A RANDOMIZED CONTROLLED TRIAL OF SYMPTOM SCREENING BY CHILDREN WITH CANCER AND FEEDBACK TO PROVIDERS

BACKGROUND

There are approximately 1,500 children and adolescents diagnosed with cancer each year in Canada and there are currently over 10,000 children living with cancer nationally.[1] Over the last few decades, impressive gains in survival have been made and now, more than 82% of children with cancer will be cured.[2] These survival gains have been, in part, attributable to the provision of intensive therapies. However, as a result, most children suffer and experience severe and distressing treatment-related symptoms such as pain, fatigue and nausea.[3] In our recent cross-sectional study of 302 inpatients 8-18 years of age, 99% of children experienced at least one bothersome symptom and 60% experienced at least one *severely* bothersome symptom, including severe pain in 22% and severe fatigue in 33% when asked about yesterday or today.[4] Symptoms impact on quality of life (QoL), morbidity and future psychosocial functioning.[5]

We know from studies in adult cancer patients that routine collection of patient-reported outcomes (PROs), improves patient-clinician communication,[6] reduces distress[7] and improves QoL.[8,9] Furthermore, a recent randomized trial showed that routine PRO assessment may improve survival in adults with metastatic solid tumors.[10] Thus, the routine measurement of PROs is considered essential to high quality of care.[8] Challenges to the incorporation of PROs into clinical practice include lack of integration into clinical care work flow.[11] We also know that delivery of care consistent with evidence-based clinical practice guidelines (CPGs) can improve patient outcomes.[12] However, compliance with CPGs is generally poor.[13,14]

Consequently, in Canadian adult oncology practice, screening and assessment of symptoms and improving accessibility of supportive care CPGs are important priorities.[15-18] Efforts by Cancer Care Ontario have culminated in the wide-spread use of a symptom screening tool based upon the Edmonton Symptom Assessment Scale (ESAS).[19] The ESAS is a validated tool which asks adult patients to rate the severity of nine common symptoms including pain, anxiety and nausea. In a satisfaction survey of 2,921 patients, 87% of respondents thought the ESAS was an important tool for letting healthcare providers know how they feel.[20] Furthermore, through an initiative with Cancer Care Ontario and the Canadian Partnership against Cancer, evidence-based guidelines were developed to manage severe symptoms identified by the tool.[20] These efforts have continued to evolve and led to the development and implementation of the Interactive Symptom Assessment and Collection (ISAAC) tool, Your Symptoms Matter, which allows patients to assess and monitor their symptoms through an online computer program. Your Symptoms Matter is available at kiosks in 14 regional cancer centers and 28 hospitals across Ontario. More than 27,000 patients are screened every month through the system. Implementation of ISAAC in the adult cancer setting improved health outcomes,[19] led to decreased emergency room visits and triggered clinical action for those with higher symptom scores.[21,22] In contrast to these advances in adult cancer care, efforts in children are limited.[23] We used the Knowledge-to-Action cycle[24] as the conceptual framework to guide this research program.

Objectives

Among children and adolescents 8-18 years of age with cancer seen in hospital daily for 5 days, to determine if daily symptom screening and provision of symptom reports to healthcare providers with links to supportive care CPGs is associated with the following when compared to standard of care:
Aim 1: Better self-reported total SSPedi scores
Aim 2: Better self-reported individual SSPedi symptom, pain (Faces Pain Scale-Revised) and QoL (PedsQL 3.0 Acute Cancer Module) scores
Aim 3: Improved provider documentation of symptoms and intervention provision for symptom control

We hypothesize that daily symptom screening and feedback with links to CPGs will be associated with lower total SSPedi scores (less bothersome symptoms), improvement in specific symptoms, pain and QoL and better documentation of symptoms and provision of interventions for symptom

management.

Figure 1: SSPedi

Preliminary Data

Efforts in children to achieve routine symptom screening and enhance CPG compliance are limited.[23] We conducted a systematic review and identified the lack of appropriate symptom screening tools for children with cancer and that no study altered patient management based upon identified symptoms.[25]

SSPedi: Early in our program, we recognized the lack of an appropriate symptom screening tool for pediatric cancer patients and thus, developed the Symptom Screening in Pediatrics Tool (SSPedi) (Figure 1).[26,27] It is a 15-item symptom screening tool for children receiving cancer treatments; recall period is yesterday or today. Items were generated using a nominal group technique among pediatric cancer clinicians and a patient advocate.[28] Next, based upon input from 50 children receiving cancer treatments and 20 parents of pediatric oncology patients, we refined the paper and electronic versions of SSPedi and confirmed content validity, understandability and ease of use.[28-30] The electronic version of SSPedi has an audio feature which allows specific questions or the entire instrument to be read aloud. A help feature provides synonyms for each symptom; these were derived primarily from children themselves during cognitive interviewing.

