When a Doctor Knows, It Shows: An Empirical Analysis of Doctors' Responses in Q&A Forum of an Online Healthcare Portal -- Online Appendices

Online Appendix A: Baseline Econometric Specifications

We examine the change in each doctor's recommendations by patients after the introduction of the doctors' response feature in the following benchmark regression model:

$$reccos_{it} = c_i + \beta_0 + \beta_1 PostLaunch_t + \beta_2 Controls + \varepsilon_{it}, \quad \text{(A.1)}$$

where the dependent variable, $reccos_{it}$, is the number of patient recommendations for doctor *i* at time *t*, $PostLaunch_t$ is a dummy variable indicating whether the feature of doctors' responses is launched (1 indicates the post-launch period; 0 indicates the pre-launch period), c_i is the unobserved doctor fixed effect, and *Controls* include: (i) *city_serp*: city search result page ranking of a doctor, (ii) *max_city_serp*: maximum rank for that city at time *t* (essentially, it is the size of available doctors, which measures the intensity of competition), (iii) *fees*: fees in Indian Rupee (INR) of the doctor, (iv) *mbbs*: a binary variable indicating if a doctor is certified to practice in allopathic medicine, (v) *bds*: a binary variable indicating if a doctor is certified to practice dentistry, (vi) *bams*: a binary variable indicating if a doctor is certified to practice in Ayurveda (traditional Indian medicine), (vii) *bhms*: a binary variable indicating if a doctor is certified to practice in Homeopathic medicine, and (viii) *apptbook*: whether online appoint booking option is available (0: online appoint booking option is not available; 1: online appoint booking option is available). We also control for time dummies.

The fixed effects estimation results without controls are presented in columns 1 and 2 of Table A.1. We are interested in the coefficient of $PostLaunch_t$. In column 1 of Table A.1, we find that the coefficient of$PostLaunch_t$ is significantly positive: After the launch of the feature of doctors' responses, in general, the number of patient recommendations increases by 9.78. We find that the introduction of the doctors' response feature can significantly increase the number of recommendations by patients. In column 2, we

compute the robust statistics. We add control variables in columns 3 (ordinary *t* statistics) and 4 (robust *t* statistics). The results are similar.

Table A.1 The Impact of the Introduction of Response Feature on Recommendations by Patients

VARIABLES	(1) FE	(2) FE, Robust S.E.	(3) FE	(4) FE, Robust S.E.
PostLaunch	9.783***	9.783***	8.506***	8.506***
	[39.43]	[37.52]	[20.82]	[23.30]
city_serp			-0.000836***	-0.000836***
			[-3.424]	[-5.723]
max_city_serp			-0.00107***	-0.00107***
			[-10.91]	[-10.24]
fees			0.00370	0.00370
			[1.411]	[1.347]
mbbs			-4.783*	-4.783
			[-1.853]	[-1.099]
bds			8.351*	8.351*
			[1.681]	[1.878]
bams			-10.17	-10.17**
			[-0.860]	[-2.491]
bhms			-4.364	-4.364
			[-0.458]	[-0.744]
apptbook			1.596	1.596
			[1.460]	[1.461]
Time dummies	No	No	Yes	Yes
Constant	10.35***	10.35***	22.13***	22.13***
	[74.68]	[101.1]	[9.908]	[9.024]
Observations	170,379	170,379	131,201	131,201

t or robust t-statistics in brackets *** p<0.01, ** p<0.05, * p<0.1

Online Appendix B: Estimating Moderating Effects Using Matched Sample

The matching methods (PSM and LA-PSM) help us achieve a more balanced sample. In this online, we re-estimate the moderating effects using the new sample created by PSM and LA-PSM. The results are robust and are presented in Tables B.1 and B.2.

Table B.1 Impact of Doctors' Responses on Recommendations: Moderating Factors Based on PSM

VARIABLES	(1) FE, Moderating Factor: traditional	(2) FE, Moderating Factor: experience	(3) FE, Moderating Factor: qual	(4) FE, Moderating Factor: apptbook	(5) FE, Moderating Factor: fees
PostLaunch*yn_consult*moderating factor	-55.74***	2.937***	24.21***	58.66***	0.0412**
	[-9.874]	[3.852]	[5.228]	[9.348]	[2.451]
Observations	131,201	101,396	131,201	131,201	131,201

Robust t-statistics in brackets *** p<0.01, ** p<0.05, * p<0.1

Table B.2 Impact of Doctors' Responses on Recommendations: Moderating Factors Based on LA-PSM

