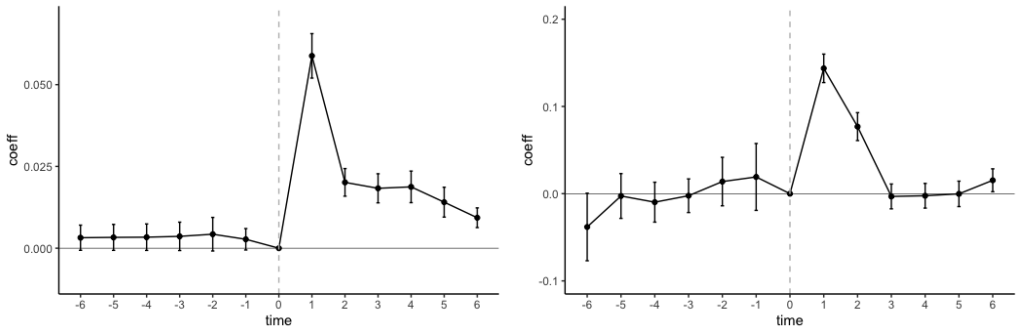
Supplementary Online Appendices

for

On-Demand Healthcare Platforms: Impact of Q&A Service on Online Consultations and Offline Appointments

A.1. Additional Figures and Tables



Notes: This plot includes the estimated coefficients and 95% confidence intervals from the dynamic DID model. Time is normalized relative to the adoption month. The regression includes individual fixed effects and time fixed effects. Standard errors are clustered at the individual level.

