

Impact of remote symptom monitoring (RSM) with electronic patient-reported outcomes (ePRO) on hospitalization, survival, and cost in community oncology practice: The Texas Two-Step Study

Debra A. Patt, MD, PhD, MBA¹; Amila Meera Patel, PharmD, BCOP²; Arun Bhardwaj, PhD²; Kathryn Elizabeth Hudson, MD¹; Amanda Christman, PharmD²; Ninad Amondikar, BS²; Susan Marie Escudier, MD¹; Sydney Townsend¹; Holly Books, BSN, RSN¹; Ethan Basch, MD, MSC³

¹Texas Oncology, Dallas, TX, ²Navigating Cancer, Seattle, WA, ³UNC Lineberger Comprehensive Cancer Center, Chapel Hill, NC

clinicalcontent@navigatingcancer.com

Background

- Patients with cancer can experience debilitating symptoms related to disease and treatment which can contribute to a diminished quality of life, emergency room visits, hospitalizations and even early death
- Electronic Patient Reported Outcomes (ePROs) provide a real time option for symptom monitoring that can facilitate rapid intervention to optimize symptom control
- Symptom management optimization improves patient quality of life, adherence to medication, and overall survival as demonstrated in the PRO-CTCAE trial at a large academic cancer center¹
- Step 1 of the Texas Two-Step Study demonstrated successful implementation of an ePRO system in >200 sites of service of a large community oncology practice. We now report step 2 of this study which evaluates the impact of ePROs on outcomes among patients enrolled in CMS' Oncology Care Model (OCM) program²

¹ Basch E, Deal AM, Dueck AC, et al. JAMA 2017; 318:197
² Patt D, Wilfong L, Hudson KE, et al. JCO Clin Cancer Inform. 2021;5:615-621.

Objective

To measure the impact of ePROs on ER visits, hospitalizations, death, and total cost of care in community oncology practice.

Intervention

Proactive Symptom Reporting
Patients report symptom issues on a weekly basis through modified PRO-CTCAE instrument while on active treatment for underlying cancer diagnosis

Tech-Enabled Care Navigation
Nursing staff monitor ePRO responses in NC care management platform with built-in alerting for significant issues and provide intervention within 1 hour

Analytics to Support Process Improvement
Bi-weekly cross-functional stakeholder meetings between NC & TXO to review established metrics with the ePRO program and discuss product enhancements

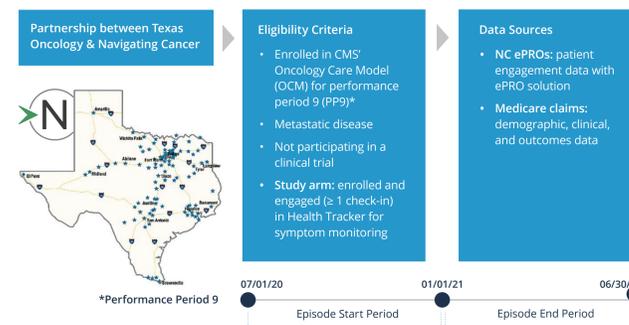
Takeaways

- When implemented across a large community oncology practice with widespread adoption, ePROs can improve emergency room visits, hospitalizations, death and total cost of care within the practice
- ePRO monitoring has a profound impact within a fertile landscape of value-based healthcare delivery investments already in place at our practice
- This research provides evidence to support ePRO programs within value-based care models, like CMS' Enhancing Oncology Model (EOM)

Methods

- This observational study focused on patients with metastatic cancer undergoing systemic therapy enrolled in OCM at multiple sites of service across Texas Oncology (TXO), a large US statewide community oncology practice, between July 2020 and December 2020
- Symptom monitoring was delivered through Navigating Cancer's (NC) ePRO digital monitoring tool, Health Tracker
- Patients who completed ≥ 1 survey via the ePRO tool were included in the study group

Patient Population & Data Sources



Statistical Analysis

- To balance the confounders between control and study groups, propensity scores using logistic regression were estimated and matching was performed using a nearest-neighbor matching algorithm with replacement⁵ to minimize selection bias after adjusting for age, gender, cancer type, radiation, surgery, and line of therapy
- A research dataset was constructed for this analysis consisting of OCM claims data derived from TXO, linked to data collected by NC's ePRO software system
- Adverse events (hospitalizations, emergency department visits, deaths), and total cost of care were a priori study outcomes
- Mann-Whitney U and Chi-Square tests compared continuous and categorical variables, with multivariable logistic regression for adjustment of covariates

Cohort Selection & Propensity Score Matching



Figure 1: Cohort selection to identify control and study group before and after propensity score matching

