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

Telemedicine, use of information and communication technologies for remote treatment and diagnosis, has been hailed as a novel channel for expanding healthcare access in developing countries with limited number of trained physicians [World Health Organization, 2010]. Yet recent evidence indicates limited impact of this delivery channel on patient outcomes [Mohanan et al., 2016]. Operational mechanisms driving these findings, particularly the extent of utilization of different delivery channels (telemedicine vs. traditional) by different types of patients, is not well understood.

Building on previous research in multi-channel retail and financial services [Bell et al., 2017, Campbell and Frei, 2010], we hypothesize that telemedicine, may act as substitute or complement 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, telemedicine 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 telemedicine may migrate to e-channels, resulting in cannibalization. Third, patients with complex needs who access telemedicine with limited capabilities could be referred to the traditional channel if two channels are well integrated. Finally, presence of the telemedicine 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. The relative magnitude of these effects can critically impact the costs and benefits of e-channels, and hence, their role within the healthcare delivery network.

We empirically estimate the above effects in the context of the introduction of teleophthalmology 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 ophthalmologist 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 4.66 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 to estimate the unbiased effect of opening vision centers at ”treatment” locations. 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.

First, we find that vision centers increase the number of visits to the overall AECS network by approximately 7.4%, more than 66% of which are from new patients. Second, we find that opening a vision center reduces patient visits to the tertiary hospital by 3.3% despite a 0.6% increase through referrals from the vision centers. This suggests that, at the tertiary facility, cannibalization effect due to the vision centers dominates referrals from vision centers and their potential marketing effects. Third, we find that vision centers do not have significant impact either on the volume of surgical and laser procedures or the volume of patients receiving prescriptions for glasses across the network. However, for latter, we find evidence of substitution away from hospital toward the vision centers.
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, primarily for new patients with simple ailments. However, it is not accompanied by overall increase in dispensing of common treatments but only substitution away from the traditional hospital channel. Moreover, vision centers do not serve as an effective referral mechanism to tertiary facilities. These findings can be used to rigorously quantify the cost-effectiveness of telemedicine as a primary care channel in rural areas of developing countries. Furthermore, they also contribute to the growing operations management literature on multi-channel delivery of healthcare services [Bavafa et al., 2017].

References


