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ORIGINAL ARTICLE

Congruence of multiple patient-related outcomes within a single day

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Abstract

Objective Clinic-based collection of patient-reported outcome (PRO) quantifying symptom burden provide crucial information for effective care. We have pioneered point-of-care electronic assessment using the Edmonton Symptom Assessment Scale (ESAS) with direct linkage to the electronic medical record (EMR) which has been readily adopted by our oncology patients. As some patients may complete more than one ESAS per day in different clinics, the goal of the current analyses was to compare the within-patient congruence of ESAS assessments completed on the same day.

Methods A total of 9621 ESAS records from 4021 patients of the Supportive Care Medicine and Radiation Oncology clinics between February and November 2017 were retrieved from the EMR. Patients completed the ESAS-r-CSS, which added sleep disturbance, constipation, and spiritual well-being domains to the standard ESAS-r.

Results A total of 65 patients provided more than one ESAS report within the same day. The data were curated, removing those sporadic missing data and those with obvious technical error. This process left 130 samples for analysis. There was no statistical difference among different ESAS collection intervals for domains of tiredness, nausea, appetite, overall well-being, spiritual well-being, constipation, and difficulty sleeping, but there was a significant difference for pain, drowsiness, shortness of breath, depression, and anxiety. Repeat tests that occurred within 1 h of one another demonstrated higher congruence than those completed over longer periods.

Conclusion Patients reported significant worsening of several symptoms over the course of the day, with greatest concordance observed within smaller time periods.

Keywords Symptom management · Patient-reported outcomes · Radiation Oncology · ESAS

Introduction

The Edmonton Symptom Assessment Scale (ESAS) and other patient self-report tools have facilitated a growing body of literature regarding symptomatology in patients with advanced cancer. This burgeoning literature validates the crucial nature of assessing patient-reported symptoms and their central role in personalized cancer care. Such patient-related outcomes (PROs) are associated with reduced symptom severity, better quality of life, and reduced hospitalization and emergency room usage compared with usual care [1, 2].

There is increasing interest in incorporating PROs into clinical care following the publication of large randomized trials demonstrating that clinic-based symptom monitoring can improve patient outcomes [2–4]. We have previously discussed our success integrating ESAS into the routine clinical workload of our Radiation Oncology [5] and Supportive Care Medicine [6] departments at Moffitt Cancer Center. Twelve individual symptoms are assessed by the ESAS which also yields a total score for each patient (the sum of each symptom). We consider ESAS administration to have improved communication with our patients about their symptoms with little additional administrative burden. When such PROs are

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collected systematically, we consider them to represent an important mechanism to identify unmet needs and improve quality of patient care. To optimize care and enhance patient convenience, Moffitt patients often receive appointments within more than one clinic in a single day, creating the potential for completion of multiple ESAS questionnaires on the same day. We anticipate that such an occurrence may become common as other cancer centers and community oncology practices integrate PROs into clinical care in multiple oncology subspecialty clinics.

As such, we sought to determine the congruence of such data over a brief time, e.g., within a single day. This study is an analysis of our ESAS library within the electronic medical record (EMR), with correlation studies of such repetitive entries. We hypothesized that congruence would be higher when questionnaires were completed over a shorter period of time.

Materials and methods

In 2014, the Supportive Care Medicine (SCM) Department of Moffitt Cancer Center introduced the use of an ESAS patient-report form for all SCM clinic encounters. In August 2015, this clinical initiative was also adopted within the Radiation Oncology (RO) Department for each patient seen in the RO clinic, with plans to disseminate structured symptom reporting center-wide. The project has evolved from the initial paper-based reporting system into the use of a tablet-based e-ESAS application that captures and records symptom data directly into the EMR. These data delivered to the EMR are time- and date-stamped when completed by the patient. While there is ongoing current discussion about the ultimate scope and tool to be used system-wide, we have been using the ESAS-r-CSS form of the tool [7]; this scale includes all ESAS domains plus constipation and sleep disturbance, as well as a spiritual well-being domain. Patients are asked to report symptoms on an 11-point Likert scale (0 = none; 10 = worst possible) according to how they are feeling at the time of survey completion.

