Journal of Geriatric Oncology 14 (2023) 101469

Contents lists available at ScienceDirect

Journal of Geriatric Oncology

journal homepage: www.elsevier.com/locate/jgo

Research Paper

Feasibility and acceptability of remote symptom monitoring (RSM) in older adults during treatment for metastatic prostate cancer

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ARTICLE INFO

Keywords:
Metastatic prostate cancer
Remote symptom monitoring
Older adults
Supportive care

ABSTRACT

Introduction: Emerging data support multiple benefits of remote symptom monitoring (RSM) during chemotherapy to improve outcomes. However, these studies have not focused on older adults and do not include treatments beyond chemotherapy. Although chemotherapy, androgen receptor axis-targeted therapies (ARATs), and radium-223 prolong survival, toxicities are substantial and increased in older adults with metastatic prostate cancer (mPC). We aimed to assess RSM feasibility among older adults receiving life-prolonging mPC treatments.
Materials and Methods: Older adults aged 65+ starting chemotherapy, an ARAT, or radium-223 for mPC were enrolled in a multicentre prospective cohort study. As part of the RSM package, participants completed the Edmonton Symptom Assessment Scale (ESAS) daily and detailed questionnaires assessing mood, anxiety, fatigue, insomnia, and pain weekly online or by phone throughout one treatment cycle (3–4 weeks). Alerts were sent to the clinical oncology team for severe symptoms (ESAS ≥7). Participants also completed an end of study questionnaire that assessed study burden and satisfaction. Descriptive statistics were used to determine recruitment and retention rates, participant response rates to daily and weekly questionnaires, clinician responses to alerts, and participant satisfaction rates. An inductive descriptive approach was used to categorize open-ended responses about study benefits, challenges, and recommendations into relevant themes.
Results: Ninety males were included (mean age 77 years, 48% ARAT, 38% chemotherapy, and 14% radium-223). Approximately 38% of patients preferred phone-based RSM. Patients provided RSM responses in 1216 out of 1311 daily questionnaires (93%). Over 93% of participants were satisfied (36%), very satisfied (43%), or extremely satisfied (16%) with RSM, although daily reporting was reported by several (8%) as burdensome. Nearly 45% of patients reported severe symptoms during RSM. Most symptom alerts sent to the oncology care team were acknowledged (97%) and 53% led to follow-ups with a nurse or physician for additional care.

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https://doi.org/10.1016/j.jgo.2023.101469
Received 21 November 2022; Received in revised form 20 February 2023; Accepted 28 February 2023
Available online 12 March 2023

Discussion: RSM is feasible and acceptable to older adults with mPC, but accommodation needs to be made for phone-based RSM. The optimal frequency and duration of RSM also needs to be established.

1. Introduction

Despite advancements in cancer prevention and control, cancer morbidity and mortality rates continue to rise each year around the world [1–3]. It is estimated that approximately 20 million new cancer cases and 10 million deaths attributable to cancer occur [2–5]. This has largely been attributed to the growing global population of older adults, as age is a known risk factor for cancer [1,6,7]. In fact, most incident cancer cases and deaths worldwide are known to occur in older adults over the age of 65 [5,8]. These trends have been noted for decades, and place an increasing strain on the healthcare system [7,9,10]

Providing timely and comprehensive care to older adults with cancer can be particularly challenging, as many older adults have complex needs [11,12]. Although a comprehensive geriatric assessment is widely regarded as the standard for identifying individual needs, access to skilled geriatric care can be limited and requires a referral [13]. Moreover, outpatient follow up frequency for those receiving active cancer treatment can vary from weeks to a few months. During this time, patients may experience new or worsening issues (e.g., side effects, disease progression) [12]. Without early identification, these issues can rapidly worsen, leading to poor health outcomes, functional decline, early treatment discontinuation, and unplanned health care use [12,14,15]. In this regard, remote symptom monitoring (RSM) has been proposed to enable early identification and intervention. Through frequent systematic collection of patient-reported outcomes (PROs) between clinic visits, clinicians can potentially intervene earlier to avoid poor outcomes [13,16].

Various studies investigating the use of RSM have suggested that it can lead to improvements in health outcomes such as physical function, symptom burden, and quality of life [16–20]. However, these studies mainly include middle-aged adults. This raises issues of generalizability, particularly for older adults who are the primary demographic affected by cancer [8]. As older adults often face a unique set of challenges, such as reduced digital literacy, cognitive changes, and a higher burden of symptoms, more research focusing on this population is needed [21–23]. To date, some research has explored the feasibility of RSM in older adults living with cancer and have found this practice to be feasible, but the existing literature is scarce [14,24–26]. Moreover, most studies have focused on younger adults with different cancer types and varying disease severity. This represents a potential gap in the literature, since RSM interventions may need to be tailored for specific tumour types and stages in order to appropriately identify patients in need of immediate care. Knowing that maintaining quality of life is often a priority for older cancer patients, RSM creates opportunities to meet these priorities [27]. Therefore, investigating the feasibility of RSM in older adults with advanced cancer is warranted.

