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Age Is Not a Barrier: Older Adults With Cancer Derive Similar Benefit in a Randomized Controlled Trial of a Remote Symptom Monitoring Intervention Compared With Younger Adults

Lorinda A. Coombs, PhD, FNP-BC[1,2], Lee Ellington, PhD[3,4], Angela Fagerlin, PhD[5], and Kathi Mooney, PhD, RN[3,4]

Abstract

This study investigated a remote symptom monitoring intervention to examine if older participants with cancer received a similar magnitude of benefit compared with younger adults with cancer. We analyzed a longitudinal symptom monitoring intervention for 358 participants beginning a new course of chemotherapy treatment in community and academic oncology practices. The study design was a randomized control trial; participants were randomized to the intervention or usual care, the intervention was delivered during daily automated coaching. Older adults with moderate and severe symptoms derived similar benefit as those adults younger than 60 years of age, adherence to the study protocol which involved daily calls was high. There was no significant difference between the 2 age categories; on average, older adult participants made 88% of expected daily calls and younger adult participants made 90% of expected daily calls. Our results challenge the perception that older adults are unwilling or unable to use a technological tool such as interactive voice response and suggest that patient utilization may be guided by other factors, such as ease of use and perceived benefit from the intervention.

Keywords

breast cancer, cancer, cancer treatment, colon cancer, lung cancer, geriatric oncology, symptom monitoring, technology

Introduction

Various health technologies have been proposed as a solution to expand monitoring of symptoms in patients with cancer.[1-3] The most promising area for use of these innovative technologies has been in patient reported outcomes. Patient Reported Outcomes (PRO) include symptoms associated with active cancer treatment as well as those that occur as a result of the disease.[4,5] Interventions delivered through technology (compared with individual clinical interactions) can expand the capacity to reach more patients and allow clinicians the opportunity to act upon real-time patient reported symptoms instead of waiting for them to contact providers or report the symptoms in their next clinic visit.[6] Identifying symptoms earlier during treatment offers the chance to reduce overall symptom burden, a benefit for patients and caregivers as well as potentially decreasing health care utilization, for urgent or emergent care.[7]

Patient reported outcome assessments such as those based upon self-report has been successful in monitoring older adults

[1] School of Nursing, University of North Carolina at Chapel Hill, NC USA
[2] Lineberger Comprehensive Cancer Center, Chapel Hill, NC, USA
[3] University of Utah College of Nursing, Salt Lake City, UT, USA
[4] Huntsman Cancer Institute, Salt Lake City, UT, USA
[5] Department of Population Health Sciences, University of Utah, Salt Lake City, UT, USA

Corresponding Author:
Lorinda A. Coombs, PhD, FNP-BC, University of North Carolina at Chapel Hill, 1708 N Greensboro, Chapel Hill, NC 27516, USA.
Email: lcoombs@ad.unc.edu

with heart failure, as well as younger adults with cancer.[8,9] Although the use of symptom monitoring in older adults with heart failure yielded positive results, the use of remote symptom monitoring has not been evaluated in older adults with cancer. Conclusions regarding older adults' use of healthcare technology are conflicting or based upon assumptions that older adults are unable or unwilling to utilize these interventions.[10-12]

Much of the developing digital health technology is based upon mobile health apps or wearable devices that utilize either smart phone platforms or require Wi-Fi for remote data acquisition.[12] These interventions require specific resources for participation, raising the question of whether older adults' lack of use is a reflection of a lack of confidence, ability to use technology, or a reflection of insufficient resources necessary for participation (e.g. Wi-Fi, broadband access, etc.).[13] Previous research has shown that older adults will utilize automated interactive voice response (IVR) systems, however it is not clear whether they used the intervention at similar rates as younger adults or whether they derived the same benefit.[14-16] Interventions such as IVR are one component under the broader term of technological interventions.