VARIABLES	(1) FE, Moderating Factor: traditional	(2) FE, Moderating Factor: experience	(3) FE, Moderating Factor: qual	(4) FE, Moderating Factor: apptbook	(5) FE, Moderating Factor: fees
PostLaunch*yn_consult*moderating factor	-52.36***	2.726***	26.88***	54.37***	0.0385**
	[-7.469]	[3.541]	[6.372]	[7.687]	[2.236]
Observations	131,201	101,396	131,201	131,201	131,201

Robust t-statistics in brackets *** p<0.01, ** p<0.05, * p<0.1

Online Appendix C: Endogenous Control Variables

To address the concern of endogenous control variable, we compare the result from a model without the control variables with our results from Table 2. The results for comparison are presented in Table C.1. We find that after controlling for unobserved fixed effects, the results on the focal variables are very similar under controls vs. no controls. It suggests that endogenous controls might be less of a concern. In the literature, it is a common approach to explore the sensitivity of treatment effects to the inclusion of observed controls. If a coefficient on the focal variable is stable after inclusion of the observed controls, this is taken as a sign that omitted variable bias is limited (Chiappori et al. 2012).

It is worth noting that even if the control variables are endogenous (correlated with the error term), they may not affect the estimates of our focal variables. Stock (2010) point out that when there are endogenous control variables and a mild condition (conditional mean independence assumption) holds, the coefficients on the focal variables are still unbiased and consistent, but the coefficients on the endogenous control variables are not.

Table C.1 The Impact of Doctors' Responses on Recommendations by Patients: Control Variables vs. No Control Variables

VARIABLES	(1) FE, No Controls, Robust S.E.	(2) FE, Robust S.E.	(3) FE, No Controls, Robust S.E.	(4) FE, Robust S.E.
PostLaunch	7.104***	6.603***	8.318***	7.895***
	[34.24]	[17.61]	[37.34]	[20.78]
PostLaunch*yn_consult	59.86***	58.80***		
	[14.72]	[14.00]		
PostLaunch*consult			0.0797**	0.0761*
			[1.983]	[1.936]
city_serp		-0.000937***		-0.00109***
		[-6.130]		[-7.152]
max_city_serp		-0.00125***		-0.00128***
		[-10.56]		[-10.72]
fees		0.00209		0.00270
		[0.779]		[0.996]

mbbs		-5.496		-5.601
		[-1.255]		[-1.276]
bds		7.120		8.267*
		[1.567]		[1.859]
bams		-15.98***		-10.48**
		[-3.646]		[-2.561]
bhms		-6.131		-4.435
		[-1.217]		[-0.756]
apptbook		2.132*		1.612
		[1.950]		[1.482]
Time dummies	No	Yes	No	Yes
Constant	10.29***	48.79	10.35***	51.28
	[100.3]	[1.521]	[101.1]	[1.612]
Observations	131,201	131,201	131,201	131,201

t or robust t-statistics in brackets *** p<0.01, ** p<0.05, * p<0.1

Online Appendix D: Institutional Details on Indian Healthcare Market

Indian primary healthcare market has undergone paradigm shift in the past 20 years with pace of change accelerating in the last decade. First, since liberalization of Indian economy in early 1990s, all sectors have witnessed growing participation of private sector. There has been a steep upsurge in proportion of healthcare services being provided by large corporate hospitals, small and mid-size hospitals, private medical colleges, and individual clinical practices as against primary care services from predominantly government sector available till then. Second, the rising income of urban consumers has led to greater demand for better healthcare that government sector was slow to respond to. Urban primary healthcare thus has a higher level of supply of private healthcare. Mobile and internet penetration coupled with entrepreneurial startups have also changed the landscape of urban primary healthcare. Third, health insurance sector is not widely adopted in India, nor does it cover primary care. Most urban consumers make purchase decision of selecting a primary-care doctor by themselves and as an out-of-pocket expense.

In this backdrop, urban patients' unmet demand has led to emergence of primary care doctor search and appointment-booking portals. Consumers want quick search of large database of doctors, with demand for information of as many decision variables as possible.