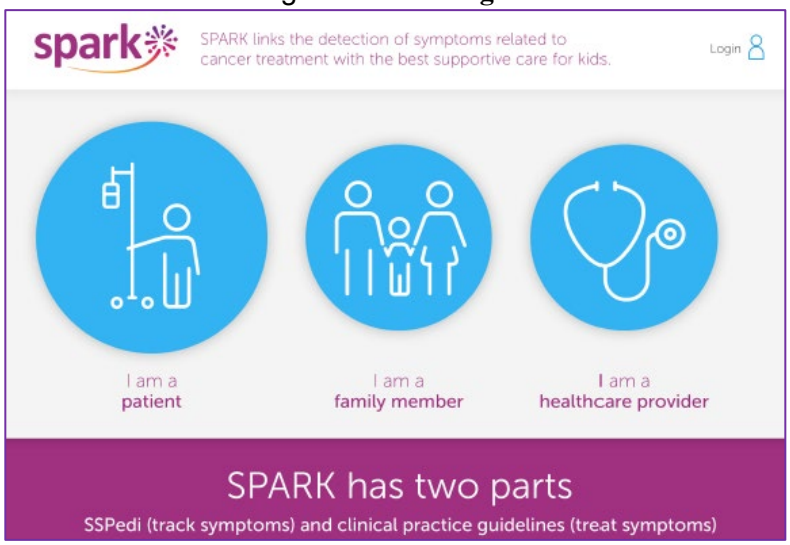
Next, we conducted a multi-center study to evaluate the psychometric properties of SSPedi. Among 502 children 8-18 years of age receiving cancer treatments, all were able to complete SSPedi without difficulty. We confirmed that SSPedi is reliable, valid and responsive to change. More specifically, the intraclass correlation coefficients were 0.88 (95% confidence interval (CI) 0.82 to 0.92) for test re-test reliability, and 0.76 (95% CI 0.71 to 0.80) for inter-rater reliability between children and parents. Mean difference in total SSPedi scores between groups hypothesized to be more and less symptomatic was 7.8 (95% CI 6.4 to 9.2; P<0.001). Construct validity was demonstrated as all hypothesized relationships among measures were observed. SSPedi was responsive to change; those who reported they were much better or worse on a global symptom change scale had significantly changed from their baseline score (absolute mean difference 5.6, 95% CI 3.8 to 7.5; P<0.001).[4]

SPARK: Supportive care Prioritization, Assessment and Recommendations for Kids (SPARK) (Figure 2) is a web-based application which builds upon SSPedi and consists of two components: (1) a symptom screening component centered on SSPedi; and (2) a supportive care CPG component. CPGs contained within SPARK are those that meet rigorous development criteria established by the National Guideline Clearinghouse.[31] There are patient, family and healthcare provider portals in SPARK. This proposal focuses on the patient and provider portals of SPARK.

SPARK pages and function were developed and iteratively refined by performing cognitive

interviews using the think aloud technique with 90 children receiving cancer treatment and 60 healthcare providers until the website was considered satisfactory for longitudinal evaluation.

Figure 2: SPARK



Next, in a pilot study conducted in preparation for the proposed RCT, we evaluated the feasibility of daily completion of SSPedi for 5 days among children who were either admitted to hospital or seen in clinic for 5 consecutive days. We defined feasibility as the completion of SSPedi within SPARK for at least 60% of on-study days in at least 75% of participants. In 3 months, we enrolled 20 participants of whom 18 completed assessments all 5 days. Two children missed one day each: one because of transfer to the intensive care unit due to a seizure and the second because she was seen in clinic only for blood work and was missed by the research team. Consequently, 100% of children met our *a priori* defined threshold for feasibility. All found completion of SSPedi via SPARK was easy and that SPARK was easy to navigate. They all thought daily completion was "about right" and not "too much" or "too little" for this population. All completely understood their own SPARK bar and line graphs.

