Can Bundled Payment Cure the Ills of Fee-for-Service?  
An Equilibrium Analysis

Healthcare, as the largest sector of U.S. GDP (17.8% in 2015), has received considerable attention from the researchers of the operations management community. A prevailing payment model, called the Fee-for-service (FFS), through which hospitals are paid by the insurers is often considered to be a major factor contributing to highly fragmented care delivery, high levels of wastage, and quality issues in this industry. FFS compensates providers based on volume of care (i.e., number of treatments, tests, procedures provided to a beneficiary) without considering quality as a criterion. Such payment models, mostly focusing on quantity rather than quality, have caused broad concerns over misaligned financial incentives for providers (see Gawande (2009)).

A large number of health plans across the U.S. (e.g., UnitedHealthcare, Horizon Blue Cross Blue Shield, Providence Health & Services) have piloted the bundled payment (BP) schemes in recent years. BP provides hospitals a lump-sum payment for an entire episode of care as opposed to each service being billed separately. On one hand, supporters of BP claim that it can remove the motivation of over-utilization and incentivize quality improvement, since low quality leads to readmissions and hence higher treatment costs. On the other hand, opponents of BP argue that this payment plan is very complex to administer, and that it is dangerous to let hospitals carry financial risks exclusively. Thus BP might force hospitals to lower the costs and increase the efficiencies without caring for quality (see Adida et al. (2016) and the references therein). Irrespective of the existence of different payment models, the patients are free to choose any healthcare provider within the rules of their respective health plans. Thus, competing hospitals under different payment models (FFS vs. BP) has emerged as a prevalent scenario for healthcare delivery in the United
Given the above observation, it is important to understand the impact of payment schemes on the equilibrium qualities of competing hospitals. Motivated by this, we consider two for-profit hospitals (Hospital 1 and Hospital 2); Hospital 1 is under FFS while Hospital 2 is under BP, competing for a common pool of patients insured by a single insurer (UnitedHealthcare, for example). Given the payment schemes, each hospital chooses its quality; and that the demand, the treatment costs of different stages, as well as the readmission probability of patients depends on a hospital’s chosen quality. In particular, we seek answers to three research questions by this parsimonious game theoretic model: Does a hospital under BP (FFS) always offer high (low) quality at equilibrium? What factors affect the equilibrium outcome and how? What insights can a policymaker (i.e., an insurer) obtain from the equilibrium quality outcomes? Although a few papers in operations literature study alternative payment models in healthcare (e.g., see Adida et al. (2016), Gupta et al. (2015), and Zhang et al. (2016)), to the best of our knowledge, ours is the first to incorporate competition between two hospitals to study the impact of different payment models on quality. Furthermore, our analytical framework is general enough to capture patient heterogeneity on treatment costs and/or readmission probabilities, as well as the properties of the possible equilibrium outcomes in a realistic setting.

We first establish the existence and uniqueness of the Nash equilibrium under relatively mild conditions. We show that equilibrium quality decisions of the two hospitals are strategic complements if demands satisfy a very mild condition, and BP (FFS) is not necessarily associated with high (low) equilibrium quality. Then, we examine the effects from payments under FFS, and find, counter-intuitively, that increasing the payment for readmission treatment may result in quality improvement, rather than deterioration. We identify threshold payments for both FFS and BP that can lead the corresponding hospital to choose the highest or lowest level of quality.

We define a consumer characteristic (the beneficiaries’ sensitivity to quality difference) and two measures of system performance (the societal benefit, and the effective aggregate quality). We show that the maximum societal benefit or the maximum effective aggregate quality is not neces-
sarily achieved when both hospitals choose the highest quality level. Our numerical experiments show that increasing either the first-time treatment payment under FFS or the bundled payment under BP helps improve the equilibrium societal benefit, however increasing the readmission payment in FFS may deteriorate the equilibrium societal benefit. We find that low sensitivity to quality difference can make it difficult for the policymaker to induce high quality choice under BP, and can decrease the equilibrium societal benefit. We present several numerical studies that complement our analytical findings. Our numerical study shows that the influence of costs dominates that of the readmission probability on the equilibrium societal benefit. Moreover, a combination of high payments to hospitals cannot effectively improve the equilibrium societal benefit, when hospitals face high treatment costs. On the other hand, when hospitals face low costs, increasing the overall payments for providers leads to better over-all system performance. Thus, providing incentives or imposing penalties based solely on hospital readmission reduction may not be effective in improving the equilibrium societal benefit. While many insurers emphasize hospital readmission reduction programs, our findings suggest that such programs, if desirable, should run concurrently with cost reduction programs to improve the equilibrium societal benefit.

References