The doctor search and appointment booking portal in our study (www.practo.com) has nearly 45 million doctor appointment bookings in 2016-17, the period of study. The portal has listing of nearly 200,000 doctors overall,[1] and has over 100,000 doctors listed from top 10 Indian metros alone. The number of bookings and doctors listed are (a) significant in number when compared to overall population of estimated 791,000 practicing doctors nationwide in India,[2] and (b) indicative of use of online portal for search, appointment booking, and engaging in other site activities by patients and doctors. From nearly no

[1] http://www.livemint.com/Companies/maqZQiBZ3tOpVsn8XkkuOO/Practo-buys-healthcare-analytics-firm-Enlightiks.html (last accessed: January 5, 2018).
[2] http://www.business-standard.com/article/current-affairs/in-india-1-doctor-serves-1-668-people-8-lakh-doctors-in-total-govt-117020300985_1.html (last accessed: January 5, 2018).

online search for doctors 6 years back, the shift in online search and appointment booking market is huge and of interest to research, industry, regulation, and society in general.

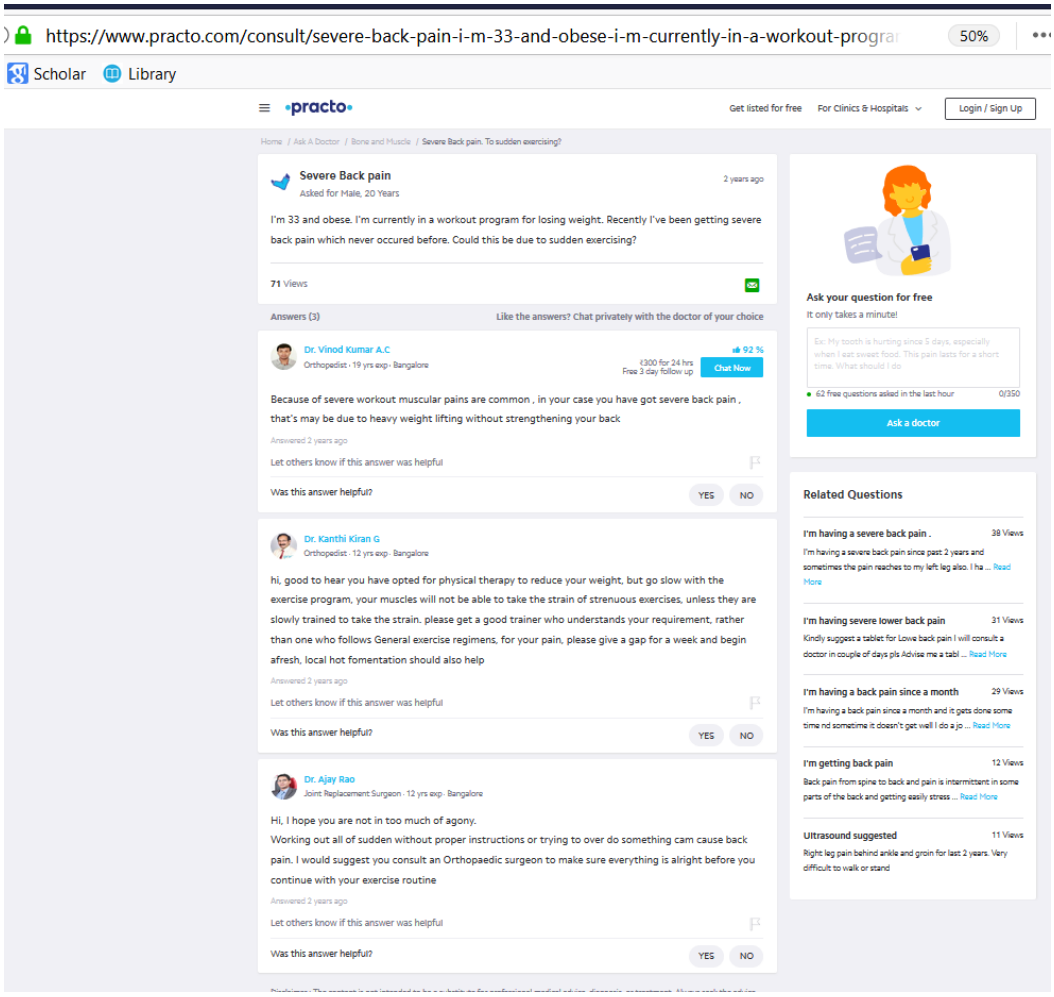


Figure D.1 Screenshot Showing Question with Answers by One or More Doctors on Q&A Forum

Questions posted on the common Q&A portal can be reached directly from the site homepage or from the doctor Q&A tab on doctor homepage. In the common repository of Q&A, users can post questions, or read existing questions and answers. All users see all answers in one place. At the same time, same answers, given by a particular doctor are all available on that doctor's homepage as well. One question can be answered by multiple doctors, and answers can be read by all users. An answer by a doctor gets "patient eyeballs" on both pages- (a) along-with other answers by other doctors to same question in search-result pages based on keyword/topic on the Q&A forum, and (b) on doctor homepage, along-with all other

answers to all questions answered by the same doctor. A doctor thus gets to showcase his expertise at question level on the Q&A forum. The screenshots in Figures D.1 and D.2 show: (i) questions with answers by one or more doctors on the Q&A forum (Figure D.1), and (ii) questions answered by a particular doctor in his/her homepage (Figure D.2). Information on Q&A forum and doctor homepage is conveniently hyperlinked to enable readers to gather information at either forums for full perspective. Patient being the decision-maker, has opportunity to process all such information, before selecting a doctor.

