore the results will be generalizable to the majority of older American adults.

While this study uses an innovative approach to create aging-sensitive "personalized pathways" for survivorship care that is tailored for two vulnerable groups—older cancer survivors and their caregivers—there are several limitations worth noting. Potential limitations include limited generalizability as we are aiming to enroll a specific population of older cancer survivors who are commonly seen in community oncology practices and are underrepresented in research studies. In addition, there is a risk of selection bias inherent in cluster randomization. Oncologists and APPs in both intervention arms (GEMS vs. usual care) are not blinded to the study conditions, and simply being part of the study may lead to increased incorporation of GA recommendations and discussion of aging-related concerns in both arms.

4. Conclusion

The results of this study will be used to determine the efficacy of GEMS intervention for improving physical and cognitive function among older cancer survivors and their caregivers. If the intervention is shown to be effective, it may lead to increased use of GEMS as a standardized survivorship care intervention, promoting the identification and management of aging-related concerns that are not captured by routine oncology assessments, and lead to improved functional outcomes and more appropriate healthcare utilization among older cancer survivors, especially those are aged 65 years and older.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

The research reported in this protocol uses resources of the University of Rochester, URCC, the URCC NCORP Research Base, and the NCI-funded postdoctoral T32 Fellowship Program in Cancer Control (NIH NCI T32CA102618 to MCJ and Gary Morrow).

Funding

Research reported in this publication was supported by NCI of the National Institutes of Health (NIH) under Award Number R01CA249467. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

Availability of Data and Materials

The investigators will provide access to data according to NIH and URCC NCORP policies.

References

[1]. Jemal A, Siegel R, Xu J, Ward E. Cancer statistics. CA Cancer J Clin. 2010;60(5):277–300. [PubMed: 20610543]

[2]. Smith BD, Smith GL, Hurria A, Hortobagyi GN, Buchholz TA. Future of Cancer incidence in the United States: burdens upon an aging, changing nation. J Clin Oncol. 2009;27(17):2758–65. [PubMed: 19403886]

[3]. Mohile SG, Xian Y, Dale W, et al. Association of a cancer diagnosis with vulnerability and frailty in older Medicare beneficiaries. J Natl Cancer Inst. 2009;101(17):1206–15. [PubMed: 19638506]

[4]. Mohile SG, Fan L, Reeve E, et al. Association of cancer with geriatric syndromes in older Medicare beneficiaries. J Clin Oncol. 2011;29(11):1458–64. [PubMed: 21402608]

[5]. Rowland JH, Gallicchio L, Mollica M, Saiontz N, Falisi AL, Tesauro G. Survivorship science at the NIH: lessons learned from grants funded in fiscal year 2016. J Natl Cancer Inst. 2019;111(2):109–17. [PubMed: 30657942]

[6]. Flannery M, Mohile SG, Dale W, et al. Interventions to improve the quality of life and survivorship of older adults with cancer: the funding landscape at NIH, ACS and PCORI. J Geriatr Oncol. 2016;7(4):225–33. [PubMed: 27197917]

[7]. Hurria A, Levit LA, Dale W, et al. Improving the evidence base for treating older adults with cancer: American Society of Clinical Oncology statement. J Clin Oncol. 2015;33(32):3826–33. [PubMed: 26195697]

[8]. Jacobsen PB, Rowland JH, Paskett ED, et al. Identification of key gaps in cancer survivorship research: findings from the American Society of Clinical Oncology survey. J Oncol Pract. 2016;12(3):190–3. [PubMed: 26907451]

[9]. Mohile SG, Hurria A, Cohen HJ, et al. Improving the quality of survivorship for older adults with cancer. Cancer. 2016;122(16):2459–568. [PubMed: 27172129]

[10]. Guerard EJ, Nightingale G, Bellizzi K, et al. Survivorship care for older adults with cancer: U13 conference report. J Geriatr Oncol. 2016;7(4):305–12. [PubMed: 27424802]

[11]. Nekhlyudov L, Levit L, Hurria A, Ganz PA. Patient-centered, evidence-based, and cost-conscious cancer care across the continuum: translating the Institute of Medicine report into clinical practice. CA Cancer J Clin. 2014;64(6):408–21. [PubMed: 25203697]

[12]. Hurria A, Naylor M, Cohen HJ. Improving the quality of cancer care in an aging population: recommendations from an IOM report. JAMA. 2013;310(17):1795–6. [PubMed: 24193075]

[13]. Brunello ASR, Extermann M. Multidimensional geriatric evaluation for older cancer patients as a clinical and research tool. Cancer Treat Rev. 2009;35(6):487–92. [PubMed: 19481353]

[14]. Fried TR, Bradley EH, Towle VR, Allore H. Understanding the treatment preferences of seriously ill patients. N Engl J Med. 2002;346(14):1061–6. [PubMed: 11932474]

[15]. Karuturi M, Wong ML, Hsu T, et al. Understanding cognition in older patients with cancer. J Geriatr Oncol. 2016;7(4):258–69. [PubMed: 27282296]

[16]. Magnuson A, Wallace J, Canin B, et al. Shared goal setting in team-based geriatric oncology. J Oncol Pract. 2016;12(11):1115–22. [PubMed: 27624949]

[17]. Magnuson A, Mohile S, Janelsins M. Cognition and cognitive impairment in older adults with cancer. Curr Geriatr Rep. 2016;5(3):213–9. [PubMed: 27547701]

[18]. Loh KP, Mohile SG, Epstein RM, et al. Willingness to bear adversity and beliefs about the curability of advanced cancer in older adults. Cancer. 2019;125(14): 2506–13. [PubMed: 30920646]

[19]. Hurria A, Mohile SG, Dale W. Research priorities in geriatric oncology: addressing the needs of an aging population. J Natl Compr Canc Netw. 2012;10(2):286–8. [PubMed: 22308521]