Results

Variable	Unmatched		Matched	
	Control (n=536)	Study (n=295)	Control (n=229)	Study (n=229)
Age	74,067.88	73,726.54	74,477.63	74,066.63
Cancer Type				
Breast Cancer	77 (14.37)	34 (11.53)	30 (13.1)	29 (12.66)
Chronic Leukemia	24 (4.48)	10 (3.39)	8 (3.49)	9 (3.93)
Lung Cancer	73 (13.62)	50 (16.95)	43 (18.78)	37 (16.16)
Lymphoma	39 (7.28)	23 (7.8)	20 (8.73)	16 (6.99)
Multiple Myeloma	64 (11.94)	24 (8.14)	20 (8.73)	20 (8.73)
Prostate Cancer	64 (11.94)	19 (6.44)	15 (6.55)	19 (8.3)
Small Intestine / Colorectal Cancer	40 (7.46)	35 (11.86)	23 (10.04)	25 (10.92)
Other	155(28.92)	100 (33.9)	70 (30.57)	74 (32.31)
Radiation Therapy	44 (8.21)	40 (13.56)	25 (10.92)	24.0 (10.48)
Surgery	8 (1.49)	10 (3.39)	5 (2.18)	6 (2.62)
Line of Therapy				
1st line	227 (42.35)	182 (61.69)	136 (59.52)	128 (55.9)
2nd line	84 (15.67)	41 (13.9)	41 (17.9)	35 (15.28)
3rd line +	40 (7.46)	25 (8.47)	20 (8.73)	22 (9.61)
Unknown	185 (34.51)	47 (15.93)	34 (14.85)	44 (19.21)

Table 1: Selected demographics of unmatched vs. matched population. Highlighted green boxes show statistically significant differences in unmatched population.

Cohort Selection & Propensity Score Matching

- Out of 831 patients with metastatic cancer, 458 matched patients (229 per group) were identified, with 52% male and mean age of 74 (Figure 1)
- Before matching, there was a significant difference in cancer type, radiation therapy, and line of therapy between the control and study populations. After matching, the control and study cohorts were similar among all focused variable categories with no significant difference (Table 1)

Adverse Events

- We observed ~33% fewer adverse events in patients who participated in the ePRO study group as compared to control (total AEs: 0.85 and 0.55 per 100 person days in control and study group, respectively) (Figure 2)
- Mean total adverse events were lower in the study group compared to control (0.98 vs 1.41; p=0.007), with decreased hospitalizations (20% vs 32.5%; p=0.002), emergency visits (38.4% vs 42.3%; p=0.05) and deaths (11.8% vs 16.6%; p>0.05) (Figure 3)
- Average number of hospitalizations was lower (0.28 vs 0.52; p=0.003) with reduced mean duration of hospitalizations (1.9 vs 3.2 days; p=0.03)

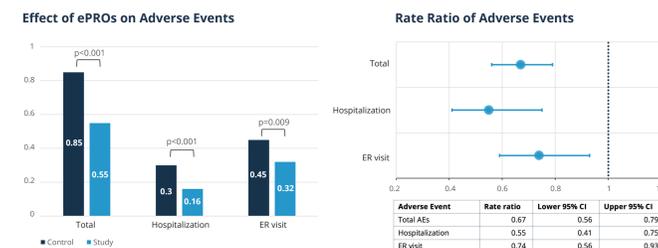


Figure 2: ePRO monitoring associated with statistically significant rate reduction in adverse events

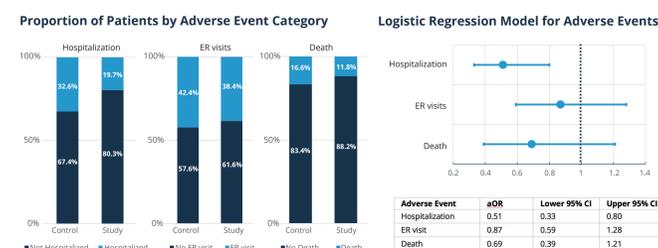


Figure 3: Reduction in adverse events associated with ePRO monitoring

Total Cost of Care

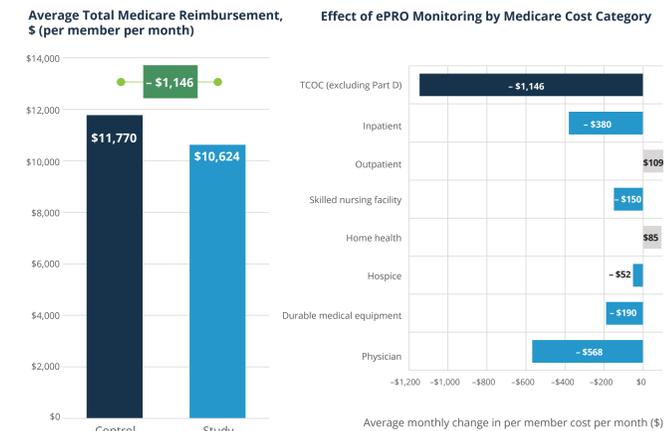


Figure 4: Mosaic plots depict the distributions of patients engaged across the different tools within the DHS

\$1,146

Total cost of care was reduced by an average of \$1,146 per member per month

80%

of savings associated with reductions in inpatient and physician office visits

Discussion

Conclusion

- Symptom monitoring with ePROs improved quality and value of cancer care delivery by reducing hospitalizations, emergency visits, and deaths, while lowering cost of care in a large oncology practice
- As the landscape of quality and value-based care continues to evolve, ePROs are a meaningful way to enhance the quality and value of patient care

Limitations

- Study occurred amidst the COVID-19 pandemic, which may have confounded results
- Despite broad implementation, the matched population with advanced cancer was relatively small
- Unaccounted differences between intervention and control groups may introduce bias

Future Directions

- Evaluate against a broader population and evaluate other factors impacting outcomes
- Additional studies needed to address the cost of staffing ePRO programs
- Leverage these findings to advocate for reimbursement for ePRO services with payors