Cancer treatment associated toxicities are common for all patients regardless of age; the range of severity varies depending upon the regimen, malignancy and individual patient. Older adults compared with younger adults with cancer have an increased risk of developing toxicities from treatment, especially chemotherapy.[17,18] Common side effects for older adults receiving chemotherapy include: fatigue, infection, fever, cognitive impairments and hematologic complications.[19-21] In one review of 18,486 patients with metastatic cancer from 2001 to 2009, O'Neill et al identified that 92 percent of patients age 65 years and older with metastatic cancer had at least 1 hospital admission compared to an age, comorbidity and disease matched comparison group who did not receive chemotherapy.[19]

Older adults who receive chemotherapy for advanced cancer have side effects, intervening earlier in these symptoms improves outcomes. Patient reported symptoms with remote symptom monitoring in cancer has shown improved outcomes compared with patients who did not have remote symptom monitoring.[22] However these studies did not examine the benefit specific to the age of the patient, e.g. whether older adults used and benefited from the technology aided interventions for symptom reporting at the same rate as younger adults.[23]

This analysis and article is based upon the study published by Mooney et al. in Cancer Medicine which analyzed all participants.[24] We conducted a sub-analysis from the study using age categories to identify if the symptom monitoring intervention had benefit regardless of age. We examined whether: 1) Older participants adhered to the intervention at a similar rate as younger adults with cancer, and 2) Older adults utilized and received similar benefit from the intervention as younger participants. We defined older adults as 60 years and older and younger adults as 59 years and younger.

Methods

We analyzed data from a prospective, longitudinal randomized clinical trial that equally allocated patients to the Symptom Care at Home (SCH) intervention or to a Usual Care (UC) attention control group. Patients were from community and academic oncology practices in Tennessee and Utah. Inclusion criteria included: age of 18 years or older, a life expectancy of at least 3 months, English speaking, beginning a new course of chemotherapy treatment expected to last for a minimum of 3 cycles and access to a telephone (landline or mobile). Exclusion criteria included concurrent radiation therapy or if treatment was exclusively biologic therapy. The study was approved by the University of Utah institutional review board and registered with clinicaltrials.gov (NCT01973946). All patients enrolled provided informed consent prior to participation.

All enrolled participants, regardless of which group they were in, were asked to call the automated system daily to report symptoms experienced in the prior 24 hours. They were then asked to grade their symptoms, using a scale of 1 through 10 for symptom severity (1 for minimal severity and 10 for extreme severity). Ten symptoms were assessed: pain, fatigue, nausea/vomiting, fever, diarrhea, constipation, trouble sleeping, sore mouth, anxiety and depressed mood. Of the 358 participants, 131 patients (37% of total sample) were 60 years or older.[24] Of those 131 participants age 60 years or older, 59 were randomized to the SCH intervention and 67 were in the UC control group, 5 participants were enrolled but did not participate in the study.

The SCH intervention was delivered with daily automated coaching for patients. When patients called into the automated system, if they were enrolled in the intervention arm, they received symptom care strategies that were tailored to the patient report using the Decision Support System (DSS). The DSS is derived from National Comprehensive Cancer Network (NCCN) nationally recognized supportive care guidelines with nurse practitioner (NP) provided symptom management. The DSS was used by NPs for patients reporting moderate to severe symptoms, who were alerted for any patient reported symptoms that met the moderate to severe category. The UC group, in contrast, called the system daily to report symptoms, but instead of the intervention, they were instructed to contact their oncology providers for symptom concerns. Usual Care participants were informed that their symptom data was not passed onto their oncology providers and reinforced the importance of sharing their symptoms with their oncology provider.

Patient demographics and cancer type and stage were collected at initial enrollment. Patient reported symptoms including severity were collected daily from study entry throughout the course of chemotherapy treatment until completion, or 6 months, whichever came first. There were no significant differences at baseline between SCH or UC groups in the demographics, disease status or symptom severity. The parent study results included 1) No difference in completion rates between the SCH or UC groups, 2) Participants in the SCH intervention

Table 1. Patients 60 Years and Older Descriptive Characteristics.