Figure A1 Event Study Plots

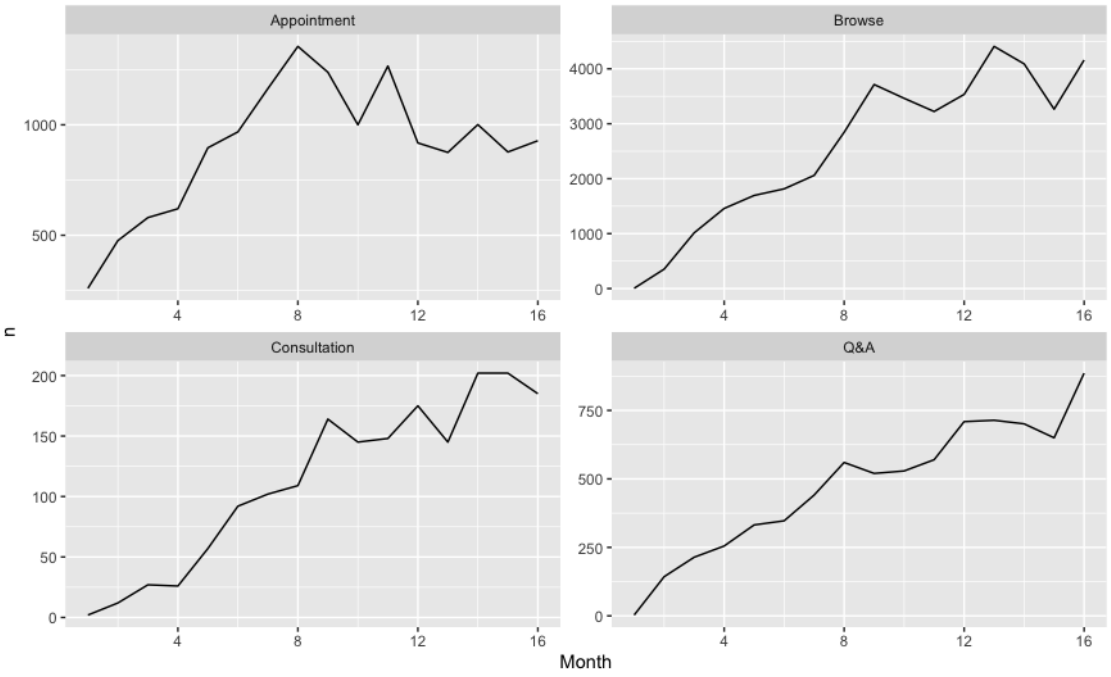
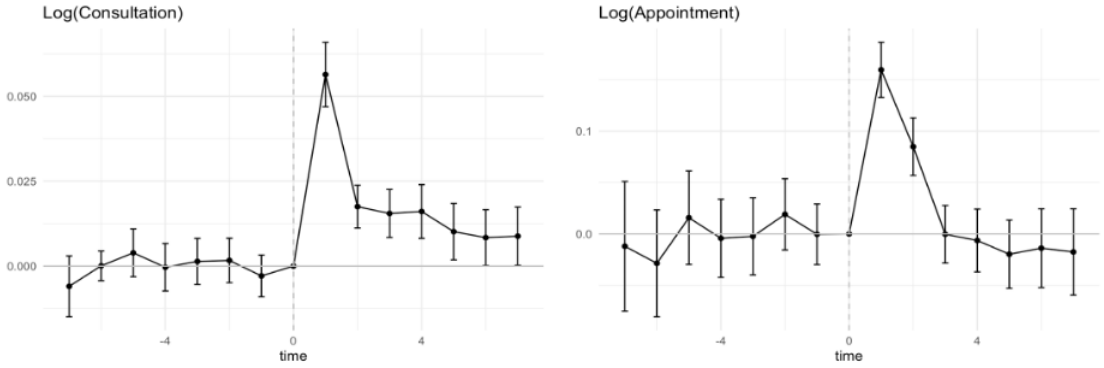
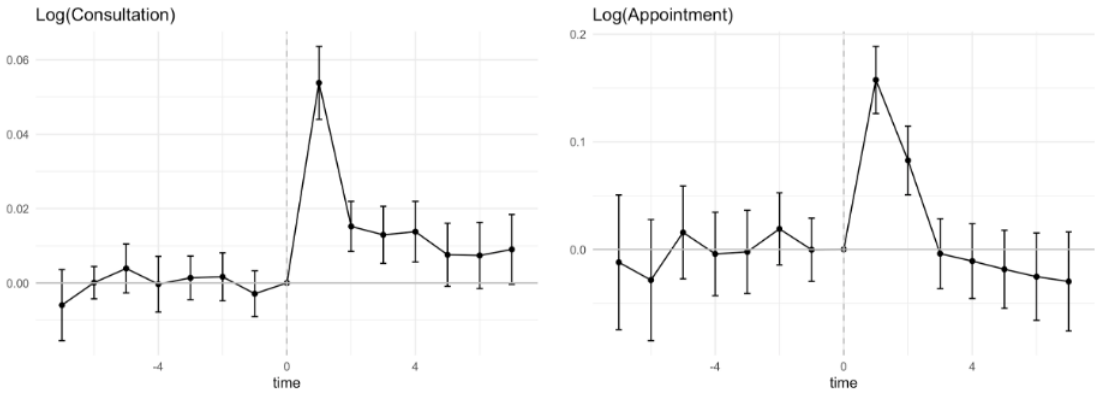


Figure A2 Trends in Platform Engagement Among Q&A Adopters

Panel A: No Anticipation



Panel B: One-Period Anticipation



Notes: This plot includes the estimated coefficients and 95% confidence intervals from the CS-DID model. Time is normalized relative to the adoption month. The regression includes individual fixed effects and time fixed effects. Standard errors are clustered at the individual level.

Figure A3 Event Study Plots Based on CS-DID Estimator

Table A1 Statistics of Consultation, Appointment, Q&A, and Browse in Each Medical Specialty.