Approval for this retrospective review was obtained from the Moffitt Cancer Center Institutional Review Board. All ESAS forms completed between February and November 2017 were retrieved from the EMR and information collated. Of these 9621 forms, 139 were submitted by 65 patients on the same day. If some patients had completed the survey more than two times at the same day, we only retained the first survey and the last survey. Finally, a few scores added during testing of the tablet interface were removed from the sample, leaving for analysis a total of 130 surveys completed by 65 patients.

Kruskal–Wallis test and Wilcoxon rank-sum test were used to compare different scores on single items and the ESAS total score between pairs of first and last questionnaires. Three time-gap group were compared: (a) less than 1 h apart, (b) 1–3 h apart, or (c) 3 or more hours apart. Pearson's correlations were used to examine congruence between pairs of questionnaires for each patient in each time group. Kruskal–Wallis test and Wilcoxon rank-sum test were also used to compare mean intra-correlations among the three groups and between pairs of groups. All analyses were conducted using SAS 9.4.

Results

Table 1 shows mean, standard deviation (SD), median, minimum (Min), and maximum (Max) of each symptom score and total score in the first survey, in the last survey, and the difference of each symptom between last survey and first survey for

Table 1 Summary table of first ESAS, last ESAS, and the ESAS difference

ESAS	First ESAS					Last ESAS					ESAS difference				
	Mean	SD	Median	Min	Max	Mean	SD	Median	Min	Max	Mean	SD	Median	Min	Max
Pain	4.29	3.43	5	0	10	4.45	3.4	5	0	10	0.15	3.01	0	−9	10
Tiredness	4.2	3.24	5	0	10	4.31	3.2	4	0	10	0.14	3.62	0	−7	9
Drowsiness	3.09	3.25	2	0	10	3.14	3.2	2	0	10	0.02	3.79	0	−9	9
Nausea	1.7	2.8	0	0	10	1.7	2.8	0	0	10	0.03	2.49	0	−8	7
Appetite	2.91	3.37	1.5	0	10	2.55	3	1	0	10	−0.31	3.56	0	−10	10
Breath	1.58	2.41	0	0	8	1.6	2.3	0	0	9	−0.03	2.49	0	−7	9
Depression	2.24	2.91	0	0	10	2.43	2.9	1	0	10	0.1	2.76	0	−7	7
Anxiety	2.76	3.07	2	0	10	2.74	2.8	2	0	10	−0.02	2.85	0	−9	8
Overall well-being	3.29	2.85	3	0	10	3.29	2.9	3	0	10	0.03	3.03	0	−8	7
Spiritual well-being	1.86	2.72	0	0	10	1.39	2.2	0	0	9	−0.53	2.78	0	−10	6
Constipation	2.19	2.65	0.5	0	8	2.49	3	1	0	10	0.34	3.17	0	−7	10
Sleeping	3.22	3.2	3.5	0	10	3.42	3.2	3	0	10	0.17	3.25	0	−8	10
Total_score	32.72	25.9	30	0	91	33.46	24	31	0	95	0.74	25.2	1	−69	76

Table 2 Kruskal–Wallis comparison of difference between the last ESAS collection and the first ESAS collection for the same patient on the same collection dates