Characteristics	UC (n = 67) *n* (%)	SCH (n = 59) *n* (%)	All (n = 126) *n* (%)	P-value
Gender				0.74
Female	47 (70)	43 (73)	90 (71)	
Male	20 (30)	16 (27)	36 (29)	
Race				
White	61 (91)	51 (86)	112 (89)	0.61
Black	5 (7.5)	6 (10)	11 (9)	
Other	1 (1.5)	2 (3)	3 (2)	
Marital Status				
Married or Partnered	48 (72)	34 (58)	82 (65)	0.09
Single	8 (12)	7 (12)	15 (12)	
Other (divorce, separated, widowed)	11 (16)	18 (30)	29 (23)	
Education				
Less than high school	6 (9)	4 (7)	10	0.32
High school graduate	19 (28)	14 (24)	33	
Some college	21 (31)	21 (36)	42	
Bachelor's degree	12 (18)	11 (19)	23	
Postgraduate education	9 (13)	9 (15)	18	
Annual Household Income				
Less than $19,999	10 (15)	12 (20)	22	0.83
$20,000—49,000	19 (28)	16 (27)	35	
$50,000—69,000	7 (10)	6 (10)	13	
$70,000 and higher	21 (31)	18 (31)	39	
Declined to state	10 (15)	7 (12)	17	
Cancer Diagnosis				
Breast	23 (34)	22 (37)	47	0.35
Colorectal/G.I.	12 (18)	9 (15)	22	
Lung	11 (16)	14 (24)	27	
Ovarian/Endometrial	12 (18)	10 (17)	23	
Other	9 (13)	4 (7)	14	
Cancer Stage				
I	5 (7.5)	4 (7)	9	0.09
II	5 (7.5)	14 (24)	19	
III	19 (28)	12 (22)	31	
IV	38 (57)	29 (49)	67	

had 67% less severe symptom days ($P < 0.001$), 39% less moderate days ($P = 0.001$) than the UC participants and 39% more mild days than the UC group.[24] In addition to the overall analysis, 9 of the 10 individual symptoms measured were significantly lower for SCH participants than UC, the only symptom not reduced was diarrhea.

Statistical Analysis

A longitudinal, mixed modeling approach was utilized for this secondary analysis of older participants. Primary endpoints included days of severity across the symptoms, and the number of days where the participant reported none of the 10 monitored symptoms, and the number of days when severity reported was in the mild range, the moderate range or the severe range.

Demographic variables between the older adults in the SCH intervention and UC were equivalent. There were an increased number of patients with stage II cancer diagnoses in the SCH group and a slightly higher number of patients with stage IV cancer diagnoses in the UC group, although neither was statistically significant. A descriptive analysis of older adults enrolled in the study was compared between the usual care (UC) group and the SCH intervention group (Table 1).

Results

Results from the overall study analysis found a significant benefit for the intervention across all ages of participants ($p < 0.001$).[24] The adherence to the study protocol of daily calls was high with the pooled average of younger adults reporting 78 days and older adults reporting 74 days. There was also no significant difference in the mean number of days reporting between the intervention groups (SCH) and the usual care (UC) groups across the younger and older age groups. Older adults in the SCH group reported an average of 77 days compared with 71 days in the UC older group.

Table 2 identifies the comparison of mean symptom severity in days for the older adults in the SCH intervention group and the UC group. Older adults in the SCH intervention experienced significant less severe and moderate symptoms. There

Table 2. Comparison of Mean Symptom Severity Days Across Older Adults Receiving UC Compared With SCH Intervention Group With Negative Binomial Regression.

	UC (SD) (n = 67)	SCH (SD) (n = 59)	OR (95% CI)	p-value
Days Reporting	71 (5.3)	77 (6)	0.92 [.746 -1.14]	0.45
Severe Symptoms	13 (2.9)	7 (1.4)	1.94[1.08-3.49]	0.03
Moderate Symptoms	25 (4)	13 (2.1)	1.96[1.24-3.09]	0.004
Mild Symptoms	13 (3)	18 (5)	0.76[0.36 -1.48]	0.38
Asymptomatic	44 (5.6)	66 (7.7)	0.21[0.48-0.94]	0.21

Table 3. Mean Symptom Severity in Days Compared Across Younger and Older Adults in the SCH Intervention Group Using Negative Binomial Regression.

	Adults <60, SCH (SD) (n =1 18)	Adults 60+, SCH (SD) (n = 59)	OR (95% CI)	p-value
Days Reporting	78 (4)	77 (6)		0.7
Severe Symptoms	14 (1.8)	13 (2.0)	0.5 [0.24 -1.06]	0.07
Moderate Symptoms	14 (1.8)	13 (2.1)	1.3 [0.76-2.3]	0.38
Mild Symptoms	12 (1.4)	15 (2.78)	1.45 [0.62-3.4]	0.39
Asymptomatic	62 (4.3)	66 (7.7)	0.82 [0.54 -1.26]	0.37

was no significant difference between the SCH intervention and UC groups for mild symptoms or asymptomatic days reported.