Specialty	Consultation	Appointment	Q&A	Browse
Cardiology	540	35,540	52	2,521
Colorectal	407	7,390	109	6,724
Dermatology	4,345	68,858	615	45,594
ED	13	5,713	39	1,188
Endocrinology	1,115	21,286	41	1,930
Gastroenterology	1,661	42,288	100	9,706
General	51	2,287	191	13,952
Gynecology	14,660	293,513	3,721	212,483
Hematology	162	4,937	104	1,423
Hepatology	380	7,414	115	3,894
Infectious	97	9,658	35	767
Internal	275	12,086	1,030	49,317
Nephrology	372	7,846	144	4,830
Neurology	1,181	33,551	198	6,976
Oncology	223	5,364	12	202
Ophthalmology	571	29,242	87	3,822
Orthopedics	768	28,799	183	4,609
Otolaryngology	1,621	49,787	462	26,231
Pain	115	5,255	71	4,065
Pediatrics	10,220	185,228	2,729	83,627
Plastic	193	4,454	48	4,836
Rehabilitation	37	3,330	98	6,611
Respiratory	554	23,700	58	1,474
Rheumatology	129	3,455	3	96
Stomatology	422	22,259	130	4,014
Surgical	212	16,801	150	7,549
Traditional	405	5,304	185	16,931
ThyroidBreast	545	24,183	312	20,512
Urology	1,882	25,604	477	74,388
Others	793	14,168	224	14,553

Table A2 Summary Statistics for Consultation, Appointment, and Q&A with Top and Non-Top Doctors.

	Number		Average Fee (Yuan)	
	Top	NonTop	Top	NonTop
Doctors	3,206	1,208	–	–
Consultation	32,606	10,793	21.2	10.3
Appointment	971,523	76,452	13.9	6
Q&A	4,692	7,009	–	–
Average Length of Questions (word count)	67	67		
Average Length of Answers (word count)	111	127		

Table A3 Variables and Definitions.

Variable	Definition
$Gender_i$	The gender of user i
Age_i	The age of user i
$City_i$	The city of user i
Reg_i	The registration time of user i
$Consultation_{i,t}$	The number of premium consultations purchased by user i in month t
$Appointment_{i,t}$	The number of offline visit appointments made by user i in month t
$Browse_{i,t}$	The number of Q&A sessions browsed by user i in month t
$Spend_{i,t}$	The expenditure of user i on the consultation service in month t
$Consultation_{i,d,t}$, $Appointment_{i,d,t}$, $Browse_{i,d,t}$, $Spend_{i,d,t}$	The number of consultations purchased, appointments made, and Q&A sessions browsed, the expenditure on consultations, respectively, from doctors specialized in medical specialty d
$Consultation\_TopDoc_{i,t}$, $Appointment\_TopDoc_{i,t}$	The number of consultations purchased and appointments made by user i in month t with top-level doctors
$Consultation\_TopDoc_{i,d,t}$, $Appointment\_TopDoc_{i,d,t}$	The number of consultations purchased and appointments made by user i in month t with top-level doctors in medical specialty d
$Consultation\_SameDoc_{i,t}$, $Appointment\_SameDoc_{i,t}$	The number of consultations purchased and appointments made with the same doctor who provided the Q&A service*
$Con\_SameDepNonTopDoc_{i,t}$, $App\_SameDepNonTopDoc_{i,t}$	The number of consultations and appointments with non-top non-focal doctors within the same medical department as the Q&A service*
$Con\_SameDepTopDoc_{i,t}$, $App\_SameDepTopDoc_{i,t}$	The number of consultations and appointments with top non-focal doctors within the same medical department as the Q&A service*
$Consultation\_SameSpecialty_{i,t}$, $Appointment\_SameSpecialty_{i,t}$	The number of consultations and appointments within the same specialty as the Q&A service*
$Consultation\_DiffSpecialty_{i,t}$, $Appointment\_DiffSpecialty_{i,t}$	The number of consultations and appointments within the same specialty as the Q&A service*
$Consultation\_Complex_{i,t}$, $Appointment\_Complex_{i,t}$	The number of consultations and appointments with doctors from complex specialties
$Consultation\_General_{i,t}$, $Appointment\_General_{i,t}$	The number of consultations and appointments with doctors from general specialties
$Consultation\_Simple_{i,t}$, $Appointment\_Simple_{i,t}$	The number of consultations and appointments with doctors from simple specialties

Note: * Regarding defining same department (or doctor) visits for the control group, since we have matched adopters and non-adopters in almost all observable factors so that adopters purchasing the Q&A is close to a random selection, we assume that if the the control group users were to adopt the Q&A, they will visit the same department (or doctor) as the matched treated users.