We examined the feasibility and acceptability of RSM in a sample of older adults starting treatment for metastatic prostate cancer (mPC). These data were collected to inform the design of a future RSM randomized controlled trial. We hypothesized that it would be feasible to capture daily symptoms if over 80% of study participants reported their symptoms over 80% of the time. The objectives of this study were (1) to determine recruitment and retention rates, (2) to determine the response rates to daily ESAS, weekly, and triggered questionnaires and explore clinician responses to alerts, (3) to determine acceptability through satisfaction rates, and (4) to explore themes related to study benefits, challenges, and recommendations expressed by participants.

2. Methods

2.1. Study Design

Toward a Comprehensive Supportive Care Intervention for Older or Frail Men with Metastatic castrate-resistant Prostate Cancer (TOPCOP2) is a prospective, multicentre, observational cohort study (NCT04193657). TOPCOP2 was conducted to investigate the feasibility and acceptability of RSM in older adults (aged 65+ years) undergoing chemotherapy, androgen receptor axis-targeted therapies (ARAT) (enzalutamide and abiraterone), or radium-223 for mPC.

2.2. Study Participants

Participants were recruited from the genitourinary clinics and chemotherapy day units at the Princess Margaret Cancer Centre (PM), University Health Network, and the Odette Cancer Centre (OCC), Sunnybrook Health Sciences Centre, both in Toronto, Canada. Both are comprehensive cancer centres that treat many older adults with prostate cancer. Participants were recruited prior to starting their first treatment cycle between January 2020 to December 2021. The flow of participants is illustrated in Fig. 1. Following the recommendations for pilot studies [28–30], we aimed to recruit a total of 90 participants (30 per treatment arm). The Ontario Cancer Research Ethics Board (OCREB) and both participating institutions approved TOPCOP2. All participants provided written informed consent prior to data collection.

Participants were included in the study if they were (1) diagnosed with metastatic castrate-resistant prostate cancer (mCRPC) (aged 65+ years) or metastatic castrate-sensitive prostate cancer (aged 75+ years); (2) starting chemotherapy, ARAT, or radium-223, or switching from one ARAT to another, or starting chemotherapy in the mCRPC setting at least one-year post use in the castrate-sensitive setting; (3) able to provide written informed consent; and (4) had a total testosterone level < 1.7 nmol/L in the mCRPC setting only. We selected a younger age limit for those with castrate-resistant prostate cancer due to postulated accelerated frailty from prior cancer treatment.

Participants were excluded if they were (1) unable to speak English fluently; (2) had severe neuropsychiatric comorbidities (e.g., moderate or severe dementia or poorly controlled depression) as per the treating physician; or (3) if their life expectancy was less than three months as estimated by the primary oncologist.

2.3. Data Collection

2.3.1. Baseline Measures

Baseline characteristics (age, education, living situation) were collected using a sociodemographic questionnaire developed for the TOPCOP2 study and patient chart extraction. To characterize the frailty status of participants, the Vulnerable Elders Survey-13 (VES-13) was used. The VES-13 is a self-administered validated and commonly used frailty scale that can predict a person's ability to tolerate chemotherapy [31–33]. A cut-off of 3 or greater was used to define vulnerability [31]. Daily functioning was evaluated using the Older Americans Resources and Services-Instrumental Activities of Daily Living (OARS-IADL) questionnaire [34] and the Eastern Cooperative Oncology Group Performance Status (ECOG PS) scale [35]. Comorbidity data were collected through chart review and classified using the Cumulative Illness Rating Scale-Geriatric (CIRS-G) [36]. Laboratory values were also obtained from chart review using the most recent results available prior to treatment [36–40].

2.3.2. Remote Symptom Monitoring Measures

RSM measures were collected daily, weekly, and triggered based on responses to other measures. Participants completed the Edmonton Symptom Assessment Scale (ESAS) daily on weekdays by phone or through a web-based online portal (based on patient preference) during their first treatment cycle (3 weeks for chemotherapy, 4 weeks for ARAT and radium-223). Phone- and web-based monitoring modalities were chosen based on ease of development and potential for implementation into clinical practice. The ESAS is a widely used and validated multi-dimensional symptom screening tool in oncology practice and research [37–42], and is endorsed by Cancer Care Ontario. It assesses 11 common cancer symptoms (pain, tiredness, nausea, appetite, insomnia, shortness of breath, depression, anxiety, wellbeing, diarrhea, and constipation) on a scale from 0 (none) to 10 (worst possible), assigning a score to each symptom. A score of $\leq$3, 4–6, and $\geq$ 7 on the ESAS represents mild, moderate, and severe symptoms, respectively.

For all ESAS symptoms (except wellbeing) that were rated 7 or higher (i.e., severe) or had a 2-point increase from the previous day, a more detailed questionnaire specific to the highly rated symptom was completed; this was referred to as the triggered questionnaire. To minimize participant burden, no more than one triggered questionnaire for each symptom was completed per week, and there was a minimum of 48 h between triggered and weekly questionnaires. Following the completion of the triggered questionnaires, if specific cut-off scores suggesting severe symptoms were met (see Supplemental Table 1), the clinical oncology team (oncologist and nursing group) was notified by the research coordinator via email and participants were advised to go to the emergency department or contact the nurse at the genitourinary clinic of their primary hospital (PM or OCC) or an after-hours oncology nursing line.