Symptom Documentation and Interventions for Symptom Control: Our previous work included the description of symptoms documented in the health record and identification of intervention provision for symptoms. We created a standard operating procedure and a list of synonyms which met criteria for documentation of symptoms. For example "tired", "feel weak", "low energy" and "sluggish" were all both considered adequate documentation for fatigue. We also created a list of interventions for each symptom. For example, acetaminophen, ibuprofen and opioids were all considered interventions for pain. We reviewed the medical records of 100 consecutive children and adolescents who had completed symptom screening using SSPedi at The Hospital for Sick Children (SickKids). Symptom documentation and interventions were generally low for all symptoms except for pain and nausea and vomiting. Among those who reported at least medium bother, the proportion of patients in whom the symptom was documented by healthcare providers were: problems thinking or remembering (0%), changes in how body or face look (4%), changes in taste (3%), feeling more or less hungry (7%), tingly or numb hand or feet (10%) and cranky or angry (10%). Among the 21 children with moderately bothersome mouth sores, only 62% had any documentation and only 62% had provision of any intervention. Among the 33 with severely bothersome fatigue, only 18% had documentation and none were given an intervention. While pain was well documented (94%) and associated with interventions (100%), it was not completely controlled as 16% of children experienced severely bothersome pain despite intervention.

Factors Associated with Total Symptom Score: In our SSPedi validation study, among the 302 patients admitted to hospital and expected to be in hospital or clinic 3 days later, older age (P=0.0003) and stem cell transplant (P=0.030) were significantly associated with higher SSPedi scores in multiple regression.[32]