Table A4 Balance Check for the Full and the Matched Samples.

FULL SAMPLE

	Adopters			Non-Adopters			
Variable	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**Test**
# of Appointments	9165	3.6	6.6	915554	1.1	2.8	t=36.397***
# of Consultations	9165	0.81	4.8	915554	0.04	0.35	t=15.451***
# of Q&A Browsed	9165	13	30	915554	0.57	6	t=39.21***
# of Q&A Purchased	9165	1.3	1.1	915554	0	0	t=113.54***
# of Appointments (1 month prior)	9165	0.6	1.1				
# of Consultations (1 month prior)	9165	0.14	0.51				
# of Q&A Browsed (1 month prior)	9165	3	9.5				
Age	8307	34	11	795665	39	13	t=-38.571**
Gender	9165			915554			χ^2=750.83***
... Female	6400	70%		508730	56%		
... Male	2452	27%		355944	39%		
... Unknown	313	3%		50880	6%		
City	9165			915554			χ^2=186.806***
... XY	7	0%		2812	0%		
... YC	36	0%		4251	0%		
... ZJ	12	0%		4688	1%		
... YZ	2362	26%		236386	26%		
... XY	4360	48%		383131	42%		
... HS	2388	26%		284286	31%		

MATCHED SAMPLE

	Adopters			Non-Adopters			
Variable	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**Test**
# of Appointments (1 month prior)	5442	0.11	0.45	5442	0.11	0.45	t=0
# of Consultations (1 month prior)	5442	0	0	5442	0	0	t=0
# of Q&A Browsed (1 month prior)	5442	1.3	3.3	5442	1.3	3.3	t=0
Age	5442	35	11	5442	35	11	t=-0.98
Gender	5442			5442			χ^2=0
... Female	3755	69%		3755	69%		
... Male	1469	27%		1469	27%		
... Unknown	218	4%		218	4%		
City	5442			5442			χ^2=0
... XY	3	0%		3	0%		
... YC	14	0%		14	0%		
... ZJ	6	0%		6	0%		
... YZ	1420	26%		1420	26%		
... XY	2602	48%		2602	48%		
... HS	1396	26%		1396	26%		

Note: For the full sample, the numbers of appointments, consultations and Q&A browsed or purchased are the numbers of such activities in the whole observation period. For the full sample, we also measure adopters' number of appointments, consultations and Q&A browsed 1 month before their first-time Q&A adoption (# of Appointments/Consultations/Q&A Browsed (1 month prior)). For the matched sample, the numbers of appointments, consultations and Q&A browsed or purchased are the numbers of such activities 1 month before the adoption month. The tenure of a user is measured in days since the users joined the platform and until the last day of the observation period. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5 Estimates of Effects on the Raw Measures for Consultations, Appointments and Expenditures.

	Consultation	*Appointment*	*Spend*
$Adopt \times Post$	0.033***	0.067***	0.57***
	(0.0028)	(0.012)	(0.10)
$Post$	0.017***	0.20***	0.26***
	(0.0016)	(0.0096)	(0.033)
N	101704	101704	101704
adj. R^2	0.116	0.155	0.101

Note: Standard errors in parentheses are clustered at the user level. All regressions contain individual and time fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6 Estimates on Effects in Post 1-3 Periods and Thereafter.

	Log*Consultation*	Log*Appointment*	*Spend*	Log*Spend*
$Adopt \times Post_1$	0.054***	0.14***	1.49***	0.18***
	(0.0034)	(0.0081)	(0.22)	(0.012)
$Adopt \times Post_2$	0.016***	0.077***	0.41***	0.053***
	(0.0023)	(0.0080)	(0.12)	(0.0079)
$Adopt \times Post_3$	0.014***	-0.0048	0.32***	0.043***
	(0.0023)	(0.0071)	(0.081)	(0.0076)
$Adopt \times Post_{4f}$	0.0093***	0.0014	0.33***	0.031***
	(0.0015)	(0.0061)	(0.080)	(0.0054)
$Post$	0.0040***	0.080***	0.12***	0.013***
	(0.00084)	(0.0047)	(0.030)	(0.0029)
N	101704	101704	101704	101704
adj. R^2	0.122	0.182	0.104	0.112

