Does Social Media Use Reduce Overuse of Medical Resource: The Case of High-Cost Tests

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Abstract

Overuse of medical resource is a significant contributor to the rapidly growing healthcare costs. Although researchers have growing interest in understanding the impact of social media use in healthcare industry, there are limited studies quantifying its impact from the lens of medical resource overuse. Motivated by this crucial research gap, we provide the empirical evidence demonstrating that unnecessary use of medical resource can be reduced by patients' social media use. Our research shows the significant value of IT application in resolving a social problem.

Keywords

Social media impact, overuse of medical resource, information asymmetry

Introduction

Rising cost of healthcare service is a significant problem worldwide. In the United State, national health expenditures are going to amount to $5.548 trillion in 2025, according to a study of the Centers for Medicare & Medicaid Services’ (CMMS)\(^1\). This problem is even more prevalent in China since physicians there have strong financial incentives to prescribe more medical services than patients need. Specifically, physicians’ incomes are closely related to the revenue generated for their sponsored hospitals (Yip et al. 2010).

Medical service is a typical credence goods in that physicians are significantly more knowledgeable than patients (Dulleck and Kerschbamer 2006). Due to high information asymmetry, physicians are more likely to provide medical interventions of higher quality than patients actually need. As information systems widely spread in the healthcare industry, existing literatures show that information technologies have great potential to curb striking medical costs. For example, a prior study shows that traditional in-hospital information technologies can help to reduce physicians’ duplicated tests prescription (Ayabakan et al. 2017).

However, there are a limited number of studies quantifying social media impacts in this regard and provide empirical evidences accordingly. Thus, by extending research domain from traditional HIT systems to social media application, we pose to ask the research question: can the use of social media help to reduce physicians’ medical resource overuse?

\(^1\)https://www.healthcare-informatics.com/article/revenue-cycle-management/medicare-actuaries-us-healthcare-spending-will-rise-5548-trillion
In this study, we focus on exploring the impact of social media on the overuse of high-cost diagnostic tests in particular. We define the situation that high-cost diagnostic tests are overused when such procedures do not add any value on patient care. Specifically, if the use of social media could reduce patients’ spending on high-cost diagnostic tests without lowering the quality of care jointly, then we can conclude that social media use can be helpful for resolving the problem in medical resource overuse. In this study, we collect a unique dataset containing patient-level observations of a large hospital from June 2016 to December 2016. After matching patients’ social media use and their in-hospital records, we collectively examine the impact of patients’ social media use on their expenditure of high-cost diagnostic tests and healthcare quality. By conducting econometric analysis, we demonstrate that patients’ social media can significantly reduce the number of unneeded high-cost diagnostic tests without lowering quality of care. Therefore, our study provides strong empirical evidences that social media can help to eliminate the overuse of medical services.

Our study can make intended contributions as the follow. First, the current research joins a large literature that examines the impact of social media on healthcare. Prior studies in this stream have shown different outcomes associated with the use of online healthcare community. This study contributes to the area by extending the social media impact onto the overuse of medical resource, which is of significance due to the fast growth of healthcare spending. Second, this study also contains interesting policy implications. From past experiences, it is quite expensive for governments to provide physicians subsidy to reduce their motivation on selling unnecessary medical services (National Audit Office, 2008). Our results suggest that encouraging social media use can be considered as a policy instrument to reduce waste due to overuse of medical resources.

**Literature review**

**Information asymmetry in healthcare industry**

There are several reasons for such an information asymmetry between patients and physicians. First, compared with physicians, patients experience obvious gaps in terms of medical knowledge. With lower medical literacy, patients have limited capacity to understand information and make informed medical decisions (Ruger 2010). Second, patients have limited channels to access health related resources and information. This problem is particularly acute in the rural areas (Gamm et al. 2010). Geographic distance makes it difficult for rural patients to get helps from medical professionals and support groups.