[20]. Wildiers H, Mauer M, Pallis A, et al. End points and trial design in geriatric oncology research: a joint European organisation for research and treatment of cancer–Alliance for Clinical Trials in Oncology–International Society Of Geriatric Oncology position article. J Clin Oncol. 2013;31(29):3711–8. [PubMed: 24019549]

[21]. Crome P, Flanagan RJ. Pharmacokinetic studies in elderly people. Are they necessary? Clin Pharmacokinet. 1994;26(4):243–7. [PubMed: 8013158]

[22]. McCabe MS, Bhatia S, Oeffinger KC, et al. American Society of Clinical Oncology statement: achieving high-quality cancer survivorship care. J Clin Oncol. 2013;31 (5):631–40. [PubMed: 23295805]

[23]. Jacobsen PB, DeRosa AP, Henderson TO, et al. Systematic review of the impact of cancer survivorship care plans on health outcomes and health care delivery. J Clin Oncol. 2018;36(20):2088–100. [PubMed: 29775389]

[24]. Emery JD, Jefford M, King M, et al. ProCare trial: a phase II randomized controlled trial of shared care for follow-up of men with prostate cancer. BJU Int. 2017;119 (3):381–9. [PubMed: 27431584]

[25]. Nicolaije KA, Ezendam NP, Vos MC, et al. Impact of an automatically generated cancer survivorship care plan on patient-reported outcomes in routine clinical practice: longitudinal outcomes of a pragmatic, Cluster Randomized Trial. J Clin Oncol. 2015;33(31):3550–9. [PubMed: 26304900]

[26]. Snyder DC, Morey MC, Sloane R, et al. Reach out to ENhancE Wellness in Older Cancer Survivors (RENEW): design, methods and recruitment challenges of a home-based exercise and diet intervention to improve physical function among long-term survivors of breast, prostate, and colorectal cancer. Psychooncology. 2009; 18(4):429–39. [PubMed: 19117329]

[27]. Morey MC, Snyder DC, Sloane R, et al. Effects of home-based diet and exercise on functional outcomes among older, overweight long-term cancer survivors: RENEW: a randomized controlled trial. JAMA. 2009;301(18):1883–91. [PubMed: 19436015]

[28]. Kilari D, Soto-Perez-de-Celis E, Mohile SG, et al. Designing exercise clinical trials for older adults with cancer: recommendations from 2015 Cancer and Aging Research Group NCI U13 meeting. J Geriatr Oncol. 2016;7(4):293–304. [PubMed: 27197916]

[29]. Klepin HD, Mohile SG, Mihalko S. Exercise for older cancer patients: feasible and helpful? Interdiscip Top Gerontol. 2013;38:146–57. [PubMed: 23503523]

[30]. Loh KP, Kleckner IR, Lin PJ, et al. Effects of a home-based exercise program on anxiety and mood disturbances in older adults with cancer receiving chemotherapy. J Am Geriatr Soc. 2019;67(5):1005–11. [PubMed: 31034591]

[31]. Sprod LK, Mohile SG, Demark-Wahnefried W, et al. Exercise and cancer treatment symptoms in 408 newly diagnosed older Cancer patients. J Geriatr Oncol. 2012;3 (2):90–7. [PubMed: 22712028]

[32]. Presley CJ, Dotan E, Soto-Perez-de-Celis E, et al. Gaps in nutritional research among older adults with cancer. J Geriatr Oncol. 2016;7(4):281–92. [PubMed: 27197919]

[33]. Huang LW, Smith AK, Wong ML. Who will care for the caregivers? Increased needs when caring for frail older adults with cancer. J Am Geriatr Soc. 2019;67(5):873–6. [PubMed: 30924526]

[34]. Kehoe LA, Xu H, Duberstein P, et al. Quality of life of caregivers of older patients with advanced cancer. J Am Geriatr Soc. 2019;67(5):969–77. [PubMed: 30924548]

[35]. Alfano CM, Leach CR, Smith TG, et al. Equitably improving outcomes for cancer survivors and supporting caregivers: A blueprint for care delivery, research, education, and policy. CA Cancer J Clin. 2019;69(1):35–49. [PubMed: 30376182]

[36]. Kent EE, Rowland JH, Northouse L, et al. Caring for caregivers and patients: research and clinical priorities for informal cancer caregiving. Cancer. 2016;122(13): 1987–95. [PubMed: 26991807]

[37]. Rowland JH, Bellizzi KM. Cancer survivorship issues: life after treatment and implications for an aging population. J Clin Oncol. 2014;32(24):2662–8. [PubMed: 25071099]

[38]. Shapiro CL. Cancer survivorship. N Engl J Med. 2018;379(25):2438–50. [PubMed: 30575480]

[39]. Giacalone A, Talamini R, Fratino L, et al. Cancer in the elderly: the caregivers' perception of senior patients' informational needs. Arch Gerontol Geriatr. 2009;49 (2):e121–5. [PubMed: 19070376]

[40]. Haley WE. Family caregivers of elderly patients with cancer: understanding and minimizing the burden of care. J Support Oncol. 2003;1(4 Suppl 2):25–9. [PubMed: 15346997]

[41]. Mitchell P, et al. Core principles and values of effective team-based care. Washington, D.C; 2012..