Table 3 compares the benefit of the symptom outcomes in the intervention group by adults less than 60 years of age compared those 60 years and older. There was no statistically significant difference in the benefit by age. Regardless of age, those in the intervention group obtained the same benefit from the intervention. Older adults reported fatigue, pain, sleeping difficulty, nausea and nervousness as the most common moderate and severe symptoms compared with younger adults who reported fatigue, pain, sleeping difficulty and nausea as the most common moderate and severe symptoms.

Discussion

Our study results demonstrate that older adults, defined in our study as 60 years or older had the same level of high adherence to using the daily symptom monitoring intervention, i.e. calling into the system, as younger adults. The older adults in the SCH intervention group received similar benefit as the younger adults in the SCH intervention group. These findings challenge assumptions that older adults will not use or benefit from remote self-reported symptom monitoring interventions as younger adults. Unlike recent research from focus groups of older adults measuring attitudes toward using technology such as tablets,[25] or smart phone applications,[26] we did not find any difference between older and younger participants in the use of our telephone based technology intervention. This may be due to the intervention's lack of reliance upon tablets or smart phone access, which allowed participants without Wi-Fi technology to utilize the intervention. This highlights an important point regarding the importance of delivering technologically driven interventions in a manner that offers participation to the greatest number of the intended population.

Older adults represent the largest group of adults diagnosed with cancer; in 2017, there were 1.6 million new cancer diagnoses, and a half million of those were diagnosed in older adults.[27] These older adults received, or were offered anticancer treatment, often in the form of chemotherapy or other biologics. Monitoring side effects from cancer treatment is an area with great potential for scalable technological interventions. Automated patient symptom monitoring is one example of interventions that may be able to directly impact and improve patient outcomes. Basch and colleagues, as well as our own work, have identified the clinical benefits associated with using technological interventions for symptom self-report while receiving cancer treatment.[28]

Our study's results on patient reported symptoms are consistent with the study's overall results, which demonstrated benefit from the SCH intervention. In this subgroup analysis, older adults reported severe symptoms less frequently than did younger adults with cancer.[29] Participants had a range of cancers that encompassed all disease stages, representing an appropriately heterogeneous portrait of older adults with cancer. Limitations in our study include a disproportionate number of female respondents (71% percent compared with 29% of male respondents) as well as a lack of ethnic and racial diversity within the study (89% were white and 9% were black). The study also included only English speakers. Finally, because this was a sub-analysis, power calculation for the sample of older adults was not possible.

Assumptions about older adults and technology use may be fueled, in part by stereotypes that portray them as either late adaptors or unable to adapt to innovative healthcare solutions. Our results challenge this perception and suggest that patient utilization of technologically delivered health interventions may be guided by other factors, namely the platform necessary for the intervention. Successful utilization of an intervention depends upon access to the needed resources. If technological

interventions are provided in a smart phone platform or require broadband access, the lack of use by older adults does not reflect a reticence for technological adaptations but instead suggests resource limitations. A recent Pew survey of older adults found that 80% had a cell phone, but only 42% identified their mobile device as a smartphone.[30] Although an increased number of older adults use the internet, there is a resource divide between the affluent, well-educated older adults who use the internet at higher rates and those with lower income levels and less internet use or access.[31] Our results support the conclusion that older adults may use and benefit from a remote symptom monitoring intervention at similar rates as younger adults, if that intervention is telephone based (not exclusively smartphone dependent).

Conclusion

As multiple technological interventions are developed and disseminated, it becomes increasingly important to assess whether older adults will use and benefit from these interventions, in part because many of the proposed technology aided interventions rely upon access to broadband Internet and/or a smart phone. As researchers and clinicians, we need to offer tailored interventions that improve patient symptoms and overall health to all older adults with cancer and ensure that the intervention is available to all older adults with cancer, not simply the ones with broad band internet access and/or smart phone access. Older adults with cancer deserve access to beneficial technological interventions irrespective of their socio-economic status.

Authors' Note

Study Concepts and design: L.C, K.M., Data Acquisition: K.M., Data analysis and interpretation: L.C., K.M., Manuscript preparation: L.C., Manuscript editing and review: L.C., K.M., L.E. A.F. Our study was approved by the University of Utah Institutional Review Board (study 17472), and all patients provided written informed consent prior to enrollment in the study.

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ORCID iD

Lorinda A. Coombs, PhD, FNP-BC https://orcid.org/0000-0003-1096-8974

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