	N; mean (STD); median [range]			
ESAS difference	< 1 h	1–3 h	> 3 h	*p* value
Pain	*n = 39; 0.54 (2.91); 0 [− 9, 10]*	*n = 16; − 0.88 (3.7); − 1 [− 6, 10]*	*n = 10; 0.3 (1.77); 0 [− 2, 3]*	*0.036*
Tiredness	*n* = 39; 0.46 (3.48); 0 [− 7, 9]	*n* = 15; − 0.87 (4.29); − 1 [− 7, 9]	*n* = 10; 0.4 (3.17); 1 [− 4, 7]	0.338
Drowsiness	*n = 39; 1.03 (3.62); 0 [− 7, 9]*	*n = 15; − 2.67 (3.81); − 2 [− 9, 3]*	*n = 10; 0.1 (2.47); 0 [− 4, 4]*	*0.013*
Nausea	*n* = 38; 0.47 (2.18); 0 [− 6, 7]	*n* = 15; − 0.6 (2.56); 0 [− 8, 3]	*n* = 10; − 0.7 (3.33); 0 [− 7, 4]	0.472
Appetite	*n* = 39; 0.36 (3.77); 0 [− 8, 10]	*n* = 15; − 1.67 (3.6); − 2 [− 10, 5]	*n* = 10; − 0.9 (1.85); − 0.5 [− 4, 2]	0.057
Shortness of breath	*n = 39; 0.62 (2.52); 0 [− 5, 9]*	*n = 15; − 1 (2.04); 0 [− 7, 1]*	*n = 10; − 1.1 (2.33); 0 [− 7, 1]*	*0.033*
Depression	*n = 38; 0.74 (2.67); 0 [− 5, 7]*	*n = 15; − 1.6 (2.95); 0 [− 7, 3]*	*n = 10; 0.2 (1.75); 0 [− 3, 4]*	*0.042*
Anxiety	*n = 38; 0.82 (2.41); 0 [− 3, 8]*	*n = 15; − 2.27 (3.28); − 1 [− 9, 3]*	*n = 10; 0.2 (1.93); 0 [− 4, 3]*	*0.010*
Overall well-being	*n* = 38; 0.26 (3.15); 0 [− 8, 7]	*n* = 15; − 0.73 (3.49); 0 [− 7, 7]	*n* = 10; 0.3 (1.49); 0 [− 2, 3]	0.581
Spiritual well-being	*n* = 38; 0.16 (2.53); 0 [− 10, 6]	*n* = 15; − 1.2 (2.14); 0 [− 5, 1]	*n* = 9; − 2.33 (3.81); − 1 [− 9, 2]	0.051
Constipation	*n* = 39; 0.97 (2.82); 0 [− 7, 9]	*n* = 15; − 0.33 (3.64); 0 [− 6, 10]	*n* = 10; − 1.1 (3.38); − 0.5 [− 6, 4]	0.064
Sleeping	*n* = 39; 0.77 (3.32); 0 [− 8, 10]	*n* = 15; − 1.13 (2.92); 0 [− 7, 4]	*n* = 10; − 0.2 (3.08); 0 [− 7, 5]	0.229

Italicized values are staitistically significant

same patient who had survey more than one time in the same day. Table 2 reveals the analysis of the entire cohort by time between submitted ESAS across all time intervals. In most cases, the median difference between pairs of questionnaires was zero. Nevertheless, there was statistically significant differences among the three ESAS collection intervals for the symptoms of pain, drowsiness, shortness of breath, depression, and anxiety ($p < 0.05$). As shown in Table 3, questionnaires completed within an hour of one another demonstrated significantly greater congruence than those completed 1–3 h apart. As shown in Table 4, questionnaires completed within an hour of one another demonstrated similar congruence to those completed more than 3 h apart, with the exception of constipation. Similarly, as shown in Table 5, congruence was similar between questionnaires completed 1–3 h apart compared to more than 3 h apart, with the exception of anxiety. There was no statistical difference among different ESAS collection intervals of tiredness, nausea, appetite, overall well-being, spiritual well-being, constipation, and difficulty of sleeping (p values > 0.05).