[42]. Koll T, Pergolotti M, Holmes HM, et al. Supportive care in older adults with cancer: across the continuum. Curr Oncol Rep. 2016;18(8):51. [PubMed: 27342609]

[43]. Pergolotti M, Lyons KD, Williams GR. Moving beyond symptom management towards cancer rehabilitation for older adults: answering the 5W's. J Geriatr Oncol. 2018;9(6):543–9. [PubMed: 29212610]

[44]. Pergolotti M, Williams GR, Campbell C, Munoz LA, Muss HB. Occupational therapy for adults with cancer: why it matters. Oncologist. 2016;21(3):314–9. [PubMed: 26865588]

[45]. Pergolotti M, Cutchin MP, Weinberger M, Meyer AM. Occupational therapy use by older adults with cancer. Am J Occup Ther. 2014;68(5):597–607. [PubMed: 25184473]

[46]. Pergolotti M, Deal AM, Williams GR, et al. Older adults with cancer: A randomized controlled trial of occupational and physical therapy. J Am Geriatr Soc. 2019;67(5): 953–60. [PubMed: 31034594]

[47]. Mackenzi Pergolotti, Alfano Catherine M, Cernich Alison, et al. A health services research agenda to fully integrate cancer rehabilitation into oncology care. Cancer. 2019;125(22):3908–16. [PubMed: 31390063]

[48]. Lyons KD, Radomski MV, Alfano CM, et al. Delphi study to determine rehabilitation research priorities for older adults with cancer. Arch Phys Med Rehabil. 2017;98 (5):904–14. [PubMed: 28007446]

[49]. Burhenn PS, Bryant AL, Mustian KM. Exercise promotion in geriatric oncology. Curr Oncol Rep. 2016;18(9):58. [PubMed: 27484061]

[50]. Loh KP, Lin PJ, Uth J, Quist M, Klepin H, Mustian K. Exercise for managing cancer- and treatment-related side effects in older adults. J Geriatr Oncol. 2018;9(4): 405–10. [PubMed: 29606599]

[51]. Cherrier MM, Anderson K, David D, et al. A randomized trial of cognitive rehabilitation in cancer survivors. Life Sci. 2013;93(17):617–22. [PubMed: 24012579]

[52]. Kesler S, Hadi Hosseini SM, Heckler C, et al. Cognitive training for improving executive function in chemotherapy-treated breast cancer survivors. Clin Breast Cancer. 2013;13(4):299–306. [PubMed: 23647804]

[53]. Fernandes HA, Richard NM, Edelstein K. Cognitive rehabilitation for cancer-related cognitive dysfunction: a systematic review. Support Care Cancer. 2019;27(9): 3253–79. [PubMed: 31147780]

[54]. Ferguson RJ, Sigmon ST, Pritchard AJ, et al. A randomized trial of videoconference-delivered cognitive behavioral therapy for survivors of breast cancer with self-reported cognitive dysfunction. Cancer. 2016;122(11):1782–91. [PubMed: 27135464]

[55]. Park CL, Pustejovsky JE, Trevino K, et al. Effects of psychosocial interventions on meaning and purpose in adults with cancer: A systematic review and meta-analysis. Cancer. 2019;125(14):2383–93. [PubMed: 31034600]

[56]. Trevino KM, Healy C, Martin P, et al. Improving implementation of psychological interventions to older adult patients with cancer: convening older adults, caregivers, providers, researchers. J Geriatr Oncol. 2018;9(5):423–9. [PubMed: 29759913]

[57]. Nelson CJ, Saracino RM, Roth AJ, et al. Cancer and aging: reflections for elders (CARE): A pilot randomized controlled trial of a psychotherapy intervention for older adults with cancer. Psychooncology. 2019;28(1):39–47. [PubMed: 30296337]

[58]. Sharma M, Loh KP, Nightingale G, Mohile SG, Holmes HM. Polypharmacy and potentially inappropriate medication use in geriatric oncology. J Geriatr Oncol. 2016;7(5):346–53. [PubMed: 27498305]

[59]. Ramsdale E, Lemelman T, Loh KP, et al. Geriatric assessment-driven polypharmacy discussions between oncologists, older patients, and their caregivers. J Geriatr Oncol. 2018;9(5):534–9. [PubMed: 29530495]

[60]. Whitman A, DeGregory K, Morris A, Mohile S, Ramsdale E. Pharmacist-led medication assessment and deprescribing intervention for older adults with cancer and polypharmacy: a pilot study. Support Care Cancer. 2018;26(12):4105–13. [PubMed: 29869294]

[61]. Mohile SG, Magnuson A, Pandya C, et al. Community oncologists' decision-making for treatment of older patients with cancer. J Nat Comp Cancer Network: JNCCN. 2018;16(3):301–9.

[62]. Sarzynski EB, H.. Current evidence and controversies: advanced practice providers in healthcare. Am J Manag Care. 2019.;25(8).

[63]. Bruinooge SS, Pickard TA, Vogel W, et al. Understanding the role of advanced practice providers in oncology in the United States. J Adv Pract Oncol. 2018;9(6): 585–98. [PubMed: 31186981]

[64]. Yen TWF, Nattinger AB, McGinley EL, Fergestrom N, Pezzin LE, Laud PW. Investigating the association between advanced practice providers and chemotherapy-related adverse events in women with breast cancer: A nested case-control study. J Oncol Pract. 2018;14(11):e644–52. JOP1800277.

[65]. McCabe MS, Pickard TA. Planning for the future: the role of nurse practitioners and physician assistants in survivorship care. Am Soc Clin Oncol Educ Book. 2012: e56–61. [PubMed: 24451832]

[66]. Puts MTE, Strohschein FJ, Del Giudice ME, et al. Role of the geriatrician, primary care practitioner, nurses, and collaboration with oncologists during cancer treatment delivery for older adults: A narrative review of the literature. J Geriatr Oncol. 2018;9(4):398–404. [PubMed: 29747954]

[67]. Jennings LA, Tan Z, Wenger NS, et al. Quality of care provided by a comprehensive dementia care comanagement program. J Am Geriatr Soc. 2016;64(8):1724–30. [PubMed: 27355394]

[68]. Golden AG, Silverman MA, Issenberg SB. Addressing the shortage of geriatricians: what medical educators can learn from the nurse practitioner training model. Acad Med. 2015;90(9):1236–40. [PubMed: 26200581]

[69]. Lichtenstein BJ, Reuben DB, Karlamangla AS, Han W, Roth CP, Wenger NS. Effect of physician delegation to other healthcare providers on the quality of care for geriatric conditions. J Am Geriatr Soc. 2015;63(10):2164–70. [PubMed: 26480977]

[70]. Reuben DB, Ganz DA, Roth CP, McCreath HE, Ramirez KD, Wenger NS. Effect of nurse practitioner comanagement on the care of geriatric conditions. J Am Geriatr Soc. 2013;61(6):857–67. [PubMed: 23772723]

