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Analytic Approaches for Causal Inference with Complex Multi-Component Interventions

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project ACHIEVE

UK UNIVERSITY OF KENTUCKY
Center for Health Services Research

Applying Research to Optimize Care©

Analytic Approaches for Causal Inference with Complex Multi-Component Interventions

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ACHIEVE Quantitative Study Design

- **Hospital Adoption:** Survey hospitals to determine the scope and timing of transitional care components (TCC)
- **Cluster Identification**: Use qualitative and quantitative data to identify clusters of TCCs implemented together
- **Retrospective Analysis**: Use administrative data to:
  - Compare patterns of care and outcomes before vs. after adoption of TCC clusters
  - Detect changes in care and outcomes attributable to TCC implementation (2009-14)
- **Prospective Analysis**: Measure patient-centered care patterns, experiences, & outcomes across TCC clusters using an incomplete fractional factorial design

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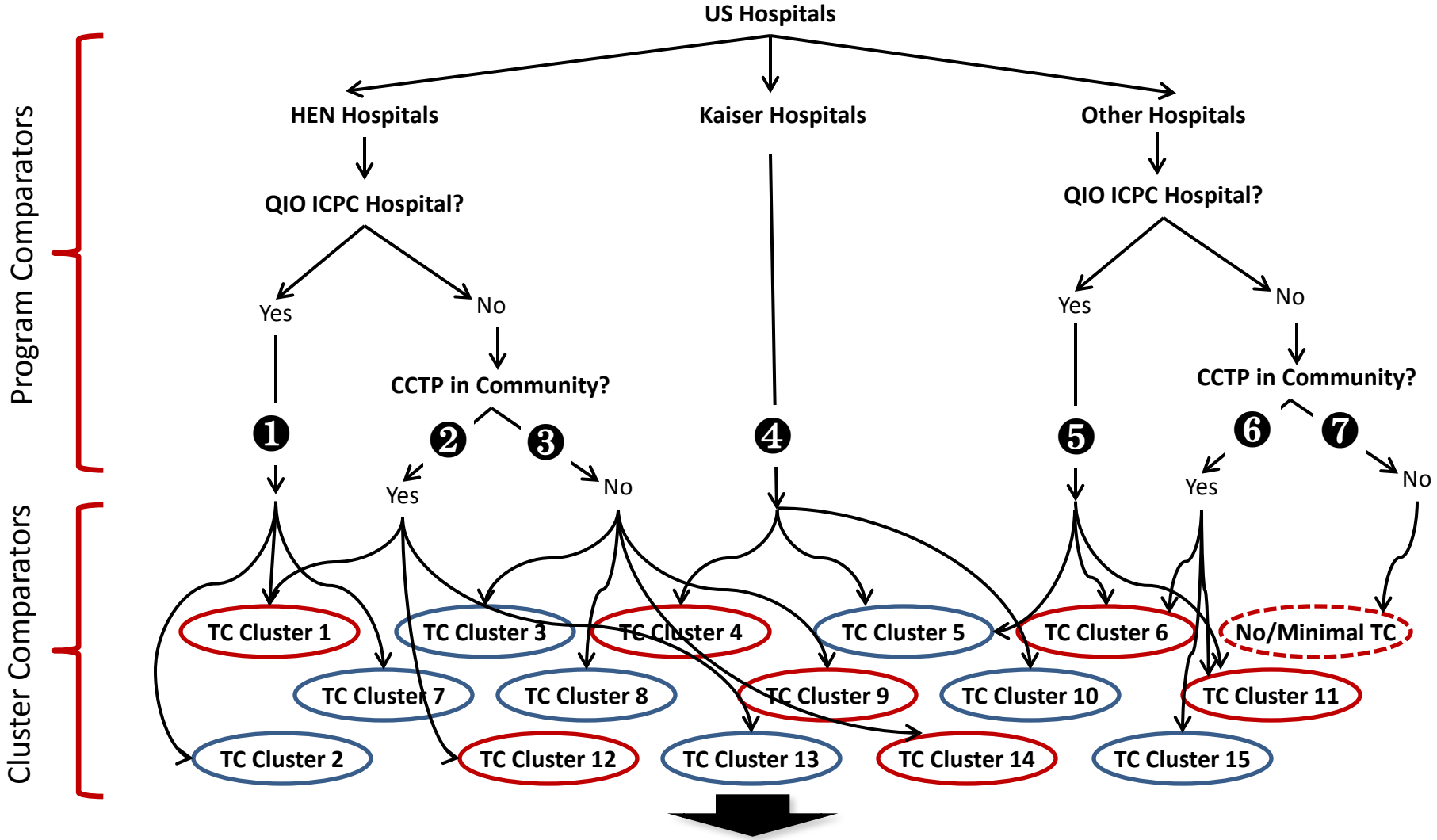
Overview of ACHIEVE Quantitative Design



Retrospective Claims Analysis: All hospitals/patients in all clusters included
Prospective Analysis: red TC clusters selected by Fractional Factorial Design

Stratified probability sample of hospitals (assume 5 hospitals from each of 8 clusters)
(sampling probabilities within strata proportional to hospital patient volume)
Stratified random sample of 300 patients from each hospital (12,000 total)

Dealing with Complexity: Retrospective Analysis

- **Principal components analysis/factor analysis:** Identify clusters of TCCs commonly implemented together
- **Cluster analysis**: Identify comparison groups of hospitals/ communities that use the same combinations of TCC clusters
- **Qualitative data:** Site visit and focus group findings inform TCC cluster and comparison group identification
- **Adoption/selection analysis:** Evaluate selection bias in hospital/ community adoption of TCCs and the types of patients exposed
- **Interrupted time series analysis:** Estimate changes in patient care and outcomes attributable to TCC implementation
- **Hierarchical multivariate adjustment:** control for patient, hospital and community covariates, balance across TCCs/groups
- **Instrumental variables and person-centered effects:** control for unobserved confounding and estimate patient heterogeneity in treatment effects

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Dealing with Complexity: Prospective Analysis

- **Incomplete fractional factorial selection:** Screen and sample a subset of TCC clusters (factors) and types of care settings (levels) that provide contrasts for the fullest possible range of TCC, hospital, and community combinations
- **Care settings/levels**: A total of 40 care settings will be selected, balancing hospital and community characteristics (10 Kaiser settings).
- **Patient/caregiver sampling**: 300 patients from each setting surveyed within 45 days of discharge, plus 180 caregivers and 75 providers
- **Outcomes:** Comparison of patterns of care, experiences with care, and patient-centered outcomes across TCC clusters and settings
- **Hierarchical modeling & propensity score weighting:** balance and adjust for patient/hospital/community covariates across TCC clusters
- **Tree-based models:** identify interactions among patient subpopulations, patient/caregiver characteristics, and TCC clusters

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Dealing with Complexity: Prospective Analysis

Hospital/Community Care Setting Combinations	TCC Clusters							
	TCC 1	TCC 2	TCC 3	TCC 4	TCC 5	TCC 6	TCC 7	TCC 8
Academic affiliations								
Community hospitals								
System memberships								
Rural settings								
Community-based TC components								
…								

Incomplete Fractional Factorial sampling from cells to reduce confounding and maximize identification of TCC effects and care setting interactions

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