Table 6 shows no statistically significant difference among different ESAS collection interval groups for ESAS correlation coefficients. This is due to the large variability in groups 2 (1–

Table 3 Wilcoxon rank-sum test comparison of difference between the last ESAS collection and the first ESAS collection for the same patient at the same collection dates (< 1 h; 1–3 h)

	N; mean (STD); median [range]		
ESAS difference	< 1 h	1–3 h	*p* value
Pain	*n = 39; 0.54 (2.91); 0 [− 9, 10]*	*n = 16; − 0.88 (3.7); − 1 [− 6, 10]*	*0.009*
Tiredness	*n* = 39; 0.46 (3.48); 0 [− 7, 9]	*n* = 15; − 0.87 (4.29); − 1 [− 7, 9]	0.162
Drowsiness	*n = 39; 1.03 (3.62); 0 [− 7, 9]*	*n = 15; − 2.67 (3.81); − 2 [− 9, 3]*	*0.004*
Nausea	*n* = 38; 0.47 (2.18); 0 [− 6, 7]	*n* = 15; − 0.6 (2.56); 0 [− 8, 3]	0.307
Appetite	*n = 39; 0.36 (3.77); 0 [− 8, 10]*	*n = 15; − 1.67 (3.6); − 2 [− 10, 5]*	*0.025*
Shortness of breath	*n = 39; 0.62 (2.52); 0 [− 5, 9]*	*n = 15; − 1 (2.04); 0 [− 7, 1]*	*0.029*
Depression	*n = 38; 0.74 (2.67); 0 [− 5, 7]*	*n = 15; − 1.6 (2.95); 0 [− 7, 3]*	*0.014*
Anxiety	*n = 38; 0.82 (2.41); 0 [− 3, 8]*	*n = 15; − 2.27 (3.28); − 1 [− 9, 3]*	*0.003*
Overall well-being	*n* = 38; 0.26 (3.15); 0 [− 8, 7]	*n* = 15; − 0.73 (3.49); 0 [− 7, 7]	0.360
Spiritual well-being	*n = 38; 0.16 (2.53); 0 [− 10, 6]*	*n = 15; − 1.2 (2.14); 0 [− 5, 1]*	*0.043*
Constipation	*n* = 39; 0.97 (2.82); 0 [− 7, 9]	*n* = 15; − 0.33 (3.64); 0 [− 6, 10]	0.083
Sleeping	*n* = 39; 0.77 (3.32); 0 [− 8, 10]	*n* = 15; − 1.13 (2.92); 0 [− 7, 4]	0.085
Total score	*n = 39; 7.23 (24.93); 4 [− 49, 76]*	*n = 16; − 11.75 (26.13); − 4.5 [− 69, 36]*	*0.020*

Italicized values are staitistically significant

Table 4 Wilcoxon rank-sum test comparison of difference between the last ESAS collection and the first ESAS collection for the same patient at the same collection dates (< 1 h; > 3 h)

	N; mean (STD); median [range]		
ESAS difference	< 1 h	> 3 h	*p* value
Pain	*n* = 39; 0.54 (2.91); 0 [− 9, 10]	*n* = 10; 0.3 (1.77); 0 [− 2, 3]	0.853
Tiredness	*n* = 39; 0.46 (3.48); 0 [− 7, 9]	*n* = 10; 0.4 (3.17); 1 [− 4, 7]	0.860
Drowsiness	*n* = 39; 1.03 (3.62); 0 [− 7, 9]	*n* = 10; 0.1 (2.47); 0 [− 4, 4]	0.477
Nausea	*n* = 38; 0.47 (2.18); 0 [− 6, 7]	*n* = 10; − 0.7 (3.33); 0 [− 7, 4]	0.318
Appetite	*n* = 39; 0.36 (3.77); 0 [− 8, 10]	*n* = 10; − 0.9 (1.85); − 0.5 [− 4, 2]	0.198
Shortness of breath	*n* = 39; 0.62 (2.52); 0 [− 5, 9]	*n* = 10; − 1.1 (2.33); 0 [− 7, 1]	0.053
Depression	*n* = 38; 0.74 (2.67); 0 [− 5, 7]	*n* = 10; 0.2 (1.75); 0 [− 3, 4]	0.615
Anxiety	*n* = 38; 0.82 (2.41); 0 [− 3, 8]	*n* = 10; 0.2 (1.93); 0 [− 4, 3]	0.810
Overall well-being	*n* = 38; 0.26 (3.15); 0 [− 8, 7]	*n* = 10; 0.3 (1.49); 0 [− 2, 3]	0.763
Spiritual well-being	*n* = 38; 0.16 (2.53); 0 [− 10, 6]	*n* = 9; − 2.33 (3.81); − 1 [− 9, 2]	0.072
Constipation	*n = 39; 0.97 (2.82); 0 [− 7, 9]*	*n = 10; − 1.1 (3.38); − 0.5 [− 6, 4]*	*0.050*
Sleeping	*n* = 39; 0.77 (3.32); 0 [− 8, 10]	*n* = 10; − 0.2 (3.08); 0 [− 7, 5]	0.959
Total score	*n* = 39; 7.23 (24.93); 4 [− 49, 76]	*n* = 10; − 4.6 (16.49); − 7 [− 31, 29]	0.118