Once a week, participants completed a more detailed questionnaire about their symptoms, which included validated scales for pain, fatigue, mood, anxiety, and insomnia [43–47], along with [43–47]questions about nausea, appetite, shortness of breath, diarrhea, and constipation (the rationale for using each validated scale is outlined in Supplemental Table 2) [18,48,49]. Supplemental Table 3 depicts the study assessments and time-points in more detail. The weekly questionnaire was administered to gain a deeper understanding of symptom patterns. Findings about symptom patterns from the daily ESAS and the weekly questionnaires will be reported separately.

2.3.3. End of Study Interviews and Satisfaction Measure

At the end of the study, participants were invited to participate in a one-time, semi-structured interview about their symptom experience during treatment. Findings from the qualitative interviews are reported separately [50]. Finally, participants were asked to complete a brief (6-item) study completion questionnaire that assessed participant burden and satisfaction in the study. Participants rated their overall satisfaction with the study on a five-point Likert scale (1 = not at all satisfied to 5 = extremely satisfied) and shared the benefits and challenges of

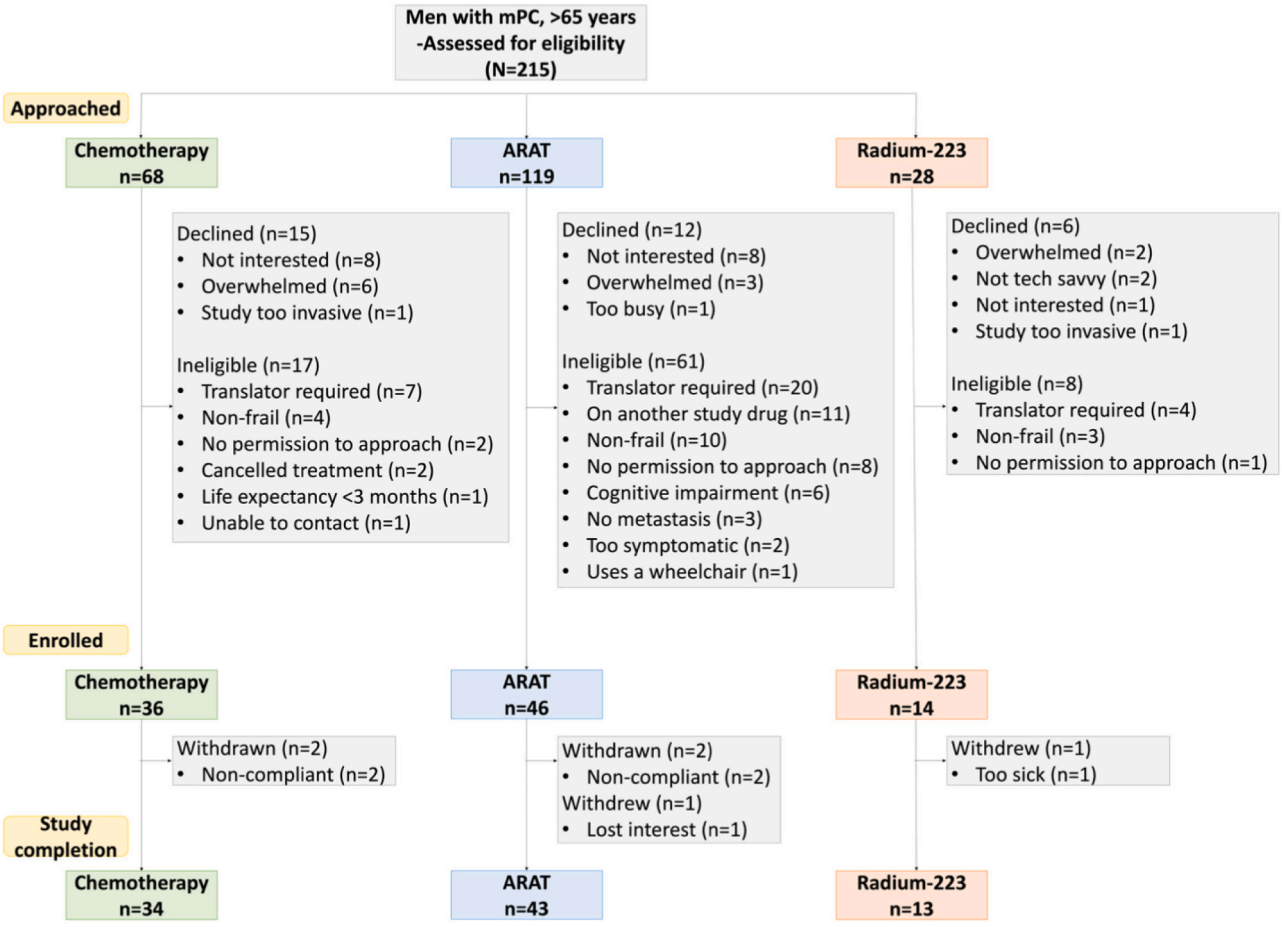

Fig. 1. CONSORT diagram illustrating the flow of participants in the study.
Note. ARAT = androgen receptor axis-targeted therapies.

participating in the study. Feedback to improve the process of symptom follow-up was also collected in the study completion questionnaire.