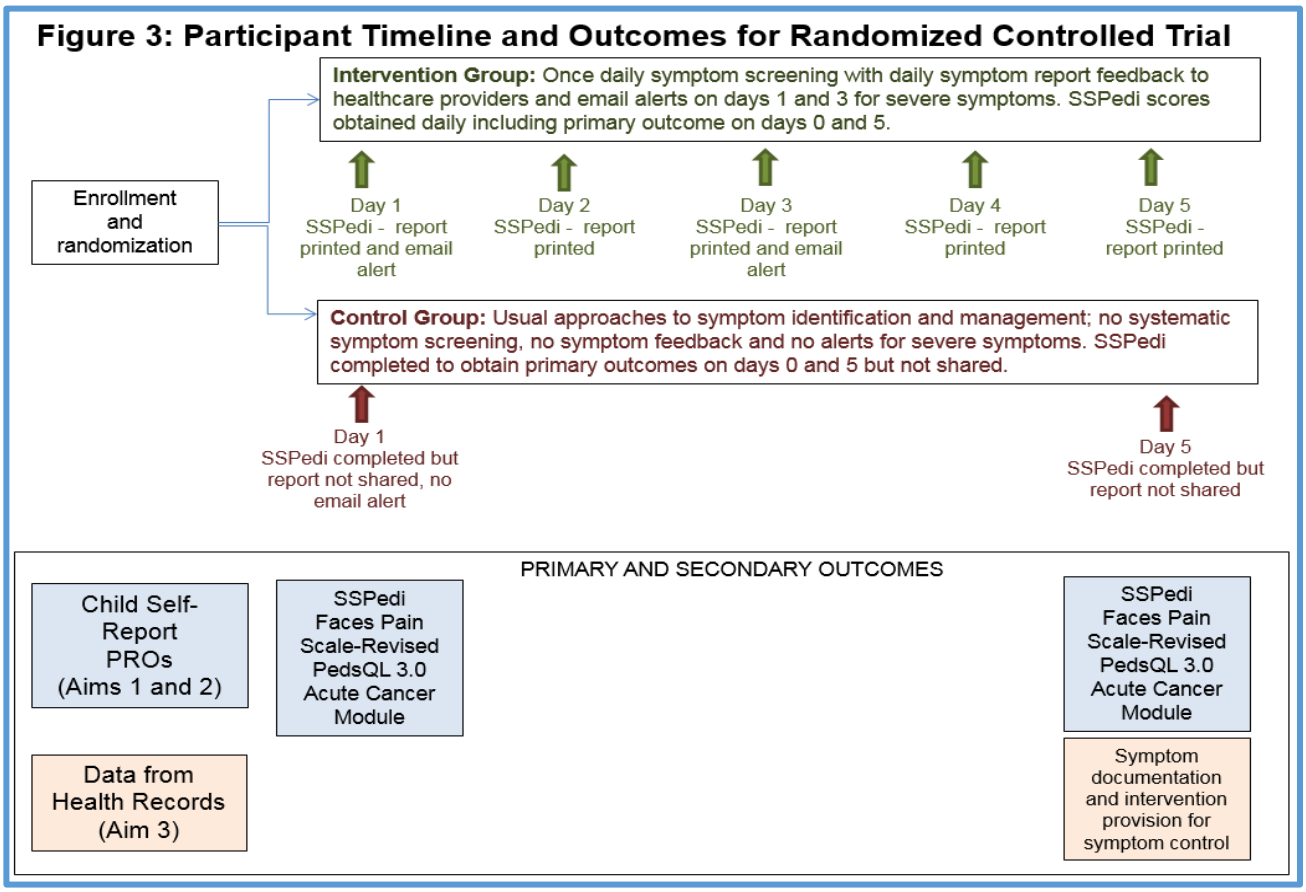
Rationale

In order to improve symptom control in pediatric cancer, we need a feasible mechanism by which children with cancer can be enabled to report and track symptoms, for this information to be readily available to clinicians and to facilitate clinician access to supportive care CPGs for symptom management. This application builds upon our expertise in pediatric cancer symptom screening, CPG

development and conduct of large multi-center pediatric cancer supportive care trials to improve pediatric cancer care and QoL. We anticipate the results to be directly translated into patient care if successful.

METHODS

This is a multi-center open label RCT and the study schema is shown as Figure 3. The setting is 8 Canadian academic institutions which care for children with cancer; all participated in our SSPedi validation study.[4]



Intervention and Control Groups

Intervention Arm: For those randomized to the intervention arm, we will use the procedures that were feasible in our longitudinal pilot study. Participants will complete symptom screening using SPARK once daily on a study-supplied iPad. For inpatients, daily reminders to complete SSPedi will appear on the iPad. Reports will be available to the child at any time. For outpatients, clinical research associates will provide the iPad in person daily and reports may be viewed at those encounters. Once daily was considered the optimal frequency for this population in our pilot study. The intervention is daily symptom screening with provision of reports to the healthcare team. Severe symptoms will result in email alerts. More specifically, SSPedi reports will be printed daily and provided in the patient chart or electronic health records (Figures 4a and 4b show example reports). On days 1 and 3, an alert will be emailed to the physician providing direct medical care if any symptom is “a lot” or “extremely” bothersome (score 3 or 4 on 0-4 scale). Reports and alerts will have links to SPARK-housed CPGs. The procedures developed for email correspondence have been approved by SickKids privacy consultants.

Figure 4a: Provider Single Day Report

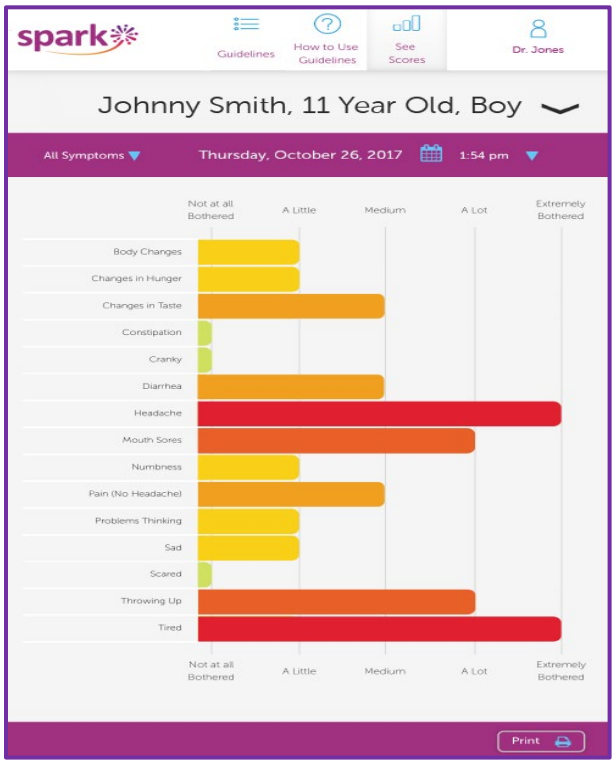
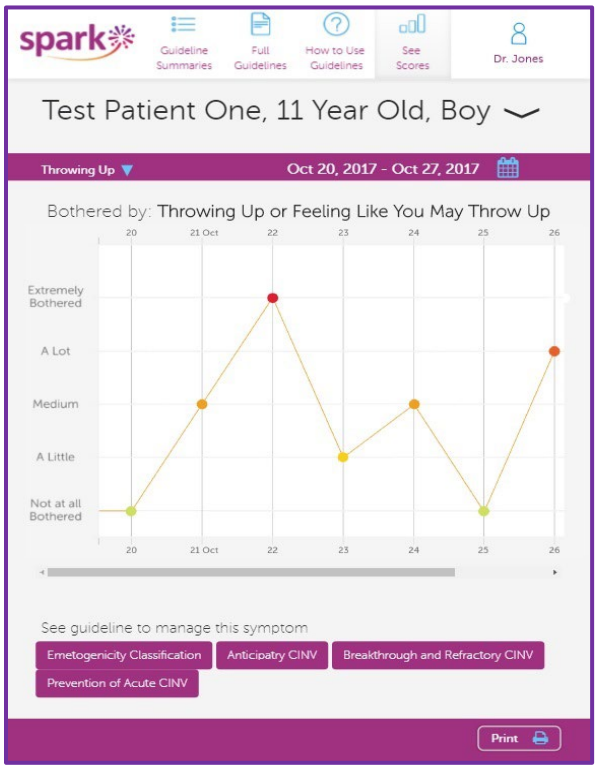