**Impact of Social Media on Healthcare**

The information systems research literature has a growing interest in the impact of social media on healthcare. Prior study on the impact of social media often emphasizes the business values they generate for firms (Nevo and Furneaux 2012; Huang et al. 2014). However, although economic returns reflect an important dimension of the value of social media, social value should receive more attentions as the primary goal is not to make money but to save patients’ lives in the healthcare industry. For example, Goh et al. 2016 shows that online health communities have great potential to reduce rural-urban health disparities. As patients shoulder heavy financial burden due to the rising costs of medical services, how social media could play a role in mitigating the problem of medical resource overuse should receive more scholarly attention.

**Hypothesis Development**

In the healthcare context, a physician is an expert on the quality of medical services that their patients need, while patients do not know what level of service they require. As a result, patients easily receive treatments that were not necessary. By extending this understanding, we further explicate how online healthcare communities could mitigate the overuse of medical resources by lowering information asymmetry. In a healthcare social media platform, participants share rich information including medical costs and effectiveness of treatments. By making the information of medical services more transparent, it helps patients to choose a cost-effective service among alternatives. Second, social media platforms provide an additional channel for patients to directly contact with physicians. By doing so, patients can easily seek advices from multiple physicians to get second opinions, which health providers’ information advantages to provide costly treatments (Mimra et al. 2016). Thus, we put forward the following hypothesis:
**H1: Social media use can decrease prescriptions of high-cost tests**

The healthcare social media examined in this study also has the potential to improve healthcare quality by reducing information asymmetry. Specifically, social media platforms contain extensive physicians’ information such as expertise, title, and past service quality. From patients’ perspective, with sufficient online information, they can better choose a physician whose professional skills match their health conditions. From the physicians’ perspective, in an environment with less asymmetric information, the effort to be a good doctor is more rewarding since performance disclosure through a public profile can affect their image and reputation (Godager et al. 2016). Based on the above arguments, we put forward the following hypothesis:

**H2: Social media use can improve healthcare quality**

**Research Context and Data Collection**

We collected the data from a large hospital in China. The focal hospital once launched a social media platform to improve interactions among physicians and patients. In this platform, physicians have public profiles containing their personal information (e.g. working schedule, position, expertise). By using this platform, physicians can share healthcare passages to introduce up-to-date medical interventions or give general health advices. As for patients, they can not only initiate online consultations with physicians but also make comments to share experiences of their in-hospital visits.

The data period starts on June 1, 2016 and ends on December 31, 2016, which covers 1307 diabetes patients receiving in-hospital medical services from 106 physicians. Our dataset consists of both information on patients and physicians. As for patients, we have patients’ demographics (gender, age), health condition (transfer, surgery), financial information (insurance type), healthcare expenditure (CT and MRI cost), healthcare outcome (recovery). Most importantly, we have detailed information on patients’ social media use. For example, we can observe whether patients have social media accounts of our focal hospital. As for physicians, we have their characteristics (gender, age, position, education and tenure). By matching unique patients’ ID with their social media use, we can get a whole picture of both online and offline information. We list the summary statistics in Table 1.

**Econometric Model Specification**

To test Hypothesis 1, we estimate the following model:

\[
\text{High\_cost\_test}_{ij} = \alpha_0 + \alpha_{11}\text{Social\_Media}_{ij} + \alpha_{12}\text{Control}_{ij} + \delta_i + \theta_t + \varepsilon_{ij}
\]  

(1)

To test Hypothesis 2, we estimate the following model:

**Table1. Summary Statistic of Key Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Cost Test</td>
<td>1307</td>
<td>259.378</td>
<td>464.242</td>
<td>0</td>
<td>2970</td>
</tr>
<tr>
<td>Recover</td>
<td>1307</td>
<td>0.988</td>
<td>0.11</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Media Adoption</td>
<td>1307</td>
<td>0.184</td>
<td>0.387</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Insurance</td>
<td>1307</td>
<td>0.979</td>
<td>0.145</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Age</td>
<td>1307</td>
<td>0.568</td>
<td>0.496</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Gender</td>
<td>1307</td>
<td>57.487</td>
<td>12.823</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Surgery</td>
<td>1307</td>
<td>0.037</td>
<td>0.19</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Quality\_ij = \alpha_0 + \alpha_{21} \text{SocialMedia}_{ij} + \alpha_{22} \text{Control}_{ij} + \delta_i + \theta_t + \varepsilon_{ij} \quad (2)

Our analysis is at patient level. As mentioned above, we define the situation that a medical service is overused when such intervention does not add any value on patient care. Thus, we need to jointly examine whether patients’ social media use led to significant changes in their quality of care and their spending on high-diagnostic tests.