[71]. Kline RM, Arora NK, Bradley CJ, et al. Long-term survivorship care after cancer treatment - summary of a 2017 National Cancer Policy Forum Workshop. J Natl Cancer Inst. 2018;110(12):1300–10. [PubMed: 30496448]

[72]. Glasgow RE, McKay HG, Piette JD, Reynolds KD. The RE-AIM framework for evaluating interventions: what can it tell us about approaches to chronic illness management? Patient Educ Couns. 2001;44(2):119–27. [PubMed: 11479052]

[73]. Katzman R, Brown T, Fuld P, Peck A, Schechter R, Schimmel H. Validation of a short orientation-memory-concentration test of cognitive impairment. Am J Psychiatry. 1983;140(6):734–9. [PubMed: 6846631]

[74]. Cahalin LP, Mathier MA, Semigran MJ, Dec GW, DiSalvo TG. The six-minute walk test predicts peak oxygen uptake and survival in patients with advanced heart failure. Chest. 1996;110(2):325–32. [PubMed: 8697828]

[75]. Jehn M, Halle M, Schuster T, et al. The 6-min walk test in heart failure: is it a max or sub-maximum exercise test? Eur J Appl Physiol. 2009;107(3):317–23. [PubMed: 19618202]

[76]. Bowie CR, Harvey PD. Administration and interpretation of the trail making test. Nat Protoc. 2006;1(5):2277–81. [PubMed: 17406468]

[77]. Borson S, Scanlan JM, Chen P, Ganguli M. The Mini-Cog as a screen for dementia: validation in a population-based sample. J Am Geriatr Soc. 2003;51(10):1451–4. [PubMed: 14511167]

[78]. Borson S, Scanlan J, Brush M, Vitaliano P, Dokmak A. The Mini-Cog: a cognitive'vital signs' measure for dementia screening in multi-lingual elderly. Int J Geriatr Psychiatry. 2000;15(11):1021–7. [PubMed: 11113982]

[79]. Costa D, Severo M, Fraga S, Barros H. Mini-Cog and mini-mental state examination: agreement in a cross-sectional study with an elderly sample. Dement Geriatr Cogn Disord. 2012;33(2–3):118–24. [PubMed: 22508578]

[80]. Guralnik JM, Ferrucci L, Simonsick EM, Salive ME, Wallace RB. Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability. N Engl J Med. 1995;332(9):556–61. [PubMed: 7838189]

[81]. Marsh APWA, Haakonssen EH, et al. The virtual short physical performance battery. J Gerontol A Biol Sci Med Sci. 2015;70(10):1233–41. [PubMed: 25829520]

[82]. Reitan RWD. The Halstead-Rietan neuropsychological test battery. Neuropsychological Press; 1985..

[83]. A. B.. Differential behavioral effects in frontal lobe disease. Neuropsychologia. 2006.;6(53).

[84]. Spreen O, Strauss Esther. A Compendium of Neuropsychological Tests: Administration, Norms and Commentary. Oxford University; 1991..

[85]. Parmelee PA, Katz IR. Geriatric depression scale. J Am Geriatr Soc. 1990;38(12): 1379.

[86]. Cella DWH, Shalhoub H, et al. Content validity and psychometric evaluation of functional assessment of chronic illness therapy-fatigue in patients with psoriatic arthiritis. J Patient-Rep Outcomes. 2019.;3(1).

[87]. Cella DNC. Measuring quality of life in chronic illness: the functional assessment of chronic illness therapy measurement system. Arch Phys Med Rehabil. 2002;83 (12):10–7. [PubMed: 11782826]

[88]. Cella DLJ, Stone A. Self-reported fatigue: one dimension or more? Lessons from the functional assessment of chronic illness-fatigue (FACIT-F) questionnaire. Support Care Cancer. 2011;19(9):1441–50. [PubMed: 20706850]

[89]. Mohile SG, Epstein RM, Hurria A, et al. Communication with older patients with cancer using geriatric assessment: A cluster-randomized clinical trial from the National Cancer Institute Community oncology research program. JAMA Oncol. 2019: 1–9.

[90]. Sattar S, Alibhai SMH, Brennenstuhl S, et al. Health status, emergency department visits, and oncologists' feedback: an analysis of secondary endpoints from a randomized phase II geriatric assessment trial. J Geriatric Oncol. 2019;10(1):169–74.

[91]. Kenis C, Heeren P, Bron D, et al. Multicenter implementation of geriatric assessment in Belgian patients with cancer: a survey on treating physicians' general experiences and expectations. J Geriatr Oncol. 2014;5(4):431–8. [PubMed: 24986786]

[92]. Magnuson A, Allore H, Cohen HJ, et al. Geriatric assessment with management in cancer care: current evidence and potential mechanisms for future research. J Geriatr Oncol. 2016;7(4):242–8. [PubMed: 27197915]

[93]. Magnuson A, Lemelman T, Pandya C, et al. Geriatric assessment with management intervention in older adults with cancer: a randomized pilot study. Support Care Cancer. 2018;26(2):605–13. [PubMed: 28914366]

[94]. Kenis C, Decoster L, Flamaing J, et al. Adherence to geriatric assessment-based recommendations in older patients with cancer: a multicenter prospective cohort study in Belgium. Ann Oncol. 2018;29(9):1987–94. [PubMed: 29905766]

[95]. Faul LA, Luta G, Sheppard V, et al. Associations among survivorship care plans, experiences of survivorship care, and functioning in older breast cancer survivors: CALGB/Alliance 369901. J Cancer Surviv. 2014;8(4):627–37. [PubMed: 24917307]

[96]. Mohile SG, Dale W, Somerfield MR, et al. Practical assessment and management of vulnerabilities in older patients receiving chemotherapy: ASCO guideline for geriatric oncology. J Clin Oncol. 2018;36(22):2326–47. [PubMed: 29782209]

[97]. Mohile SG, Velarde C, Hurria A, et al. Geriatric assessment-guided care processes for older adults: A Delphi consensus of geriatric oncology experts. J Nat Comp Cancer Network. 2015;13(9):1120–30.