Italicized values are staitistically significant

3 h) and 3 (> 3 h). However, the < 1 h group showed the highest mean intra-correlation ($r = 0.6$) followed by the > 3 h group ($r = 0.49$). The 1–3 h group showed the lowest mean intra-correlation ($r = 0.4$).

Discussion

The study of intraday congruence of ESAS scores is of value toward development of system-wide PRO collection protocols that will avoid unnecessary use of resources, decrease patient burden, and be meaningful to foster appropriate interventions. The current study showed that questionnaires collected within an hour of one another are more congruent than those collected over longer time periods. Patients typically reported worse symptomatology on the second questionnaire when questionnaires were completed within an hour of one another. They tended to report reduced symptomatology on the second questionnaire when completed 1–3 or > 3 h apart. Because the ESAS asks about

Table 5 Wilcoxon rank-sum test comparison of difference between the last ESAS collection and the first ESAS collection for the same patient at the same collection dates (1–3 h; 3 h)

	N; mean (STD); median [range]		
ESAS difference	1–3 h	3 h	*p* value
Pain	*n* = 16; − 0.88 (3.7); − 1 [− 6, 10]	*n* = 10; 0.3 (1.77); 0 [− 2, 3]	0.126
Tiredness	*n* = 15; − 0.87 (4.29); − 1 [− 7, 9]	*n* = 10; 0.4 (3.17); 1 [− 4, 7]	0.261
Drowsiness	*n* = 15; − 2.67 (3.81); − 2 [− 9, 3]	*n* = 10; 0.1 (2.47); 0 [− 4, 4]	0.073
Nausea	*n* = 15; − 0.6 (2.56); 0 [− 8, 3]	*n* = 10; − 0.7 (3.33); 0 [− 7, 4]	0.977
Appetite	*n* = 15; − 1.67 (3.6); − 2 [− 10, 5]	*n* = 10; − 0.9 (1.85); − 0.5 [− 4, 2]	0.467
Breath	*n* = 15; − 1 (2.04); 0 [− 7, 1]	*n* = 10; − 1.1 (2.33); 0 [− 7, 1]	0.927
Depression	*n* = 15; − 1.6 (2.95); 0 [− 7, 3]	*n* = 10; 0.2 (1.75); 0 [− 3, 4]	0.110
Anxiety	*n = 15; − 2.27 (3.28); − 1 [− 9, 3]*	*n = 10; 0.2 (1.93); 0 [− 4, 3]*	*0.043*
Overall well-being	*n* = 15; − 0.73 (3.49); 0 [− 7, 7]	*n* = 10; 0.3 (1.49); 0 [− 2, 3]	0.382
Spiritual well-being	*n* = 15; − 1.2 (2.14); 0 [− 5, 1]	*n* = 9; − 2.33 (3.81); − 1 [− 9, 2]	0.548
Constipation	*n* = 15; − 0.33 (3.64); 0 [− 6, 10]	*n* = 10; − 1.1 (3.38); − 0.5 [− 6, 4]	0.605
Sleeping	*n* = 15; − 1.13 (2.92); 0 [− 7, 4]	*n* = 10; − 0.2 (3.08); 0 [− 7, 5]	0.293
Total score	*n* = 16; − 11.75 (26.13); − 4.5 [− 69, 36]	*n* = 10; − 4.6 (16.49); − 7 [− 31, 29]	0.616