For our dependent variables, we constructed our first dependent variable as High\_cost\_test\_ij which is measured as the total expenditure on high-cost tests which is prescribed by physician i during the care for patient j. In this study, we use patients’ spending in computerized tomography (CT) and magnetic resonance imaging (MRI) to calculate their spending on high-cost tests. CT and MRI are two typical high-cost diagnostic tests, which can be overused in many cases. For example, MRI tests and CT could be avoided by using simple X-ray for diagnosing diseases with good clinical certainty (Pompan 2011; Schwartz et al. 2008). We denote the second variable as Quality\_ij which is measured whether patient j recovers after the visit of physician i. The variable takes one if patient j recovers.

For the explanatory variable, we created a binary variable SocialMedia\_ij (SocialMedia\_ij = 1) to capture patient i has a social media account or not (SocialMedia\_ij = 0). For control variables, we first control differences from patient characteristics (i.e. gender, age). To account for the variation of outcomes due to the type of medical intervention, we create Surgery\_ij, a dummy variable which takes the value one for patient j of physician i needs a surgery, otherwise it takes zero; We notice the insurance type can affect physicians’ prescription behavior. We create a dummy variable Insurance\_ij, indicating that patient j of physician i has an insurance (Insurance\_ij = 1) or does not have an insurance (Insurance\_ij = 0); Finally, we account for systematic differences arising from unobserved differences by physicians, we include physician fixed effects denoted as \delta_i. Finally, we account for time effect by using time fixed effects denoted as \theta_t.

**Preliminary Result**

Table 2 shows our estimations from a series of alternative models. First, we find that parameter corresponding to the effect of social media use on the healthcare quality is consistently negative and significant across Model (1) to Model (2). These findings (Model 1 and Model 2) imply that physicians can be forced to reduce the use of high-cost tests, which supports H1. In addition, we find that parameter corresponding to the effect of social media on healthcare quality is positive across Model (3) to Model (4). However, the coefficient in Model (4) is not significant. Thus, these findings (Model 3 and Model 4) partially support H2, indicating patients can have better healthcare quality by using social media.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Cost Test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social media adoption</td>
<td>-1.229***</td>
<td>-1.057***</td>
<td>0.0141*</td>
<td>0.0145</td>
</tr>
<tr>
<td>(0.216)</td>
<td>(0.295)</td>
<td>(0.00759)</td>
<td>(0.00970)</td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.0148</td>
<td>-0.0157</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.623)</td>
<td>(0.0205)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.335*</td>
<td>0.00700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.180)</td>
<td>(0.00599)</td>
<td></td>
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<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0.0325***</td>
<td>-0.0000348</td>
<td></td>
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<td></td>
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<tr>
<td>(0.00714)</td>
<td>(0.000235)</td>
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<tr>
<td>Surgery</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>-0.394</td>
<td>-0.0849***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.520)</td>
<td>(0.0171)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.832***</td>
<td>-0.0294</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.0171)</td>
<td>(0.00107)</td>
<td></td>
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</tbody>
</table>
Conclusion and Future Research

This research examines the relationship between social media impact and medical resource overuse. We demonstrate that social media use can reduce expenditure on high-cost diagnostic tests without lowering quality of care. Thus, we can conclude that social media can reduce the problem of medical resource overuse. Nevertheless, our study has a few limitations for future study. First, we only examined one medical condition. In the future study, we would examine how impact of social media on care quality and expenditure of high-cost tests may vary across different medical conditions. Second, due to the potential endogenous concern for patients' social media adoption, we will utilize PSM and instrumental variables to eliminate this problem.

Acknowledgements

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