Figure 4b: Provider Multi-Day Report



Control Arm: Participants randomized to the control arm will not complete daily symptom screening. They will complete SSPedi on days 1 and 5 to obtain the primary outcome. Health care providers will not be notified of their SSPedi scores and no symptom reports or symptom alerts will be generated.

For both study groups participant's guardian will be asked to fill out a household demographic form.

Allocating Participants

The allocation sequence will be computer generated and will be concealed from all participants, healthcare providers and research team members. Consenting participants will be randomized 1:1 to intervention vs. control groups using permuted block sizes and stratified by treatment (stem cell transplant yes vs. no) and age (8-10, 11-14 and 15-18 years) as our previous data suggested that these factors were the most strongly associated with higher total SSPedi scores. Assignment of enrolled participants will be communicated by email to the institutional principal investigator and clinical research associate following randomization.

Protecting against Bias

We hypothesize that the key elements to improving symptom control will be: (1) the systematic measurement of bothersome symptoms; (2) providing this information to healthcare providers; and (3) improving access to supportive care CPGs for providers. Given that this trial is randomized at the individual level and not at the cluster level, clinicians caring for patients in the control group may be more aware of supportive care CPGs. Although this information does represent contamination, we hypothesize that without a mechanism for children and adolescents to report symptoms, this level of contamination will not substantially influence the effectiveness of the intervention. However, we will measure documentation of symptoms and provision of interventions to facilitate interpretation of trial

results. We are not conducting a cluster randomized trial because there are only 17 centers in Canada that treat children with cancer, and site numbers and logistical challenges preclude this study design.

Since the main outcomes are subjective, they will be reported by the participants themselves. They will not be blinded to allocation, thus raising concerns of reporter bias. Participants in the intervention arm will not know which of the five SSPedi scores they provide for the trial is the outcome; this should lessen the concern about reporter bias. The use of a standard of care control arm, in contrast to an attention control arm, is consistent with the more pragmatic nature of this randomized trial.

In our control group, we will obtain SSPedi scores at baseline and day 5 as they are required for the planned statistical analysis. We will not share these scores with the child, family or providers and thus, we do not anticipate bias. Further, in our studies of SSPedi and SPARK, we explicitly asked children whether they shared scores with their providers and even when patients can access their reports at any time (which will not be the case in our control patients), they almost never tell their providers this information. Thus, the risk of contamination is minimal.

Planned Inclusion and Exclusion Criteria

We will include pediatric patients with cancer who are 8-18 years of age, who can understand English and who are expected to be in hospital or in clinic daily for 5 days. Five days was chosen to allow longitudinal daily evaluation but preserve feasibility as few children are admitted or seen daily for longer than 5 days. Exclusion criteria will be illness severity, cognitive disability, or visual impairment that preclude utilization of SPARK according to the primary healthcare team.

Study Duration

The study period is 5 days. The study is complete on day 5 after completion of the intervention and ascertainment of outcomes.

Primary and Secondary Outcome Measures

For both intervention and control groups, all outcomes will be obtained in an identical fashion. Primary and secondary outcomes will be obtained at baseline and day 5; a clinical research associate will visit the participant at those two visits to facilitate self-reported outcomes. The primary outcome will be the self-reported total SSPedi score on day 5. The total SSPedi score is a validated measure that reflects the total burden of bothersome symptoms experienced.[4] The total score is the sum of each of the 15 items' Likert scores which range from 0 (not at all bothered) to 4 (extremely bothered) to yield a total score that ranges from 0 (no bothersome symptoms) to 60 (worst bothersome symptoms).