Note: Standard errors in parentheses are clustered at the user level. All regressions contain individual and time fixed effects. For $k = 1, 2, 3$, $Post_k$ is coded as 1 for the k_{th} week after the Q&A; $Post_{4f}$ is coded as 1 for the fourth week and beyond after the Q&A service.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7 The Effect for the Same Doctor Controlling for Browsing.

	Log*Con_SameDoc*	Log*App_SameDoc*
$Adopt \times Post$	0.0012***	0.00035
	(0.00029)	(0.00026)
$Post$	0.00076***	-0.00012
	(0.00017)	(0.00016)
Log$Browse$	0.0016***	-0.000027
	(0.00039)	(0.000053)
N	101704	101704
adj. R^2	0.060	0.074

Note: Standard errors in parentheses are clustered at the user level. All regressions contain individual and time fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A8 The Results of Users Coming Back to Platform for Service after Six Months.

	Log*Consultation*	Log*Appointment*
Adopt × *Post*	0.010***	0.026
	(0.0037)	(0.028)
Post	0.0064	0.040
	(0.0051)	(0.045)
N	8383	8383
adj. R^2	0.023	0.153

Note: Standard errors in parentheses are clustered at the user level. All regressions contain individual and time fixed effects. In this analysis, we consider a subsample of users who have made an consultation/appointment within six months after the Q&A service, and estimate the impact on the number of consultations and appointments before Q&A vs. post six months after Q&A.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A9 The Effect on Revisits for Old Users.

	$\kappa = 1$: one month after Q&A		$\kappa = 2$: two months after Q&A		$\kappa = 3$: three months after Q&A	
	Log*Con*	Log*App*	Log*Con*	Log*App*	Log*Con*	Log*App*
Adopt × $Post_{\kappa-}$	-0.032	0.057	-0.026***	-0.011	-0.011*	-0.047*
	(0.022)	(0.070)	(0.007)	(0.036)	(0.007)	(0.027)
$Post_{\kappa-}$	-0.11	-0.32	0.018*	0.014	0.016**	0.10***
	(0.18)	(0.43)	(0.010)	(0.033)	(0.0068)	(0.023)
N	796	796	1899	1899	3121	3121
adj. R^2	0.018	0.477	0.143	0.4	0.201	0.365

Note: Standard errors in parentheses are clustered at the user level. All regressions contain individual and time fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A10 Balance Check for the Field Experiment.

Week 1	**A**		**B**		**C**		
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Test**
Age	36	17	36	16	36	16	t=0.39
Gender							χ^2=2.056
... Female	57%		57%		57%		
... Male	41%		41%		41%		
... Unknown	2%		2%		2%		
Tenure	323	249	324	249	323	248	t=0.91
# of Q&A (1 month prior)	0.001	0.035	0.0011	0.035	0.001	0.035	t=0.66
# of Consultations (1 month prior)	0.0062	0.11	0.0069	0.11	0.0063		t=1.68*
# of Appointments (1 month prior)	0.14	0.56	0.14	0.57	0.14	0.56	t=1.62*
Week 2	**A**		**B**		**C**		
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Test**
Age	36	16	36	16	36	17	t=0.97
Gender							χ^2=1.626
... Female	57%		57%		57%		
... Male	41%		41%		41%		
... Unknown	2%		2%		2%		
Tenure	323	248	323	248	324	249	t=1.11
# of Q&A (1 month prior)	0.00096	0.034	0.0011	0.036	0.001	0.035	t=1.44
# of Consultations (1 month prior)	0.0063	0.11	0.0065	0.11	0.0066	0.12	t=0.84
# of Appointments (1 month prior)	0.14	0.56	0.14	0.56	0.14	0.56	t=0.94
Week 3	**A**		**B**		**C**		
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Test**
Age	36	16	36	16	36	17	t=0.66
Gender							χ^2=7.981*
... Female	57%		57%		57%		
... Male	41%		41%		41%		
... Unknown	2%		2%		2%		
Tenure	323	248	324	249	324	249	t=1.19
# of Q&A (1 month prior)	0.00099	0.033	0.0011	0.037	0.001	0.034	t=1.16
# of Consultations (1 month prior)	0.0065	0.11	0.0065	0.11	0.0064	0.11	t=0.26
# of Appointments (1 month prior)	0.14	0.56	0.14	0.55	0.14	0.57	t=0.40
Week 4	**A**		**B**		**C**		
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Test**
Age	36	17	36	16	36	16	t=1.13
Gender							χ^2=1.741
... Female	57%		57%		57%		
... Male	41%		41%		41%		
... Unknown	2%		2%		2%		
Tenure	323	249	324	249	324	248	t=0.56
# of Q&A (1 month prior)	0.001	0.034	0.0011	0.035	0.001	0.036	t=0.71
# of Consultations (1 month prior)	0.0064	0.11	0.0065	0.11	0.0065	0.11	t=0.35
# of Appointments (1 month prior)	0.14	0.56	0.14	0.56	0.14	0.56	t=0.25

