How does multichannel delivery impact access to a care network? Evidence from telemedicine in South India

Advances in information and communication technologies are set to disrupt the healthcare sector through the introduction of novel “e-channels” such as e-visits [Bavafa et al., 2013], and telemedicine [Rajan et al., 2014]. However, the net impact on how often and through which channels patients access provider resources as well as on patient outcomes is unclear because an e-channel may act as both a complement to, and a substitute for, existing channels.

Building on previous research in multi-channel retail and financial services [Bell et al., 2015, Campbell and Frei, 2010, Avery et al., 2012], we hypothesize that e-channels, in particular telemedicine, may act as substitutes or complements to traditional channels depending on: (i) the relative costs and capabilities of alternative channels; (ii) the complexity of patient needs; and (iii) the level of integration between channels (e.g., referral mechanisms). First, e-channels may expand access to remote patients for whom accessing care from traditional channels is prohibitively expensive, thereby increasing overall volume. Second, patients with simple conditions who currently access traditional channels but whose needs can be satisfied through e-channels may migrate to e-channels, hence cannibalizing visits to the existing channels. Third, patients with complex needs who access the e-channel with limited capabilities could be referred to the traditional channel if two channels are well integrated. Finally, presence of an e-channel closer to patient locations might increase awareness and enhance care seeking behavior in general, thereby increasing visits to the traditional channels independent of the referrals. Estimating the relative magnitude of these effects is necessary to weigh the costs and benefits of e-channels and effectively manage their role within the healthcare delivery network.

We empirically estimate the above effects in the context of the introduction of tele-ophthalmology centers (called vision venters) by one of the world’s largest eye care providers, the Aravind Eye Care System (AECS), located in southern India. The vision centers are located in rural areas and serve a population of around 50,000 within a radius of 10km. Each vision center is staffed by two ophthalmic nurses who provide basic eye care and facilitate e-consultation with an oph-
thalmologist at the tertiary hospital via digital eye-imaging and video conferencing. Patients with simple conditions (e.g., refractive errors) are prescribed glasses and/or medication on-site whereas more complex patients are referred to tertiary hospitals in the AECS network.

Our estimation framework is a quasi-experimental difference-in-differences (DiD) approach that exploits variation in the time and location of the openings of 20 vision centers affiliated with the flagship AECS tertiary hospital between 2006 and 2015. We utilize registration, diagnosis, and billing data on 5.15 million patient visits to the ACES network over this period. We map patient addresses to 2081 census locations and aggregate the data at a monthly level to obtain a balanced panel with 235,153 location-month observations. The 713 census locations that lie within 10km radius of a vision center comprise our treatment group whereas the remaining census locations comprise the control group. To account for potential endogeneity in the choice of vision center locations (e.g., AECS chose them to maximize impact), we adopt a two-stage approach as in Bell et al. [2015]. In the first stage, we estimate the propensity of each location receiving treatment, i.e., of a vision center opening within 10 km, as a function of population density, road connectivity, etc. In the second stage, we estimate a DiD model, which controls for other factors that vary over time and space (e.g., outreach camps and opening of other AECS facilities) and incorporates inverse probability weights calculated from the estimated propensity scores. This approach allows us to estimate the unbiased effect of opening vision centers at "treatment" locations.

Our first key finding is that vision centers increased the number of visits to the overall AECS network by approximately 5% more than 70% of which are from new patients, who had not visited any AECS facility previously. This provides strong evidence of increased patient access. Second, we find that opening a vision center reduces patient visits to the tertiary hospital by 4% despite a minimal increase in referrals from the vision centers (0.15%). This suggests that cannibalization is the dominant effect at the tertiary facility, overpowering both referrals and any potential marketing effects. Third, we find that vision centers do not have significant impact on the volume of surgical and laser procedures but they increase the volume of patients receiving prescriptions for glasses by 3.5% across the network without a corresponding decrease
at the tertiary hospital. These findings indicate that vision centers offer limited benefits for complex patients, and primarily expand access for simple patients.

In conclusion, our results highlight the multifaceted impact of a novel e-channel for health care delivery on patients’ access behavior. Vision centers significantly expand access to eye care, and possibly improve outcomes, especially for patients requiring non-complex services. They also enable some non-complex patients to migrate away from the traditional hospital channel thereby reducing cost. However, vision centers do not seem to provide an effective referral mechanism leading to a decrease in visits to tertiary facilities. These findings provide insight into the benefits and the limitations of the vision center model. They are important in evaluation of their effectiveness and efficiency of telemedicine as a primary care delivery channel in rural areas of developing countries. Furthermore, these results also contribute to the growing operations management literature on multi-channel delivery of services within the healthcare context.

References