Secondary outcomes will be self-reported individual SSPedi symptom, pain (Faces Pain Scale-Revised) and QoL (PedsQL 3.0 Acute Cancer Module) scores. We will also measure documentation of symptoms and intervention provision for symptom control. Self-reported pain will be assessed using the Faces Pain Scale-Revised which consists of a series of horizontal faces that depict a neutral facial expression of no pain on the left and worst pain on the right. It has 6 faces and may be scored on a 0 to 10 scale in which higher numbers denote more pain.[33] Faces Pain Scale-Revised is psychometrically sound and feasible for children 4 to 18 years of age.[34] Self-reported QoL will be measured using the PedsQL 3.0 Acute Cancer Module. This measure is a multidimensional instrument that is reliable and valid in children with cancer.[35-38] It assesses pain and hurt, nausea, procedural anxiety, treatment anxiety, worry, cognitive problems, perceived physical appearance and communication. The self-report 7-day recall version will be used.

Documentation of symptoms and intervention provision for symptom control will be abstracted from the patients' health records using the procedures we developed. Interventions for each symptom will be categorized as any intervention provided vs. no intervention provided. Both documentation of symptoms and interventions for these symptoms will be described for each specific symptom. These outcomes will be obtained on day 5 with a one day window before and after the day 5 assessment. In other words, if the participant completed SSPedi on a Tuesday, we would accept documentation of that

symptom (or provision of an intervention for that symptom) if it were recorded in the health records on Monday, Tuesday or Wednesday.

The primary and secondary PROs will be measured by patient self-report while documentation of symptoms and intervention provision will be abstracted from the health record. Self-reported PROs and QoL measures are essential in this study as the intervention is focused on reducing symptom burden.

Sample Size Justification

We used data from our SSPedi validation study for power calculations.[4] We recruited 302 children who were hospitalized and expected to be in hospital or in clinic 3 days later. Children completed SSPedi on days 1 and 4 and a 5-point global symptom change scale on day 4. The average absolute change in total SSPedi scores for those who rated they were a little worse or a little better (1-point change) was 2.7 which is the minimally clinically important difference. The average standard deviation of the two total SSPedi scores (on days 1 and 4) was 8.5. Thus, with 80% power and alpha of 0.05, we will require 157 patients per group or 314 patients total. Assuming 10% will be non-evaluable, we will recruit 345 total.

Recruitment

All 8 participating institutions enrolled patients in our previous SSPedi validation study; all have experience with SSPedi, recruited patients in a timely fashion and submitted high quality data. Investigator calls twice a month will focus on recruitment status and enrollment issues. Specific outreach to each institutional principle investigator and clinical research associate will be made in the event of lagging accrual and a specific plan to rectify accrual will be made. If accrual continues to lag, the institution may be replaced.

Table 1 shows the number of expected eligible participants at the 8 sites; estimates were based on our pilot study. We anticipate 160 eligible patients per year. Thus, assuming that at least 60% of patients are identified and consent, we will complete enrollment within 4 years although accrual may take longer given the COVID-19 pandemic. Data analysis and knowledge dissemination will occur in year 5.

Table 1: Site (PI): Number new cancer patients annually (all ages)	**Year 1** Enroll	**Year 2** Enroll	**Year 3** Enroll	**Year 4** Enroll	**Year 5**
Toronto (Sung): 300-350	80	80	80	80	Analyze
Vancouver (Dix): 120-160	30	30	30	30	
Winnipeg (Vanan): 40-60	10	10	10	10	Publish
London (Patel): 55-70	10	10	10	10	
Hamilton (Gibson): 65-80	10	10	10	10	KTE
Ottawa (Johnston): 55-70	10	10	10	10	
Halifax (Kulkarni): 55-70	10	10	10	10	
Edmonton (McKillop) 40-70	10	10	10	10	
TOTAL	*170*	*170*	*170*	*170*	

Based upon our pilot data of 20 children completing longitudinal symptom screening, we do not anticipate problems with compliance. The loss to follow-up rate is likely very small given the 5 day nature of the study; we anticipate it will be less than 10%. There are 8 Canadian centers participating.