Italicized values are staitistically significant

Table 6 Comparison of ESAS intra-correlations among the three time-gap groups

Variable	*N*; mean (STD); median [range]			*p* value
	< 1 h	1–3 h	> 3 h	
Comparison among three groups	*n* = 31; 0.6 (0.31); 0.67 [− 0.2, 1]	*n* = 15; 0.4 (0.39); 0.58 [− 0.4, 0.9]	*n* = 10; 0.49 (0.37); 0.67 [0.1, 0.9]	0.256
Comparison between group 1 and 3	*n* = 31; 0.6 (0.31); 0.67 [− 0.2, 1]	*n* = 15; 0.4 (0.39); 0.58 [− 0.4, 0.9]	–	0.103
Comparison between group 1 and 2	*n* = 31; 0.6 (0.31); 0.67 [− 0.2, 1]	–	*n* = 10; 0.49 (0.37); 0.67 [− 0.1, 0.9]	0.524
Comparison between group 2 and 3	–	*n* = 15; 0.4 (0.39); 0.58 [− 0.4, 0.9]	*n* = 10; 0.49 (0.37); 0.67 [− 0.1, 0.9]	0.471

current symptoms, divergence is not likely due to recall bias. Instead, it may be capturing true fluctuations in symptoms. Overall, our data support the stability of symptoms and reliability of the ESAS within the same day.

In our study, congruence appears to be highest for the < 1 h group based on two observations: (a) the small mean differences of ESAS scores and (b) the highest intra-correlations (see Table 6). Nevertheless, it should be noted that divergence was relatively uncommon. In almost all comparisons, the median difference score between pairs of questionnaires was zero. In early ESAS reliability studies, test–retest evaluation showed universal correlation at 2 days and far less correlation at 1 week [8]. The authors concluded that possible causes of non-congruence were changes in symptoms or symptom perception over time. In this vein, others have noted that ESAS test–retest reliability within a day is generally good [9–11].

Our mean ESAS score differences showed some interesting patterns. In the < 1 h group, the difference is small (most congruent with the baseline) yet most of the differences were positive. Within the initial hour, patients might have experienced increased symptoms. In the 1–3 h group, the mean differences were largest (least congruent with the baseline) and most of them were negative: after the initial visit, patients noted fewer symptoms during that time window. Finally, in the > 3 h group, the mean differences returned to about the same magnitude as < 1 h group, but the differences were both negative and positive. With extended time between surveys, symptom scores returned close to the baseline, and differences appear to be more random statistically.

Concern may be raised that several symptoms may benefit from quick-acting and time-limited interventions (pain medications, anxiolytics, etc.), and this may be responsible for severity at 1–3 h, followed by return to baseline subsequently.

While conceptually valid, our current clinical practice is to utilize pharmacologic adjustments and other non-drug interventions outside of the clinic environment. Such modifications would not be expected to result in symptom severity changes over such short time intervals.

In a study of total patient symptom burden (total ESAS score) by day, stability of total symptom burden was noted for the first 5 days in a palliative care unit only for the cadre of patients who ultimately were discharged. This is different from the observed score decline over that same period for patients who ultimately died [12]. This study explored less day-to-day congruence than the ultimate natural history of symptom burden in two unique populations. Further, the use of the total ESAS score allows for no discussion of the individual domains.

Having such an extensive and searchable tool of PROs, we are engaged in several initiatives within our organization. As mentioned, which tool should be used by the entire clinical staff for all patients to directly input their data into the EMR is under consideration. We are investigating symptom burden in unique patient populations and mechanisms to facilitate intervention when self-reported scores exceed a threshold of severity.