2.4. Data Analysis

Descriptive statistics were used to determine recruitment and retention rates (objective 1), response rates to daily ESAS, weekly, and triggered questionnaires (objective 2), and satisfaction rates (objective 3). Clinician responses to triggered alerts were also analyzed descriptively. An inductive descriptive approach was used to identify themes related to study benefits, challenges, and recommendations, as expressed by participants (objective 4).

3. Results

3.1. Baseline Characteristics

The mean age of the 90 participants was 77 years (range 65–91 years). Most participants had at least some college or university education (76%), lived with their spouse/partner/children (78%), and were retired (86%). The median PSA at the start of the study was 19 ng/mL, and the most common site of metastasis was bone (76%). Ninety percent of participants reported a good performance status (i.e., ECOG PS 0–1). However, 38% reported dependency in at least one OARS-IADL, and 58% reported a score ≥ 3 on the VES-13, suggesting frailty or vulnerability. Most participants were at least somewhat comfortable with using a smartphone (59%) and the internet (59%). Additional baseline characteristics are presented in Table 1.

3.2. Objective 1: Recruitment and Retention Rates

Of the 215 patients we approached, 86 were found to be ineligible (40% screen failure rate, predominantly due to limited English proficiency). Of the 129 eligible patients, 33 declined participation (17 not interested, 11 overwhelmed, two felt the study was too invasive, two reported low technological literacy, and one was too busy) and 96 were enrolled into the TOPCOP2 study (74% (96/129) recruitment rate). Ninety participants (34 chemotherapy, 43 ARAT, and 13 radium-223) who completed the study were included in the final analyses (94% retention rate). Four participants were withdrawn due to non-adherence and two participants withdrew due to disease progression and loss of interest. The CONSORT diagram illustrating the flow of participants is depicted in Fig. 1.

3.3. Objective 2: Participant Response Rates to Daily, Weekly, and Triggered Questionnaires and Clinician Responses

A high RSM response rate was observed across the daily, weekly, and triggered questionnaires. This includes 1216 out of 1311 completed daily questionnaires (93%) and 295 out of 321 completed weekly questionnaires (92%). Due to limitations in the data collection software, an exact response rate for the triggered questionnaires could not be computed. However, in a randomly selected sample of ten participants, 52 out of 58 triggered questionnaires were completed (90%). Overall, 38% of patients in this study preferred phone-based RSM as opposed to web-based RSM.

A total of 210 episodes of severe symptoms were reported by 45 participants, for which a triggered questionnaire was sent. However, 78 triggered questionnaires were not completed (37%), and therefore, we could not determine whether the symptoms were reportable to the clinical oncology team. Among participants who completed the triggered questionnaires, 63 symptoms (48%) were not categorized as severe based on the cut-off scores in Supplemental Table 1, and the notification of one symptom was missed by the research team.

The remaining 68 episodes of severe symptoms were reported to the oncology team, of which 66 (97%) were acknowledged (documented

Table 1
Baseline characteristics of study participants ($N = 90$).

	Chemo ($n = 34$)	ARAT ($n = 43$)	Ra223 ($n = 13$)	*p*-value
Sociodemographic Factors				
Age (y), mean (SD)	74 (5.5)	78 (6.0)	78 (6.1)	0.0067
Education, n (%)				0.30
College/university graduate	23 (68)	25 (58)	10 (77)	
Some college/ university	3 (8)	7 (16)	0	
High school graduate	3 (9)	4 (9)	0	
Less than high school	5 (15)	7 (16)	3 (23)	
Living Situation, n (%)				0.61
Living Alone	6 (18)	10 (23)	4 (31)	
Other	28 (82)	33 (77)	9 (69)	
Working Situation, n (%)				0.15
Full time or part time	7 (21)	3 (7)	1 (8)	
Retired	27 (79)	38 (91)	12 (92)	
Other	0	2 (5)	0	
Digital Literacy				
Used activity tracker prior to study, n (%)	19 (56)	13 (30)	6 (46)	0.07
Self-reported comfort with using a smartphone, n (%)				0.03
Extremely comfortable	2 (6)	3 (7)	0	
Very comfortable	18 (53)	6 (14)	5 (38)	
Somewhat comfortable	5 (15)	12 (29)	2 (15)	
A little comfortable	2 (6)	6 (14)	0	
Not at all comfortable	7 (21)	15 (36)	6 (46)	
Self-reported comfort with using the internet, n (%)				0.92
Extremely comfortable	2 (6)	3 (7)	1 (8)	
Very comfortable	16 (47)	16 (47)	4 (31)	
Somewhat comfortable	7 (21)	7 (21)	3 (23)	
A little comfortable	2 (6)	2 (6)	2 (15)	
Not at all comfortable	7 (21)	7 (21)	3 (23)	
Clinical Variables				
PSA (ng/mL), median (IQR)	35 (11.9–74.6)	13 (6.1–61.3)	26 (13.8–39.9)	0.60
Testosterone (nmol/L), median (IQR)	0.5 (0.2–0.6)	0.5 (0.3–0.6)	0.5 (0.2–0.5)	0.39
Site of metastasis, n (%)*				
Lymph node	5 (15)	11 (26)	0	0.003
Bone	25 (74)	30 (70)	13 (100)	0.03
Solid organ	8 (24)	5 (12)	0	0.02
CIRS-G Comorbidity Severity Index, mean (SD)	1.7 (0.5)	1.7 (0.6)	1.6 (0.4)	0.25
ECOG PS, n (%)				0.20
0	12 (38)	16 (39)	5 (38)	
1	16 (50)	25 (61)	2 (33)	
2	4 (13)	0	1 (17)	
Geriatric Variables				
One or more falls in the past six months, n (%)	8 (24)	8 (19)	3 (23)	0.26
OARS-IADL, dependency in at least one item, n (%)	16 (47)	14 (33)	4 (31)	0.36
VES-13, score of ≥ 3, n (%) (frailty or vulnerability)	19 (56)	25 (58)	8 (62)	0.93