ANALYTIC PLAN

Baseline characteristics: Summary statistics on baseline characteristics will be calculated within each study arm and presented in a table – means and standard deviations (SDs) for variables treated as continuous, counts and percentages for categorical variables, along with total numbers with missing data.

Outcomes: Similar tables will be created for all study outcomes. Individual SSPedi symptom scores (which would require a total of 15 X 4 = 60 percentages for full reporting) will be summarized by the percentages of participants with scores of 3 or 4, the two most bothersome categories.

Comparative Analyses: The primary analysis will compare the day 5 total SSPedi scores between randomized groups using a linear regression model (analysis of covariance, ANCOVA) adjusting for the baseline SSPedi score, the two stratification variables age (8-10, 11-14 and 15-18 years) and treatment (hematopoietic cell transplant yes or no), diagnosis group (leukemia/lymphoma, solid tumor or central nervous system tumor) and relapse status (yes or no). The model-based estimated mean difference in day 5 scores between groups will be presented with a 95% confidence interval (CI) and a p-value for the test of the hypothesis that the difference is zero. If the distribution of residuals in this linear model is demonstrably skewed, we will use the non-parametric bootstrap with 2000 replications to estimate the standard error of the treatment effect (for hypothesis testing) and to estimate the 95% CI for the treatment effect.

Secondary outcomes will be analyzed as follows.

1. **Self-reported individual symptoms at day 5 on the SSPedi instrument**: For each of the 15 ordinal outcomes representing symptoms (scored 0-4), a proportional odds model will be fitted using the corresponding baseline symptom score, participant age and treatment as covariates. As some individual symptoms may be uncommon, to avoid specifying models that may be overfitted for those symptoms, these models will use only this minimal set of three covariates. The estimated odds ratio for the intervention (representing the odds of having a higher versus lower score in the intervention group) will be estimated and presented along with a 95% CI.
2. **Faces Pain Scale-Revised**: In keeping with common practice, this 6-point scale (scores of 0, 2, 4, 6, 8,10) will be treated as a continuous variable and analyzed using ANCOVA in the same way as the primary SSPedi outcome. To check the sensitivity of the substantive finding (i.e., whether the conclusion about efficacy is the same) to the analytic method, the analysis will be repeated using the same ordinal model used for the individual SSPedi components.
3. **PedsQL 3.0 Acute Cancer Module domain scores**: Each of these 8 scores will be treated as continuous variables and analyzed using ANCOVA in the same way as the primary SSPedi outcome.
4. **Documentation of symptoms on day 5 (±1 day):** Analyses will involve three analyses for each symptom class. Each analysis will fit a logistic regression model to estimate the odds ratio for documentation (on day 5 ±1 days) comparing intervention groups, adjusting for age and treatment. It is possible that there will be too few documentation events to reliably fit this three-parameter model to a sufficient number of the 15 symptoms. To be consistent across analyses of symptoms, if more than 5 of the 15 symptoms have fewer than 30 documentation events for any of analyses a, b, or c below, all treatment effects here will be estimated by a simple difference in the proportions with documentation, p-values will be computed from the Fisher exact test, and 95% confidence intervals will use the Newcombe method.
    a. Each participant will be classed as having the symptom documented or not. All participants are included in the analytic sample for each symptom.
    b. The analytic sample will be limited to those participants who self-report the symptom on the day 5 SSPedi (symptom score > 0).
    c. The analytic sample will be limited to those participants who have the most bothersome self-report of the symptom on the day 5 SSPedi (symptom score ≥ 3).
5. **Interventions for symptoms**: Analyses will follow a similar flow to the analyses of documentation of symptoms. For each of the 15 symptoms, each participant will be classified as having an intervention at day 5 (±1 days). Also collected is whether interventions were administered specifically for the specific symptoms. For example, acetaminophen may be administered for fever or pain. As interventions are expected to be more uncommon than symptoms, all treatment effects will be estimated by simple differences in the proportions with interventions, p-values will be computed from the Fisher exact test, and 95% confidence

intervals for differences in proportions will use the Newcombe method.

a. Each participant will be classed as having an intervention for the symptom or not. All participants are included in the analytic sample for each intervention-symptom pair.
b. The analytic sample will be limited to those participants who self-report the symptom on the day 5 SSPedi (symptom score > 0).
c. The analytic sample will be limited to those participants who have the most bothersome self-report of the symptom on the day 5 SSPedi (symptom score ≥ 3).

