

Spatiotemporal Patterns of Residents' Access to Tertiary Hospitals in Megacities and Planning Implications

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Abstract

Equitable access to tertiary hospitals is a critical concern in urban planning, yet conventional assessments often rely on static proximity assumptions and fail to capture the dynamic interplay between traffic conditions and residents' hospital-selection behaviour. This study proposes an improved two-step floating catchment area method that integrates a power-law probabilistic choice function to simulate residents' preferences beyond the nearest-facility rule, a continuous Gaussian decay to replace binary thresholds, and year-round real-time traffic data from routing APIs to measure dynamic accessibility across weekday/weekend, peak/off-peak periods, and multiple time thresholds (5, 10, and 30 minutes). Applied to Chengdu—a megacity with 59 Grade-A tertiary hospitals—the analysis reveals a three-tier spatial gradient from central urban areas to inner and outer suburbs. Notably, inner suburbs fall within the 30-minute catchment but exhibit severe functional insufficiency, with up to 90% of critical care relying on central-city referrals. Global spatial autocorrelation is significantly positive, intensifying with larger thresholds (Moran's I: 1.12–1.21 at 30 minutes), confirming that the concentration of 80% of top-tier hospitals within the ring road is the dominant driver of inequity. Residents' choice behaviour deviates markedly from the nearest-principle, and weekend leisure traffic further disrupts access in tourist hotspots, reflecting the city's “leisure-oriented transition”. These findings underscore the necessity of decentralising medical resources through regional sub-centres in accessibility blind zones and implementing adaptive traffic management, such as dynamic bus-lane policies, to enhance off-peak response efficiency. The improved method demonstrates high robustness across parameter sensitivity, data perturbation, and cross-validation. This study provides quantitative evidence for urban planners to reconcile resource agglomeration with transport dynamics, advancing spatial equity in medical service delivery.

Keywords

Urban Healthcare Accessibility, Tertiary Hospitals, Two-step Floating Catchment Area, Spatial Equity, Traffic Dynamics, Chengdu, Urban Planning, Spatiotemporal Heterogeneity