[98]. Cella D, Lai JS, Stone A. Self-reported fatigue: one dimension or more? Lessons from the Functional Assessment of Chronic Illness Therapy–Fatigue (FACIT-F) questionnaire. Support Care Cancer. 2011;19(9):1441–50. [PubMed: 20706850]

[99]. Cella D, Nowinski CJ. Measuring quality of life in chronic illness: the functional assessment of chronic illness therapy measurement system. Arch Phys Med Rehabil. 2002;83(12 Suppl 2):S10–7. [PubMed: 12474167]

[100]. Cella D, Wilson H, Shalhoub H, et al. Content validity and psychometric evaluation of functional assessment of chronic illness therapy-fatigue in patients with psoriatic arthritis. J Patient Rep Outcomes. 2019;3(1):5. [PubMed: 30680661]

[101]. Mohile S, Dumontier C, Mian H, et al. Perspectives from the Cancer and Aging Research Group: caring for the vulnerable older patient with cancer and their caregivers during the COVID-19 crisis in the United States. J Geriatr Oncol. 2020;11 (5):753–60. [PubMed: 32340908]

[102]. DiGiovanni G, Mousaw K, Lloyd T, et al. Development of a telehealth geriatric assessment model in response to the COVID-19 pandemic. J Geriatr Oncol. 2020;11 (5):761–3. [PubMed: 32327321]

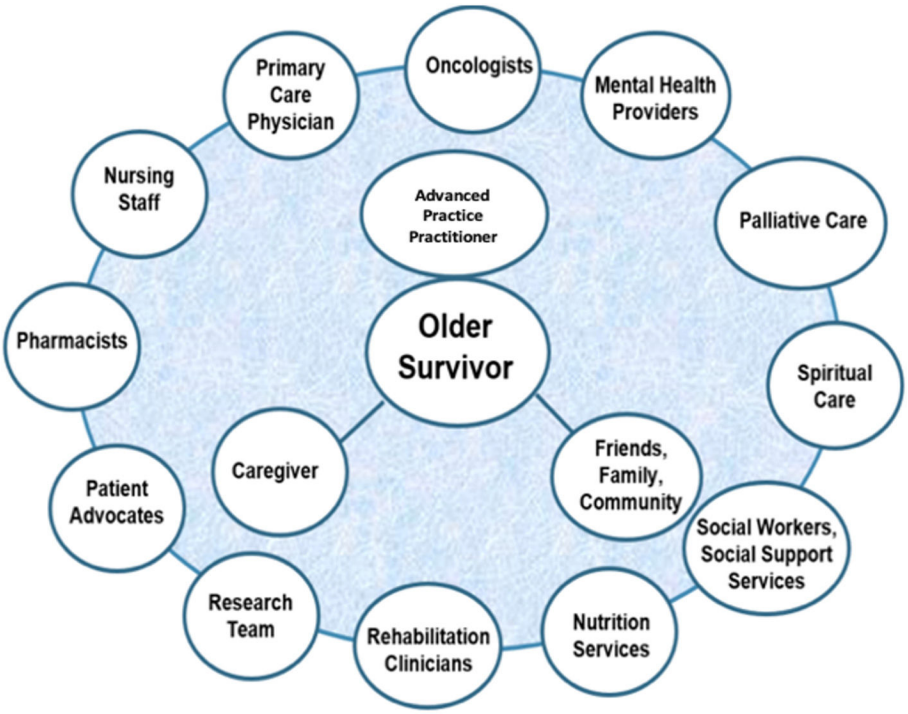

Fig. 1.
APP-directed management for older cancer survivors.

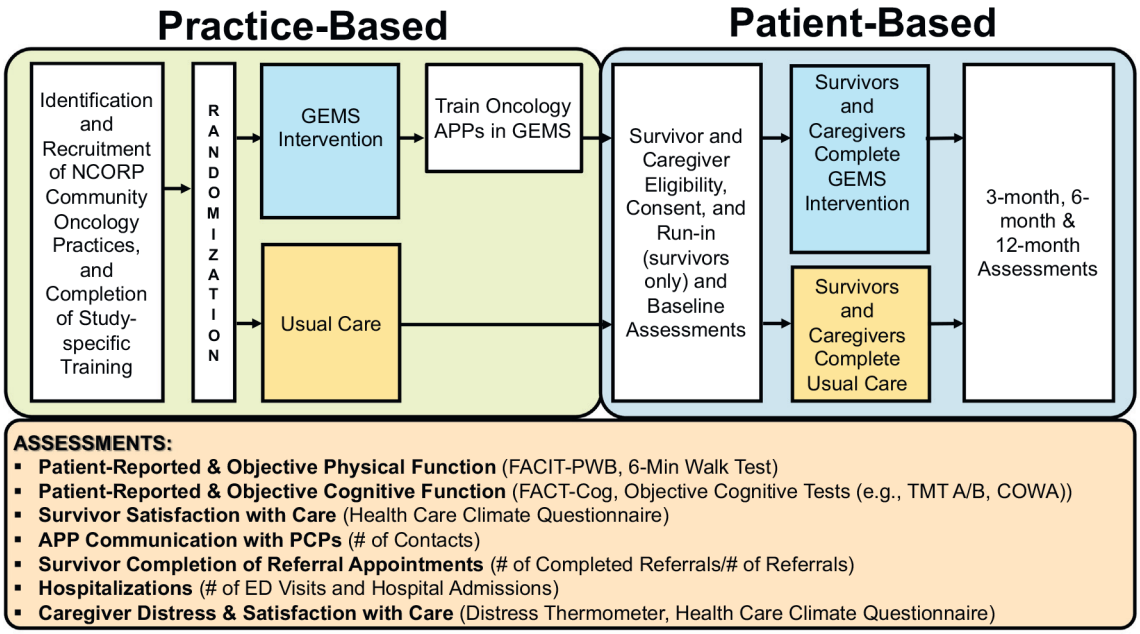

Fig. 2.