As in our experience, others consider that a single daily administration of the ESAS is sufficient, even while hospitalized [13]. Cancer Care Ontario, a model center for widespread healthcare system integration of ESAS, has devised a protocol for their massive ESAS data collection, whereby patients only complete the scoring of symptoms at the first encounter of the day and the data follow them to each subsequent clinic encounter that day to avoid confounding from repetitive reporting on the same day. We are considering such a tactic as well, particularly given the high congruence of duplicate ESAS administrations detailed in this manuscript.

Conclusion

The current study suggests that duplicate administrations of the ESAS in a single day have high congruence, particularly when completed over a short period of time. As time between administrations increases, clinicians may wish to use the most recent completed version of the ESAS.

Compliance with ethical standards

Conflict of interest Dr. Johnstone has nothing to disclose. Dr. Bulls has nothing to disclose. Dr. Lee has nothing to disclose. Dr. Zhou has nothing to disclose. Dr. Portman has nothing to disclose. Dr. Yu reports personal fees from UpToDate, Inc. Dr. Jim has nothing to disclose.

References

1. Basch E, Deal AM, Kris MG et al (2016) Symptom monitoring with patient-reported outcomes during routine cancer treatment: a randomized controlled trial. J Clin Oncol 34:557–565
2. Cleeland CS, Wang XS, Shi Q, Mendoza TR, Wright SL, Berry MD, Malveaux D, Shah PK, Gning I, Hofstetter WL, Putnam JB Jr, Vaporciyan AA (2011) Automated symptom alerts reduce postoperative symptom severity after cancer surgery: a randomized controlled clinical trial. J Clin Oncol 29:994–1000
3. Basch E, Deal AM, Kris MG, Scher HI, Hudis CA, Sabbatini P, Rogak L, Bennett AV, Dueck AC, Atkinson TM, Chou JF, Dulko D, Sit L, Barz A, Novotny P, Fruscione M, Sloan JA, Schrag D (2016 Feb 20) Symptom monitoring with patient-reported outcomes during routine cancer treatment: a randomized controlled trial. J Clin Oncol 34(6):557–565
4. Basch E, Deal AM, Dueck AC, Scher HI, Kris MG, Hudis C, Schrag D (2017 Jul 11) Overall survival results of a trial assessing patient-reported outcomes for symptom monitoring during routine cancer treatment. JAMA 318(2):197–198
5. Johnstone PAS, Lee J, Zhou JM, Ma Z, Portman D, Jim H, Yu HM (2017 Sep) A modified Edmonton Symptom Assessment Scale for symptom clusters in radiation oncology patients. Cancer Med 6(9): 2034–2041
6. Portman D, Thirlwell S, Atkins L et al (2017) An e-App to foster symptom documentation and intervention. J Pall Med 20(4):A-22 (#46)
7. Watanabe SM, Nekolaichuk C, Baumont C et al (2011) A multicenter study comparing two numerical versions of the Edmonton Symptom Assessment System in palliative care patients. J Pain Symptom Manag 41(2):456–468
8. Chang VT, Hwang SS, Feuerman M (2000) Validation of the Edmonton symptom assessment scale. Cancer 88(9):2164–2171
9. Bruera E, Kuehn N, Miller MJ, Selmser P, Macmillan K (1991) The Edmonton Symptom Assessment System (ESAS): a simple method for the assessment of palliative care patients. J Palliat Care 7:6–9
10. Dudgeon DJ, Harlos M, Clinch JJ (1999) The Edmonton Symptom Assessment Scale (esas) as an audit tool. J Palliat Care 15:14–19
11. Nelson JE, Meier DE, Oei EJ, Nierman DM, Senzel RS, Manfredi PL, Davis SM, Morrison RS (2001) Self-reported symptom experience of critically ill cancer patients receiving intensive care. Crit Care Med 29:277–282
12. Rees E, Hardy J, Ling J, Broadley K, A'Hern R (1998) The use of the Edmonton Symptom Assessment Scale (ESAS) within a palliative care unit in the UK. Palliat Med 12(2):75–82
13. Richardson LA, Jones GW (2009 Jan) A review of the reliability and validity of the Edmonton Symptom Assessment System. Curr Oncol 16(1):55–64