Note. ARAT = androgen axis receptor therapy; Chemo = chemotherapy; CIRS-G = Cumulative Illness Rating Scale-Geriatric; Eastern Cooperative Oncology Group Performance Status; PSA = prostate-specific antigen; OARS-IADL = Older Americans Resources and Services-Instrumental Activities of Daily Living; VES-13 = Vulnerable Elders Survey-13.

* Numbers may not add up to 100% as participants can have more than one response.

actions included 19 participants being contacted by the genitourinary clinic, ten receiving medication advice, and six being referred to palliative care). In addition, 74 reminders to participants to call the nurses at the genitourinary clinic/CAREpath or proceed to the emergency room were given by the research team (some participants received multiple reminders due to ongoing severe symptoms). Based on these reminders, 15 participants called the nurses at the genitourinary clinic, six went to the emergency room, and two called the after-hours oncology nurse line. Fig. 2 describes the flow of severe symptom follow-up.

3.4. Objective 3: Participant Satisfaction Rates

A total of 71 participants (79%) were approached to complete the study completion questionnaire and 59 participants (83%) agreed (Table 2). Some participants were not approached due to administrative issues ($n = 10$), loss to follow-up ($n = 6$), language barriers ($n = 2$), and non-adherence (n = 1). Most respondents ($n = 55$, 95%) were satisfied, very satisfied, or extremely satisfied with RSM (Fig. 3). Most

Table 2
Study completion questionnaire response rates overall and by cohort.

	Chemo	ARAT	Ra223	Overall
Enrolled in study, n	34	43	13	90
Approached for study completion questionnaire[1], n	28	32	11	71
Completed questionnaire, n	25	25	9	59
Active Response Rate[2], %	89.3	78.1	81.8	83.1
Total Response Rate[3], %	73.5	58.1	69.2	65.6

Note. ARAT = androgen receptor axis-targeted therapy; Chemo = chemotherapy; Ra223 = radium-223.
[1] Some participants were not approached due to administrative issues ($n = 10$), loss to follow-up ($n = 6$), language barriers ($n = 2$), and non-adherence (n = 1).
[2] Active response rate was calculated using the number of completed questionnaires and the number of participants approached to complete the questionnaire.
[3] Total response rate was calculated using the number of completed questionnaires and the number of participants enrolled in the study.