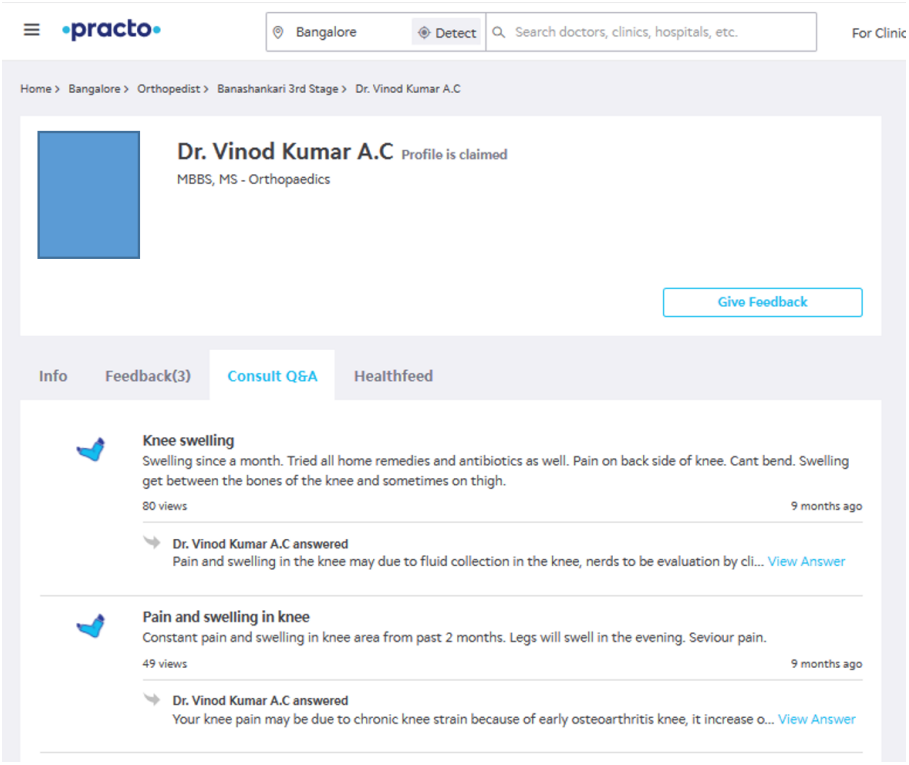
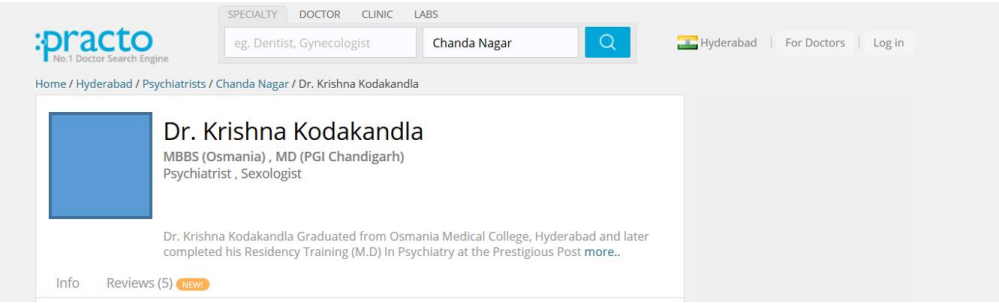


Figure D.2 Screenshot of Doctor Homepage Showing Questions Answered by a Particular Doctor