Study schema.

Note: NCORP = National Cancer Institute Community Oncology Research Program; GEMS = Geriatric Evaluation and Management combined with Survivorship Health Education and Exercise for Cancer Patients (EXCAP©®); APP = Advanced Practice Practitioner; FACIT-PWB = Functional Assessment of Chronic Illness Therapy – Fatigue Physical Well-being Subscale; TMT A/B = Trail Making Part A and Part B; COWA = Controlled Oral Word Association (i.e., FAS Test); PCP = Primary Care Physician; ED = Emergency Department.

J Geriatr Oncol. Author manuscript; available in PMC 2022 July 15.

Table 1

Inclusion and exclusion criteria.

	Inclusion Criteria	Exclusion Criteria
Practice Cluster	■ Identify one (or more) advanced practice practitioner (APP). ■ Desire to participate in the study, including presence of an investigator (e.g., NCORP PI, oncology physician, APP) and/or program administrator/supervisor who is willing to be a key contact. ■ Agreement that enrolled cancer survivors and caregivers (if available) will not formally be offered other survivorship plans or programs and that a Survivorship Health Education instructor(s) will be identified for your practice cluster. ■ Demonstrated support/buy-in from oncology physicians and APPs who are willing to enroll cancer survivors. ■ Agreement of practice leadership and staff (e.g., study coordinator) to support study activities. ■ If necessary, willingness to participate in a phone interview to determine capacity to implement the intervention.	
Oncology Physician and APP	■ Works at a URCC NCORP practice with no plans to leave that practice or retire within two years of enrollment into the study. ■ Has experience in oncology and/or geriatrics (APP). ■ Has license to practice (APP).	
SHE Instructors	■ Must have a minimum of a Bachelor's degree in a health-related field (e.g., exercise science/kinesiology, health education, public health, nursing, psychology, social work, other). ■ The SHE instructor is also required to have a professional fitness certification to perform exercise prescription and instruction (individual and/or group) via the American College of Sports Medicine (ACSM) or similar fitness certification organizations (e.g., American Council on Exercise, National Council on Strength and Fitness, National Strength and Conditioning Association, YMCA). ACSM Cancer Exercise Trainer certification is preferred, but not required. ■ SHE instructors must also have ≥2 years of experience working with individuals who are cancer patients or survivors, or individuals with other chronic diseases or disabilities. It is strongly preferred that SHE instructors have experience working with older individuals. ■ SHE instructor experience is required in the areas of teaching healthy lifestyle behaviors, prescribing individualized exercise, and/or teaching group exercise classes.	
Cancer Survivor	■ 65 years of age or older. ■ Have completed or will have completed curative-intent adjuvant chemotherapy for any solid tumor malignancy in last 4 weeks. ■ Be willing and able to come in for study visits or willing to undergo informed consent and assessments remotely via tele-health visits when necessary. ■ Be willing and able to provide informed consent and must sign consent in-person or remotely if it is not convenient or feasible to provide informed consent in-person. ■ Speak and read English and/or Spanish. Spanish-speaking cancer survivors are eligible as long as there are appropriate resources in place for completion of study procedures at the practice site.	■ Have surgery *planned* within six months of informed consent. Cancer survivors who previously had surgery are eligible. ■ Have a condition that precludes their ability to participate in informed consent or procedures (e.g., dementia and/or Blessed Orientation Memory Concentration (BOMC) Score ≥ 11).
Caregiver	■ 18 years ofageorolder. ■ Selected by the cancer survivor when asked if there is a "*family member, partner, friend or caregiver [age 18years or older] with whom you discuss or who can be helpful in health-related matters.*" A caregiver need not be someone who lives with the cancer survivor or provides direct hands-on care. ■ Speak and read English and/or Spanish. Spanish-speaking caregivers are eligible as long as there are appropriate resources in place for completion of study procedures.	■ Caregivers unable to understand the informed consent form or study procedures due to cognitive, health, or sensory impairment will be excluded. ■ Capacity to conduct informed consent procedures and study procedures will be determined by the coordinators in collaboration with the cancer survivors' oncologists. ■ Have surgery *planned* within six months of informed consent. Caregivers who previously had surgery are eligible.

Table 2

Outcome Measures

(Measures will be collected at run-in, baseline, 3, 6, and/or 12 months).

