

A Framework for Incorporating Distance-to-Care Metrics in Cancer Outcomes Research: Exploratory Insights Using Real-World Data From a Network of Community Practices

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Background and Objectives

- Geographic access to oncology care has been proposed as an important determinant of cancer outcomes, particularly for patients treated in community settings who may face transportation, caregiving, and resource constraints.
- Prior studies evaluating distance-to-care and cancer outcomes have produced mixed and sometimes conflicting results, with reported associations varying by cancer type, care setting, outcome examined, and analytic approach.
- Heterogeneity in findings may reflect true mitigation of geographic barriers through mechanisms such as telehealth, satellite clinics, and decentralized care delivery, as well as substantial methodological variation across studies.
- Differences in how distance-to-care is measured, categorized, and incorporated into analytic models may meaningfully influence observed associations and limit comparability across studies.
- There remains a need for a structured and transparent approach to incorporating distance-to-care into real-world oncology outcomes research.

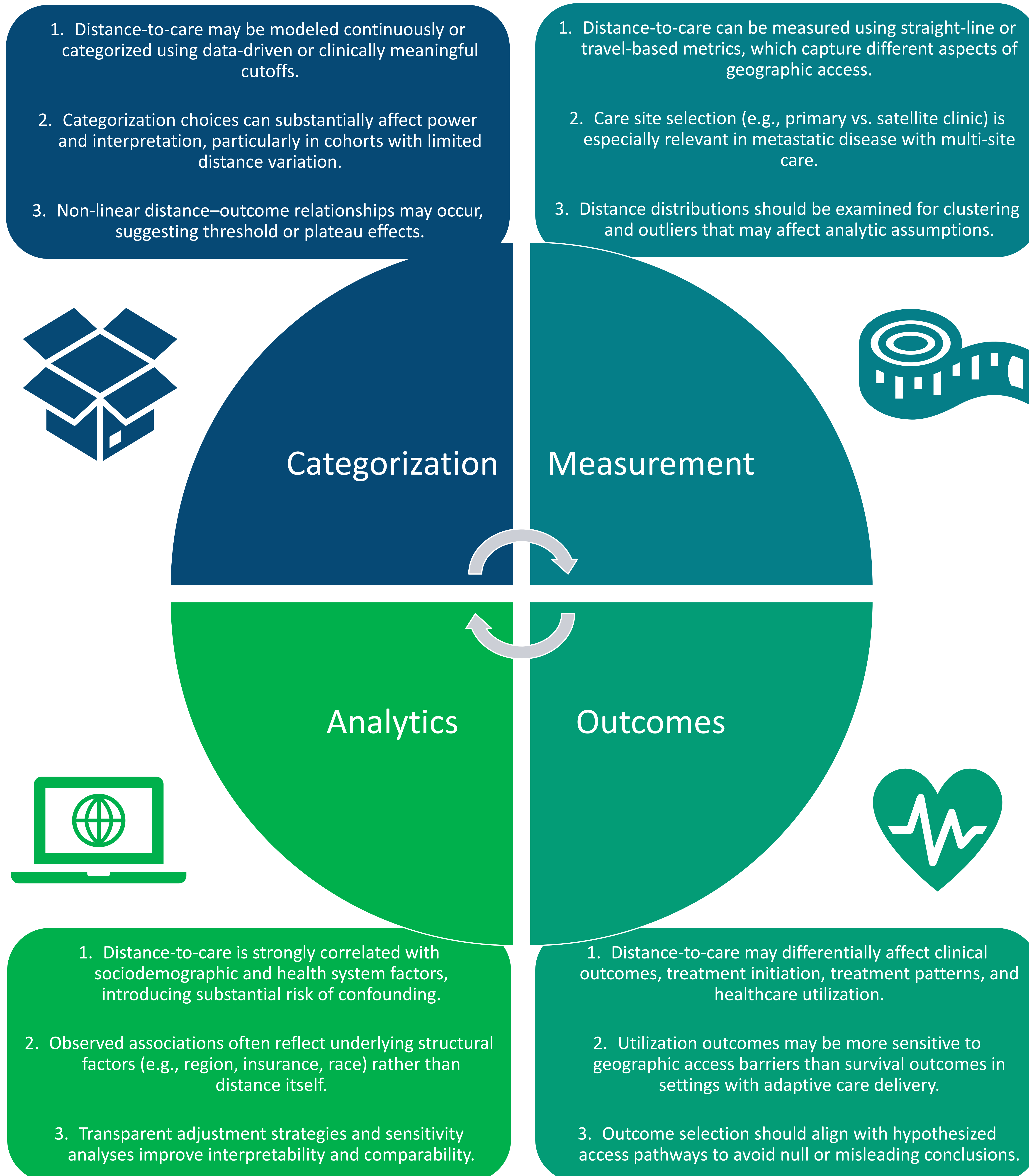
To develop and apply a structured framework for evaluating geographic distance-to-care and its real-world associations with outcomes in metastatic breast cancer (mBC).