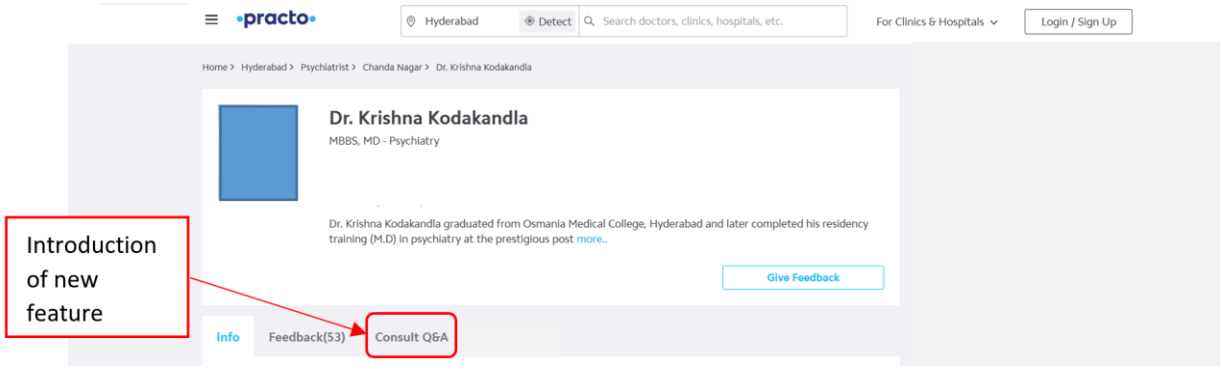
As for strategic marketing effort, the online healthcare portal has elaborate guidelines on patients posting feedback on doctors on the site and claims expert moderators and verification process to ensure that any fake/inflated/promotional feedback is rejected.[3] For example, the guidelines state that "please write only about your first-hand experiences with the facilities or services of an establishment. Avoid copying or quoting material from other sources such as other feedback responses, getting paid to write feedback or

[3] https://help.practo.com/practo-feedback/guidelines-for-patients/ (last accessed: January 6, 2018).

posting feedback from multiple accounts. We will pull down feedback written for healthcare professionals without a prior consultation with them. Practo works on trust." Also, the guidelines highlight conflict of interest and professional ethics: "If you own or work at a medical establishment, please don't review your own medical establishment or employer. Don't accept money, products, or services to write feedback for a healthcare professional or to write negative feedback about another healthcare professional. If you're a business owner, don't set up review stations or kiosks at your place of business to ask for feedback to be published on Practo. This includes doctor to doctor feedback (including that submitted by medical establishment staff & representatives). This also includes references about other healthcare professionals or their comments on medical judgements by another healthcare professional." The online health care portal also requires people who made recommendations to share their valid contact information: "We may need to get in touch with you regarding your feedback. Please provide your legitimate contact information. We do not share your details with anyone."



(a) Web Page Design Before the Introduction of Doctors' Online Responses



(b) Web Page Design After the Introduction of Doctors' Online Responses

Figure D.3 Web Page Design Before and After the Introduction of Doctors' Online Responses

As a summary, the site administration team makes a careful and critical examination of any feedback that may violate policy. Users' phone numbers are mandatorily required so that the administrator of the site can check for any queries/doubts and to instill caution. Beyond these, Doctor too can bring it up to their notice. After the verification effort of the online healthcare portal, strategic marketing effort should be less of a concern.

We also provide the design of the web page before and after the introduction of the Q&A feature in Figure D.3. The major change in web page design is the introduction of doctors' online responses.

Online Appendix E: Analysis Based on Longer Time Window

In this online appendix, we re-estimate regression equations (1) and (2) using a longer time window (March 2016 – September 2016). The results are robust and are presented in Table E.1.

Table E.1 The Impact of Doctors' Responses on Recommendations by Patients: Longer Time Window

VARIABLES	(1) FE, Robust S.E.	(2) FE, Robust S.E.
PostLaunch	6.854***	7.431***
	[19.36]	[18.46]
PostLaunch*yn_consult	61.27***	
	[15.29]	
PostLaunch*consult		0.0812**
		[2.25]
city_serp	-0.000834***	-0.00115***
	[-5.427]	[-7.325]
max_city_serp	-0.00146***	-0.00139***
	[-12.71]	[-12.54]
fees	0.00216	0.00253
	[0.731]	[0.938]
mbbs	-5.336	-5.518
	[-1.216]	[-1.237]
bds	7.139	8.472*
	[1.651]	[1.886]
bams	-16.42***	-11.33**
	[-3.853]	[-2.741]
bhms	-6.226	-4.487
	[-1.354]	[-0.852]
apptbook	2.142*	1.634
	[1.889]	[1.589]
Time dummies	Yes	Yes
Constant	47.35	53.42
	[1.433]	[1.745]

t or robust t-statistics in brackets *** p<0.01, ** p<0.05, * p<0.1

Online Appendix References

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