Missing Data: The PedsQL will be scored according to its scoring guide, which includes rules for scoring in the presence of missing elements on each domain modules. No other deterministic rule-based method will be used to deal with missing data.

If more than 5% are missing data on data needed to fit any of the analytic models (for the primary outcome, individual symptom scores, Faces Pain Scale-Revised, and PedsQL 3.0 Acute Cancer Module domain scores) the results for that model will use multiple imputation. A set of 20 complete datasets will be generated using separate within-treatment-group imputation models. These models will include all the study outcomes listed just above, and the key covariates that appear in our adjustment models (age, treatment, diagnosis group and relapse status). The models will be fitted in each imputed dataset and the pooled estimate of the treatment effect and its standard error will be computed using Rubin's rules.

Analyses of documentation and interventions will not use any imputation. There can be no missing data for these outcomes: if a symptom is not documented in the health record and there is no record of an intervention being used, then this constitutes a 'no' for the outcome. While it is possible that the SSPedi symptom score needed for the identification of the analytic datasets in analyses (4b, 4c, 5b, and 5c) is missing for some participants, the more exploratory nature of these analyses led us to the decision to use only observed data for these outcomes.

We will conduct one end-of-study analysis. There are no planned subgroup analyses.

Justification for Methodological Choices

A lower age limit of 8 years was chosen as this is the youngest age for which SSPedi has been validated. However, in parallel work, we have developed a proxy (2-7 years) and self-report (4-7 years) version of SSPedi for younger children and we are currently evaluating the reliability and validity of these instruments. Future work will expand SPARK using these tools in development.

We plan to conduct this study among English-speaking children because SSPedi is currently only available in English. Translation to other languages is in progress and future work will expand SPARK to include other languages.

INNOVATION, KNOWLEDGE TRANSLATION AND FUTURE PLANS

Innovation and Knowledge Translation and Exchange (KTE)

An innovative approach throughout our research program is the engagement with choice architecture experts to enhance the design of SPARK. Choice architecture is important as context can be created to nudge people into actions.[29,39] For instance, the layouts, message framing, visual elements and other contextual cues in the SPARK platform have been optimized to maximize the likelihood that the platform is used and the material is understood. We will continue to incorporate choice architecture input as we execute the trial.

The targets of our KTE efforts are patients, families, healthcare providers and decision makers including hospital and governmental administrators.

Integrated KTE*:* To increase awareness and to engage with a variety of stakeholders, we will create an Advisory Panel. The Panel will include two childhood cancer survivors, one parent of a child with

cancer, healthcare providers and hospital administrators. We will meet face-to-face or by teleconference at least annually to discuss progress and identify opportunities for KTE.

End of Grant KTE*:* We will publish the results of this study in peer-reviewed journals (minimum of 3 mid to high impact journals) and support attendance at national and international conferences. We plan to distribute plain language summaries throughout the Children's Oncology Group (COG), the C17 Research Network (represents the 17 centers in Canada) and the Pediatric Oncology Group of Ontario (represents the 5 centers in Ontario). We also plan to hold regular webinars and podcasts. The SickKids Industry, Partnerships and Commercialization office will help promote SPARK as a no cost web-portal for hospital use within Canada, offering the license to purchase to use the platform, technical support and data management outside of Canada. In order to further enhance KTE, we will create an end-of-grant report which summarizes the processes refined to achieve symptom screening and symptom feedback to providers. This report will include the steps taken, challenges encountered and solutions to those challenges. This report will help other institutions to implement the approach expeditiously.

Future Plans

Upon completion of this trial, we will use the information garnered to propose an incrementally more complex RCT in which we will achieve electronic health records integration of symptom data and create actions in the health records based upon high symptom scores. It is premature to undertake this trial in pediatric oncology at present as 3 of our 8 sites do not yet have computerized physician order entry. Further, achieving electronic health records integration will require years of preparatory work; we plan to conduct this work alongside this trial such that the next RCT will include electronic health record integration. This next trial will also include ambulatory patients with remote symptom screening from home.

A second future project will be to link the data from this trial with a pediatric cancer national database named Cancer in Young People-Canada (CYP-C). CYP-C has been collecting detailed demographic, cancer-related, and treatment data on all children with cancer in Canada since 2001 and it currently includes > 13,000 patients. The consent form for this application's RCT will allow future linking to CYP-C such that we can identify patient and institutional factors associated with high symptom scores and we can evaluate survival outcomes for those with uncontrolled symptoms.

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