Methodology

- A **targeted literature review** was conducted to identify common methodological approaches and recurring limitations in prior studies.
- Insights from the literature informed development of a **four-domain conceptual framework** to guide study design and analysis.
- The framework was applied to **ONCare Alliance electronic medical record data** to identify a real-world cohort of patients diagnosed with mBC.
- Distance-to-care was calculated using patient residence and oncology care location data and summarized descriptively.
- Patient demographics, clinical characteristics, and care utilization were assessed overall and across distance categories.
- Associations between distance-to-care and outcomes were evaluated using descriptive statistics and survival analyses.

Results

Figure 1. Conceptual Framework for Incorporating Distance-to-Care into Oncology Outcomes Research



Real-world Application for a Cohort of Patients with mBC

- The study cohort included 576 patients with mBC (mean age: 63.1 years; 97.6% female; 78.3% White).
- Median distance-to-care was 12.3 miles, with a highly skewed distribution (range: 0–968.8 miles), and 90.1% of patients residing within 50 miles of care.
- Distance distributions demonstrated substantial clustering at shorter distances, with a small number of extreme outliers.
- Application of the framework demonstrated that observed associations varied substantially by:
 - Outcome examined (OS, time to treatment initiation, visit frequency, systemic therapy receipt)
 - Distance categorization strategy
- Greater distance, analyzed by quartiles, was associated with fewer 90-day office visits ($p=0.0063$), with no association observed for OS ($p=0.2082$) or systemic therapy initiation (odds ratio for farthest vs. nearest quartile, 0.77; 95% CI, 0.27–2.19).
- Visual and analytic patterns suggested non-linear relationships between distance and utilization outcomes.
- Distance-to-care was strongly associated with region ($p<0.0001$), insurance status ($p<0.0268$), and race ($p<0.0001$), highlighting substantial confounding risk.

Key Take-Aways, Implications, and Future Directions

Associations between geographic distance-to-care and real-world outcomes in mBC are highly sensitive to methodological decisions, including distance measurement, categorization, outcome selection, and analytic adjustment.

Distance-to-care demonstrated stronger and more consistent relationships with healthcare utilization outcomes than with clinical outcomes such as overall survival, highlighting the importance of aligning outcomes with hypothesized access pathways.

Observed non-linear patterns and clustering of distance distributions reinforce the limitations of assuming linear or uniform distance effects across patient populations.

Strong correlations between distance and region, insurance, and race emphasize the substantial risk of confounding and the need for transparent, framework-guided analytic approaches.

The proposed framework provides practical guidance to improve consistency, interpretability, and comparability across distance-to-care studies in oncology.

Distance-to-care should not be interpreted as an independent causal exposure without careful consideration of structural confounding and analytic specification.

Future research should apply this framework across cancer types and care settings, incorporating time-varying distance measures, telehealth utilization, and referral patterns to better inform equity-focused care delivery and policy decisions.