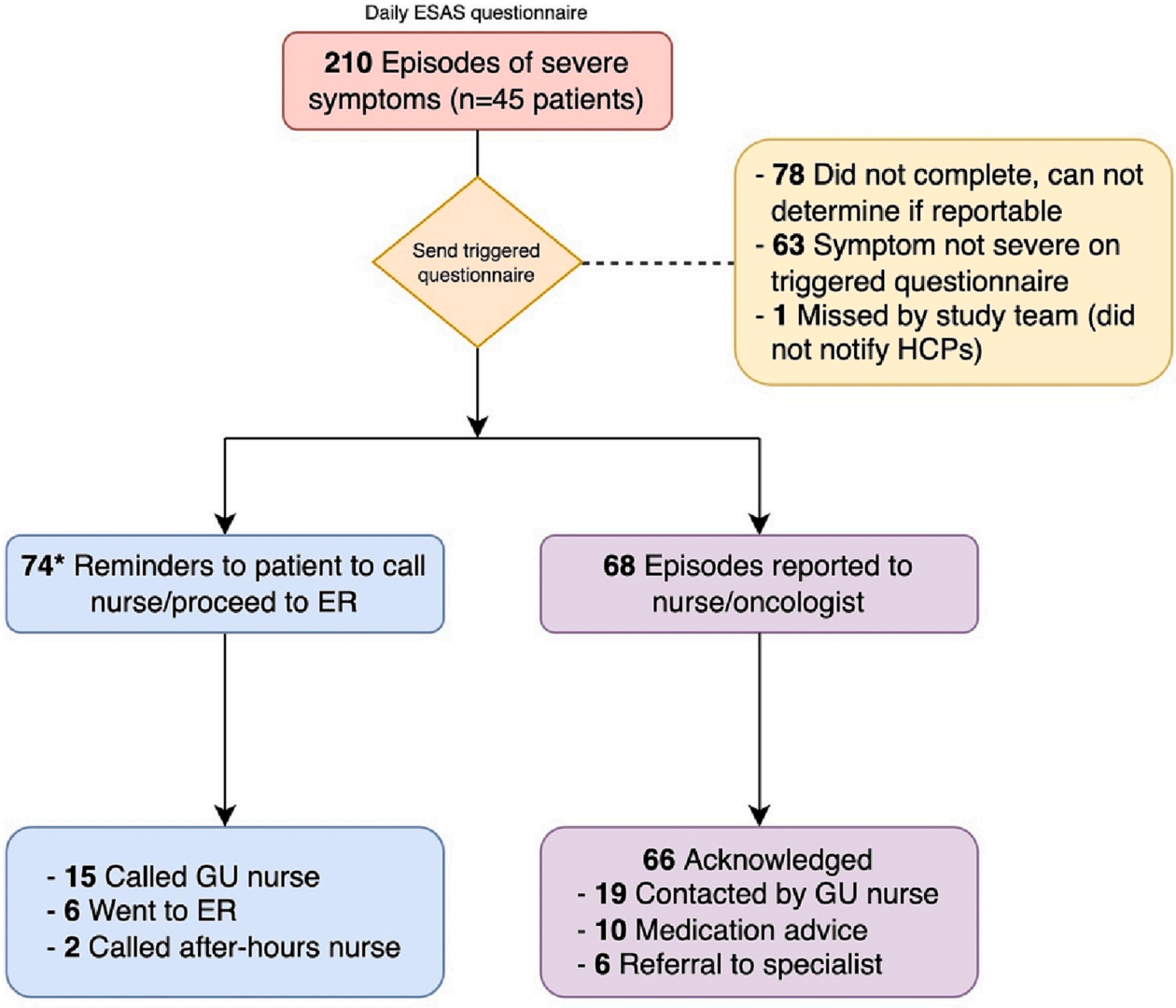

Fig. 2. Documented clinician and patient responses to severe symptoms (ESAS ≥7).
Note. ER = emergency room; ESAS = Edmonton Symptom Assessment Scale; GU = genitourinary; HCP = health care prover.
* Some patients received more than one reminder call for the same symptom episode.

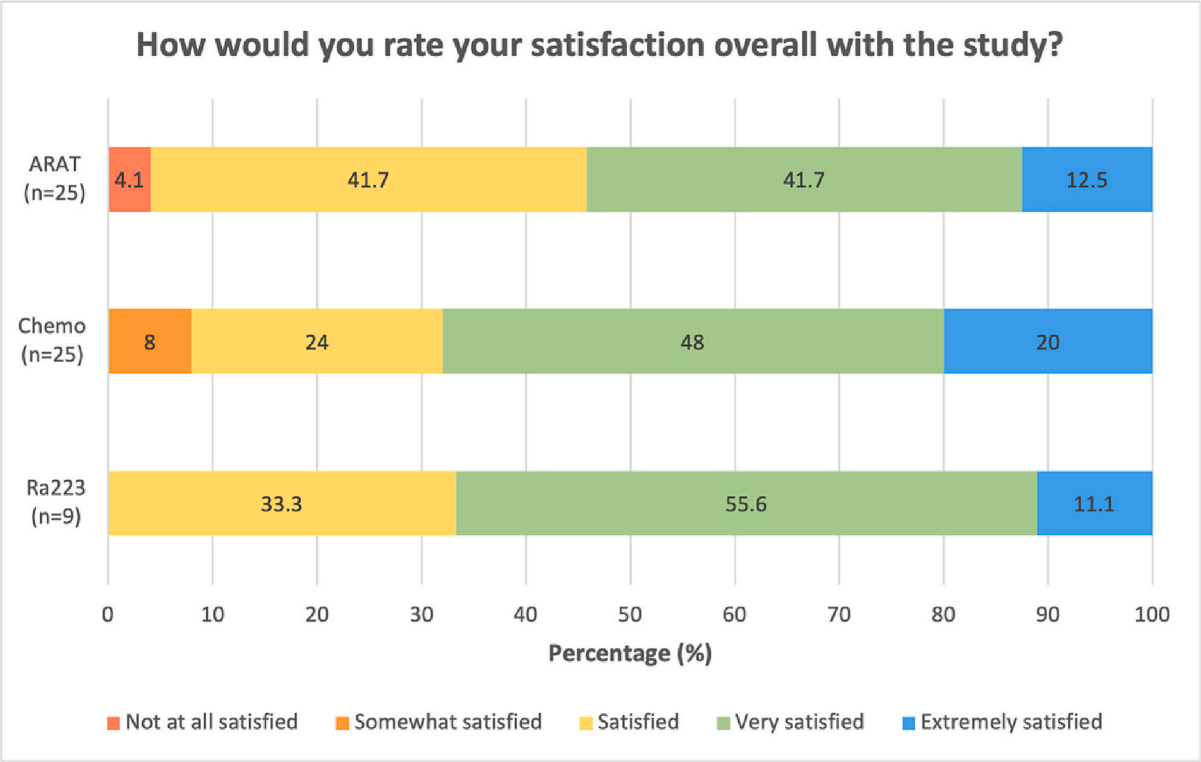

Fig. 3. Participants' overall level of satisfaction with the TOPCOP2 study.
Note. ARAT = androgen receptor axis-targeted therapy; Chemo = chemotherapy; Ra223 = radium-223.

respondents (92%) did not consider stopping participation at any point during the study. However, a few considered stopping participation due to logistic reasons (e.g., timing of phone calls [n = 2]), inconvenience (i.e., time consuming, too many questions asked [n = 2]), and critiques about the relevance of the study (e.g., ticking many boxes without seeing the benefit [n = 1]).