Outcome	Measures	Descriptions	References
Primary	Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F)–Physical Well-being Subscale [FACIT-PWB]	The FACIT-F is a 40-item questionnaire divided into five domains: Physical well-being (PWB; 7-items), social/family well-being (SWB; 7-items), emotional well-being (EWB; 6-items), functional well-being (FWB; 7-items), and fatigue (13-items). Each question uses a 5-point rating scale (0 = Not at all; 1 = A little bit; 2 = Some what; 3 = Quite a bit; and 4 = Very much). The FACIT-F has been validated in the geriatric population. It has consistently demonstrated high internal validity and high test-retest reliability. The FACIT-PWB is used for assessing primary survivor aim to capture patient-reported physical function in this study. The FACIT-F will be offered both in-person and via tele-health when it is not convenient or feasible to do so in-person.	- Cella D, Lai JS, Stone A. Self-reported fatigue: one dimension or more? Lessons from the Functional Assessment of Chronic Illness Therapy–Fatigue (FACIT-F) questionnaire. *Support Care Cancer.* 2011;19 (9):1441–1450. - Cella D, Nowinski CJ. Measuring quality of life in chronic illness: the functional assessment of chronic illness therapy measurement system. *Arch Phys Med Rehabil.* 2002;83(12 Suppl 2): S10–17. - Cella D, Wilson H, Shalhoub H, et al. Content validity and psychometric evaluation of Functional Assessment of Chronic Illness Therapy-Fatigue in patients with psoriatic arthritis. *J Patient Rep Outcomes.* 2019;3(1):5.
Secondary and Tertiary	FACT-Cognitive Function (FACT-Cog, version 3)	The FACT-Cog provides an overall score and subdomain scores (perceived impairment, perceived abilities, comments from others, impact on quality of life). The FACT-Cog will be offered both in-person and via tele-health when it is not convenient or feasible to do so in-person.	- van Dam FS, Schagen SB, Muller MJ, et al. Impairment of cognitive function in women receiving adjuvant treatment for high-risk breast cancer: high-dose versus standard-dose chemotherapy. *J Natl Cancer Inst.* 1998;90(3):210–218. - Vardy J, Wong K, Yi QL, et al. Assessing cognitive function in cancer patients. *Support Care Cancer.* 2006;14 (11):1111–1118.
	Six-Minute Walk Test (6MWT)	A validated protocol is used to derive the total distance walked in 6 min. The coordinator will administer in-person 6MWT.	- Cahalin LP, Mathier MA, Semigran MJ, Dec GW, DiSalvo TG. The six-minute walk test predicts peak oxygen uptake and survival in patients with advanced heart failure. *Chest.* 1996;110(2):325–332. - Jehn M, Halle M, Schuster T, et al. The 6-min walk test in heart failure: is it a max or sub-maximum exercise test? *Eur J Appl Physiol.* 2009;107(3):317–323.
	Trail Making Part A/B (TMT A/B) and Controlled Oral Word Association (COWA) (i.e., FAS test)	*Trail Making (TMT) A/B* is validated in English and is used to assess attention, visual scanning, psychomotor speed, and executive function. In part A, participants draw a line connected to each encircled number in sequential order. In part B, participants draw a line to connect encircled numbers and letters in sequential order. Time to complete the test (in seconds) is recorded for both parts A and B. Part A is stopped after 3 min and Part B is stopped after 5 min. It will be offered only in-person. *Controlled Oral Word Association (COWA) Test* (i.e., FAS Test) is validated in English and is used to assess verbal associative fluency and executive function. The test assesses fluency with naming words with F, A, and S. Participants are asked to tell the administrator as many words as possible beginning with the letter F, excluding proper nouns, and the same word with a different suffix. The participant has 60 s to list as many words as possible. The number of correct words, incorrect words, and the number if repeats will be recorded. This test takes less than 5 min to administer. Trials are repeated for the letters A and S. This will be offered both in-person and via tele-health.	- Bowie CR, Harvey PD. Administration and interpretation of the Trail Making Test. *Nat Protoc.* 2006;1 (5):2277–2281. - Reitan R WD. The Halstead-Rietan neuropsychological test battery. *Neuropsychological Press.* 1985. - B. Differential behavioral effects in frontal lobe disease. *Neuropsychologia.* 2006;6(53). - Spreen O, and Esther Strauss. A Compendium of Neuropsychological Tests: Administration, Norms and Commentary. *Oxford University.* 1991.
Exploratory Health Care Outcomes	Health Care Climate Questionnaire (HCCQ) and HCCQ-Communication	This questionnaire measures patient-centered autonomy-supportive physician behaviors such as whether the patient and caregiver feel that the physician understands his/her perspective, provides choices and options, and encourages participation in decisions. The measure has been studied and validated in older patients. Similar to other studies that adapt satisfaction	- Elkin EB, Kim SH, Casper ES, Kissane DW, Schrag D. Desire for information and involvement in treatment decisions: elderly cancer patients' preferences and their physicians' perceptions. *J Clin Oncol.* 2007;25 (33):5275–5280.

Outcome	Measures	Descriptions	References
		scales to capture specific clinical criteria (e.g., satisfaction with physician regarding communication about chemotherapy), the HCCQ has also been modified for this study to specifically address patient satisfaction with physician behaviors and communication regarding age-related issues and concerns in order to specifically address satisfaction with the intervention (Geriatric Assessment summary) rather than satisfaction with other aspects of cancer care (e.g., communication about cancer treatment). The HCCQ (both original and modified for communication) is available only in English. It is offered both in-person and via tele-health.	- Arora NK, Weaver KE, Clayman ML, Oakley-Girvan I, Potosky AL. Physicians' decision-making style and psychosocial outcomes among cancer survivors. *Patient Educ Couns.* 2009;77(3):404–412. - Epstein RM, Street RL,Jr. Shared mind: communication, decision making, and autonomy in serious illness. *Ann Fam Med.* 2011;9(5):454–461.
	Health Care Utilization (Emergency Department visits, hospitalizations, and routine survivorship care practices)	These data will be extracted from the electronic medical record by the coordinators. As in our previous studies, clinic visits, Emergency Department visits, and hospital records will be sent to the URCC NCORP Research Base for review.	- Epstein RM, Duberstein PR, Fenton JJ, et al. Effect of a Patient-Centered Communication Intervention on Oncologist-Patient Communication, Quality of Life, and Health Care Utilization in Advanced Cancer: The VOICE
	Participant Feedback Questionnaire	All participants (cancer survivors and caregivers) in the intervention arm will be asked to provide their views on the GEMS intervention independently using open-ended qualitative interviews at the end of the study. The feedback questionnaire and interviews will allow us to obtain information needed to assess participant reaction (e.g., what they liked? disliked?) to improve the intervention for future studies by altering aspects of the intervention that participants might have disliked. It was developed in English and will be translated from English to Spanish when administered to a Spanish-speaking participant by a medical interpreter. It will be offered both in-person and via tele-health.	Randomized Clinical Trial. *JAMA Oncol.* 2017;3 (1):92–100.
	APP Communication with PCPs	These data will be collected at *baseline, 3, and 6 months* using a REDCap questionnaire in which coordinators and/or APPs document the number of times the APPs or other staff have contacted (i.e., in-person or by phone, email, text) the cancer survivors' primary care teams. Total count will be used in analyses.	
	Completion ofReferral Appointments	These data will be collected at *baseline, 3, and 6 months* using a REDCap questionnaire where coordinators record the total number of referrals provided to each cancer survivor and the total number of referrals completed. The total number of referrals completed/total number of referrals will be used in analyses. The coordinators will verify with the APPs and the medical record which management recommendations were completed as well as barriers to non-completion. Any survivorship care practices outside of study procedures will also be captured.	
Exploratory Caregiver Outcomes	Health Care Climate Questionnaire (HCCQ) caregiver-Communication (caregiver)	This questionnaire measures provider behavior such as whether the provider answers questions and encourages caregiver participation in decisions involving the cancer survivors. The HCCQ (both original and modified for communication) is available only in English. It is offered both in-person and via tele-health.	- Elkin EB, Kim SH, Casper ES, Kissane DW, Schrag D. Desire for information and involvement in treatment decisions: elderly cancer patients' preferences and their physicians' perceptions. *J Clin Oncol.* 2007;25 (33):5275–5280. - Arora NK, Weaver KE, Clayman ML, Oakley-Girvan I, Potosky AL. Physicians' decision-making style and psychosocial outcomes among cancer survivors. *Patient Educ Couns.* 2009;77(3):404–412. - Epstein RM, Street RL,Jr. Shared mind: communication, decision making, and autonomy in serious illness. *Ann Fam Med.* 2011;9(5):454–461.
	Distress Thermometer	This measure is widely used by health professionals to assess the level of patient and caregiver distress (on a 0–10 scale). The Distress Thermometer is translated from English to Spanish using consensus translation by a team of certified Spanish-speaking translators. It will be offered both in-person and via tele-health.	- Elizabeth A. Guancial CD, Andrea Baran, Sandra Sabatka, Judith Baumhauer, and Paul Duberstein. Distress Thermometer. *Journal of Clinical Oncology.* 2016;34(2):350. - Fujinami R, Sun V, Zachariah F, Uman G, Grant M, Ferrell

