When Supply Shocks Meet Rigid Demand: Spatial and Social Barriers to Stroke Treatment Access

Baptiste HAON*
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*Hospinnomics - Paris School of Economics, GATE UMR 854 - Université Lyon 2

Abstract

Mechanical thrombectomy (MT) for large-vessel occlusion stroke is a high-value, time-critical technology fully covered under France's universal public health insurance system, yet access remains uneven across space and social groups. This paper examines how far expanding MT capacity can improve timely access when demand for emergency care is rigid and rationed mainly by non-price rather than financial frictions. A simple framework treats patients as facing an implicit "time-and-effort" price that combines travel time, organisational frictions, and social isolation. Supply shocks that reduce travel times relax logistical constraints inside the stroke pathway but have limited leverage on pre-hospital behaviour, especially where social ties are weak.

The analysis exploits the 2019 opening of two new MT-capable centres in Pau and Bayonne (Nouvelle-Aquitaine) as a quasi-experimental supply shock. Detailed GIS routing under a drip-and-ship model is used to construct commune-level travel-time gains, which are linked to a 2019–2023 registry of stroke episodes. A continuous difference-in-differences design, with standardised travel-time gain as treatment intensity, identifies a dose–response relationship between improved geographic accessibility and onset-to-treatment (OTT) times, MT utilisation, and a utility-loss index calibrated from clinical time–outcome gradients.

Three main results emerge. First, supply expansion generates clear intensive-margin gains: a one–standard deviation improvement in accessibility reduces OTT by about 1–1.5 minutes, with larger effects for early presenters. Second, the extensive margin is essentially unchanged in the short run: MT volumes per capita and MT shares do not respond detectably, consistent with rigid demand in the presence of behavioural and informational frictions. Third, the translation of formal proximity into effective access is socially unequal: OTT gains are similar across educational strata but substantially attenuated in communes with a high share of single-person households, suggesting that social isolation lowers the marginal product of supply expansion.

Treating the estimated dose–response as a local policy gradient, the paper embeds it in a national microsimulation of alternative comprehensive stroke centre configurations and demand-side interventions. The simulations show that supply expansion is necessary to close spatial gaps but insufficient to eliminate social gradients in timely MT access. Policies that jointly target CSC siting and pre-hospital behaviour in socially isolated populations deliver larger and more equitable gains in timely access than supply-side measures alone, highlighting the complementarity between spatial and social proximity in the production of high-value emergency care.