3.5. Objective 4: Themes Related to Study Benefits, Challenges, and Recommendations

Most respondents ($n = 39$, 66%) reported experiencing benefits from participating in the study, and a few experienced challenges ($n = 7$, 12%). Four themes emerged when participants discussed the benefits of participating in this study: having more opportunities to discuss their health, gaining motivation to engage in health-promoting behaviours, becoming aware of symptom trajectories, and enjoying participating and contributing to research (Table 3). Many participants reported that the study motivated them to exercise and become more conscious of their eating habits. Numerous participants also felt that speaking to someone about their health provided psychological benefits such as alleviating stress. Some participants reported that the daily ESAS questionnaires helped them to keep track of symptoms that were improving and worsening. Finally, some participants expressed enjoyment in taking part in this study, due to the aforementioned benefits and wanting to contribute to research for the benefit of future patients.

Two major themes emerged when participants discussed challenges from participating in this study: issues related to digital literacy and study logistics (Table 3). Issues related to digital literacy included forgetting to check emails to complete questionnaires and navigating the survey website. Study logistics included the inconvenient timing of questionnaires sent via email, difficulty with quantifying symptoms on a 10-point scale, and the length of the weekly questionnaire (i.e., too many questions).

When participants discussed recommendations to improve the study design, two major themes emerged: the frequency and timing of reporting, and the type of questions that were asked (Table 3). Participants expressed that monitoring symptoms for one treatment cycle was insufficient to understand the full symptom experience. It was suggested that a longer pre-post design would help to understand changes in symptoms, weekly questionnaires would be better due to a lack of day-to-day variation, and that the questionnaires sent via email were received too late in the day. In terms of the style of questions that were asked, many participants reported that they were repetitive, lengthy, not applicable to chronic conditions or symptoms unrelated to cancer, outdated, and could be interpreted in more than one way. Some participants also preferred to have fewer questions about emotions and more questions about physical symptoms. Finally, some participants felt that the depth of symptom concerns were not adequately investigated.

4. Discussion

We examined the feasibility and acceptability of implementing daily RSM in a cohort of older adults with mPC starting one of three main therapies. Our results indicate that RSM is both a feasible and acceptable intervention for older adults receiving treatment as demonstrated by the high rates of recruitment (74%), retention (94%), and response (94%) observed in this study. Additionally, 95% of participants reported being satisfied, very satisfied, or extremely satisfied with RSM. Qualitative feedback from participants at the end of the study also revealed numerous benefits of engaging in RSM. These benefits included improvements in motivation and health-promoting behaviour, having more opportunities to discuss their health, becoming aware of symptom trajectories, and contributing to health research. Nevertheless, participants in the study also reported challenges using web-based RSM and logistical difficulties, such as grading symptoms and the increased time invested in responding to lengthy questionnaires.

These findings align with a recent systematic review on the use of RSM across various chronic diseases [51]. In oncology studies, there

Table 3
Qualitative feedback from participants regarding daily remote symptom monitoring (RSM).

Theme	Quotes
Benefits from participating in RSM	
Appreciated being able to discuss their health more often ($n = 14$)	"I got a chance every morning to talk about my symptoms. Psychologically that is a benefit." (Age 76, ARAT)
Gained motivation to engage in health-promoting behaviours (e.g., exercise, diet, etc.) (n = 9)	"Instead of laying down to recover when pain or discomfort arose, I opted for slow persistent walking instead and then resting or napping. While it was difficult to do so, I found myself feeling more stamina and quick recovery." (Age 74, chemo) "Structure, conscience regarding watching diet." (Age 67, ARAT) "Improve my condition and I have to leave the house to walk and that benefits. Heart works better, heart rate improved ever since I started walking and fainting almost completely stopped." (Age 79, Ra223)
Becoming more aware of symptom trajectories (e.g., improvements/declines) ($n = 7$)	"Allows me to keep track of symptoms that are getting better/worse." (Age 77, Ra223)
Enjoyed participating in the study and contributing to research (n = 2)	"Whatever helps the cause helps me." (Age 71, ARAT) "I felt gratitude for my treatment and happy to participate" (Age 78, ARAT)
Challenges from participating in RSM	
Logistic (e.g., remembering where the study phone is, email vs phone questionnaires, timing of questionnaires) (n = 5)	"By email was faster, telephone took longer" (Age 67, ARAT) "Some quandary. I could not answer some of the questions correctly (i.e., insomnia)" (Age 78, ARAT) "Daily calls a little inconvenient but I got used to it and appreciated the calls." (Age 81, ARAT)
Issues related to digital literacy (e.g., forgetting to check emails, navigating the survey website) (n = 2)	"Did not see the emails and did not complete all (every day)" (Age 87, Chemo)
Recommendations to Improve the Study Design	
Types of questions asked ($n = 19$)	"I think I would probably ask more questions about particular kinds of movement and exercises that might be helpful. So for instance, I've been doing Qigong and Tai-chi for like 25 years. That's very useful for me…" (Age 74, Chemo) "Some of them seemed a bit repetitive." (Age 80, Chemo) "…You ask how was your pain from 1 to 10, how was your anxiety from 1 to 10. I think perhaps should be made a little more clear, because how do I express the pain, how do I measure myself. In my mind, what's a 10 – when you're at the edge of the cliff?" (Age 84, Ra223)
Frequency and timing of questionnaires (n = 7)	"…maybe once a week instead of one everyday report." (Age 79, Ra223)