Outcome	Measures	Descriptions	References
			B. Family caregivers' distress levels related to quality of life, burden, and preparedness. *Psychooncology*. 2015;24(1):54–62.

Table 3

Geriatric assessment scores and management recommendation examples.

Domain	Tool	Score Signifying Impairment	Management Recommendation Examples
Functional Status	■ Activities of Daily Living (ADL)* ■ Instrumental ADLs(IADL)*	■ AnyADLdeficit ■ AnyIADLdeficit	■ Referral to physical/occupational therapy ■ Home safety evaluation ■ Physical activity/exercise prescription
Objective Physical Performance	■ Short Physical Performance Battery* ■ Fall History* ■ Older Adult Resources and Services (OARS) Physical Health*	■ ≤9 points ■ Any history of falls ■ A lot of difficulty with any task	■ Direct communication with the primary care physician (PCP) in relation to risk of falls ■ Referral to physical/occupational therapy ■ Home safety evaluation ■ Education and/or handouts for fall prevention
Comorbidity	■ OARS Comorbidity*	■ **Patient answered "yes" to ≥ 3 chronic illnesses** and/or one illness that interferes "a great deal" with quality of life	■ Direct communication with PCP to develop management plan for comorbidities ■ Communicate with relevant subspecialists (e.g., cardiologist) ■ Smoking cessation counselling if smoking
Nutrition	■ Body Mass Index ■ Mini Nutritional Status* ■ Weight loss	■ <21 kg/m^2 ■ ≤11 points ■ >10% in the last 6 months	■ Referral to nutritionist/dietitian ■ Referral to meal support services ■ Education on a healthy diet ■ Referral for oral or swallowing assessment and intervention if appropriate
Social Support	■ OARS Medical Social Support*	■ Patient answers one of the social support questions indicating less than adequate support for care	■ Referral to social worker or visiting nurse service ■ Financial counselling ■ Assess for elder abuse ■ Confirm health care proxy
Polypharmacy	■ Polypharmacy	■ ≥5 regularly scheduled prescription medications	■ Direct communication with PCP to reduce complexity of meds ■ Medication review of pill bottles and boxes and assessment of adherence
Psychological Status	■ Generalized Anxiety Disorder (GAD)-7* ■ Geriatric Depression Scale*	■ ≥10points ■ ≥5 points	■ Direct communication with PCP ■ Assess for substance abuse ■ Referral to counselling or social worker ■ Referral for group support options
Cognition	■ Blessed Orientation Memory Concentration (BOMC) ■ Mini-Cog*	■ ≥11 ■ 0 words recalled OR 1–2 words recalled + abnormal clock drawing test	■ Direct communication with PCP about cognition concerns ■ Evaluate for concurrent mood disorder ■ Identify reversible causes of cognitive impairment ■ Referral to clinician with experience in assessing and treating cognitive impairment (e.g., neuropsychologist)
General (for all)			■ Health care proxy information ■ Advanced care planning ■ Assessment ofliteracy

Abbreviations: ADL (Activities of Daily Living); BOMC (Blessed-Orientation Memory Concentration Test); GAD (Generalized Anxiety Disorder); GDS (Geriatric Depression Scale); IADL (Instrumental Activities of Daily Living).

Table 4

Survivorship Health Education (SHE) group session content.

Week	Session	Topic	Examples of Content Reviewed
1	1	Cancer Survivorship Overview	Defining Survivorship Health records and individualized care
	2	Managing Side Effects	Late and long-term side effects and resources
2	3	Exercise Behavior Change	Physical Activity and Exercise: Exercise for Cancer Patients (EXCAP©®) Program
	4	Cancer Rehabilitation	Concerns and challenges, counselling services, rehabilitation
3	5	A Healthy Lifestyle	Tobacco cessation, reducing alcohol intake, nutrition
	6	Stress Management and Changes in Relationships	Reducing stress, emotional well-being support, changes in families and relationships
4	7	Support Groups and Resources	Survivorship services and support
	8	Financial Management	Managing finances, organizing bills

J Geriatr Oncol. Author manuscript; available in PMC 2022 July 15.