Note. Chemo = chemotherapy; ARAT = androgen receptor axis-targeted therapy; Ra223 = radium-223.

were high response rates when participants were asked to report their symptoms weekly or monthly [51]. TOPCOP2 supports these findings, while suggesting that more frequent monitoring is also feasible for most participants but increases participant burden. Similarly, these results are consistent with the feasibility and acceptability results of an RSM study conducted in Mexico, which also focused on older adults with cancer [24]. Previously described benefits of engaging in RSM have also been replicated in this study, particularly through initiating discussions between patients and health care providers regarding symptoms [18].

These findings expand upon the existing RSM literature by providing insights into older patients' preferences around RSM. For instance, participants in this study were given the choice of web-based or telephone-based monitoring. Although most participants opted for web-based monitoring, 38% of participants preferred traditional telephone-based monitoring with a member of the research team. Moreover, nearly 20% of participants were not comfortable with using the internet at baseline. These findings suggest that RSM trials and implementation programs need to incorporate both web-based and phone-based options to maximize inclusion of older adults. Among the major RSM studies, we identified eleven trials or implementation studies using web-based/electronic monitoring [18,52–62], three trials using an automated telephone system [52,63,64], and two studies using manual telephone calls from a clinician [65,66]. Given that previous studies on RSM have not given participants the option to choose an RSM modality [18,52,64] and many older adults may not feel comfortable with smartphone/internet use [67], our study highlights the need to incorporate patient preferences into RSM approaches. In addition, the psychological benefit of being able to regularly discuss health issues with the research team was a recurring theme in qualitative interviews. Therefore, symptom monitoring modalities involving contact with a staff member may provide additional benefits compared to automated monitoring (e.g., interactive voice technology, automated telephone interviewing), although this is more resource-intensive than automated approaches and further investigation is needed.

This study has multiple strengths and contributes to the RSM literature in several ways. Firstly, it is one of the few studies that have examined the use of RSM in an older population with advanced disease receiving chemotherapy and non-chemotherapy-based treatments. Despite long-standing stereotypes regarding the aversion of older adults toward the use of digital technologies, RSM was still found to be feasible and acceptable among this demographic [68]. However, regardless of treatment type, the feasibility and perceived benefits of RSM were similar. Finally, this study explored the use of daily symptom monitoring, which is known to be more demanding for both patients and staff. Similar to previous studies using weekly, biweekly, or longer intervals of reporting, a high retention and response rate was observed [51]. These findings begin to reveal the optimal demographic and frequency characteristics of a successful RSM intervention.

It should also be noted that this study has some limitations. The lack of a control group makes it difficult to determine whether RSM leads to greater improvements in health outcomes as compared to usual care and follow-up. As the focus of this study was on feasibility, further research exploring the clinical and health services outcomes of RSM is needed to determine its utility. For practical reasons, we were not able to conduct RSM on weekends, holidays, or outside of regular working hours. We also did not conduct RSM beyond one treatment cycle. These constraints may have affected the completion and retention rates, as well as the outcomes of alerts. In addition, noticeable differences in feasibility between treatment cohorts were not observed. However, we had a smaller number of radium-223 participants compared to the other cohorts and thus differences within this treatment arm may not have been made apparent. Although response rates for interviews were high, it is possible that participants who declined to be interviewed were less satisfied with the study. Moreover, our estimated response rates to the triggered questionnaire were based on a microcapture technique, which produces some uncertainty. Notably, our results may be susceptible to volunteer bias as participants in this study may have had a higher level of education, physical functioning, and digital literacy. Thus, additional research with a more diverse sample is warranted. Finally, the ongoing COVID-19 pandemic created challenges in recruiting participants and resulted in a longer recruitment period.

Although the findings from this study align with the existing literature on RSM, more research exploring the use of RSM as an early-intervention strategy is needed in the context of geriatric oncology. A

larger trial with a control group would be ideal to establish the differences between RSM and usual care and follow-up. Moreover, research focusing on clinician responses and patient health outcomes during RSM is warranted, as the benefits of RSM in older adults remain poorly understood. An exploration of varying frequencies of RSM is also imperative to determine the optimal timing of RSM that balances both patient and staff burden along with its benefits. Qualitative feedback provided by participants suggested that the triggered questionnaires may have been burdensome and, thus, a simplified approach to RSM in future studies should be examined (e.g., rapid weekly screening followed by nurse telephone follow up based on severity thresholds). In addition, weekly rather than daily monitoring and longer follow-up periods were suggested by some participants in qualitative interviews. Finally, an exploration of ways to integrate RSM into existing clinical programs (e.g., oral anti-cancer programs led by pharmacy teams) would aid in the future implementation of RSM.

Funding

The TOPCOP2 study was funded by Prostate Cancer Canada (Dr. Alibhai, principal investigator).

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Declaration of Competing Interest

The authors have no conflicts of interest to declare.

Appendix A. Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jgo.2023.101469.

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