Note: The numbers of appointments, consultations and Q&As are the numbers of such activities in 1 month before the experiment. The tenure of a user is measured in days since the users joined the platform and until the starting date of the experiment. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.2. Matching Strategy

To put it more concretely, for each adopter, we find a non-adopter following the criteria summarized in Table A11.

Table A11 Matching on Propensity Score and Covariates.

Variables	Matching Criteria
$PropensityScore_{i,t}$	Within range of 0.001
$Gender_i$	Exact match
$City_i$	Exact match
Age_i	Within range of 5
$Appointment_{i,d,t-1\&-2}$	Exact match
$Appointment\_Top_{i,d,t-1}$	Exact match
$CumulativeAppointment_{i,d,t-1}$	Within range of 1
$Browse_{i,d,t-1}$	Exact match
$Browse_{i,d,t-2}$	Within range of 1
$\|t-t'\|$	Within range of 6

Besides the conditions listed above, we also use topic distribution of Q&A browsed by adopters and non-adopters for matching. In what follows, we describe these matching process for the topics.

Firstly, we combine dialogues of consultations and Q&A browsed for each medical specialty and conduct LDA for texts of each specialty separately. Analysis using LDA to identify pairs of items with similar text characteristics has been applied by IS researchers (e.g. Lee et al. (2020)). The best number of topics is selected based on Cao et al. (2009) and Deveaud et al. (2014). Here, each specialty may end up with different number of topics. Then, for each adopter who has browsed an existing Q&A before purchasing his/her own, we identify non-adopters who also have browsed Q&As within the same specialty and with similar distribution over topics as matching candidates. Regarding similarity, we set calipers on the largest difference in the probabilities over topics. The comparison of topic distributions between adopters and their matched non-adopters are is shown in Figure A4.

A.3. Additional Analysis the for the Experiment

To provide additional support for the effects we have discovered and examine robustness of our findings from the experiment, we conduct several supplemental analyses based on the experiment data. We first repeat the two-stage estimation on the full sample of the data. Also, the direct impact of coupons on online and offline visits is estimated. Lastly, we provide additional statistics for supporting the implementation of the matched sample for the analysis.

Table A12 presents the two-stage IV estimation for the full sample. Assigning users to Group A, which received a deeper discount, provides a marginally higher incentive for purchasing the Q&A service. However, when applying the Stock and Yogo test (Stock and Yogo 2005), the first-stage estimation fails to reject the null hypothesis that the instruments are weak. A plausible reason is that only users with medical conditions are likely to adopt the Q&A service and hence assignment of coupons cannot explain adoption. We also estimate the direct impact of coupons on users acquiring consultation and appointment services for both full and matched samples. Table A13 suggests that coupons only have a marginally significant effect for online consultations and

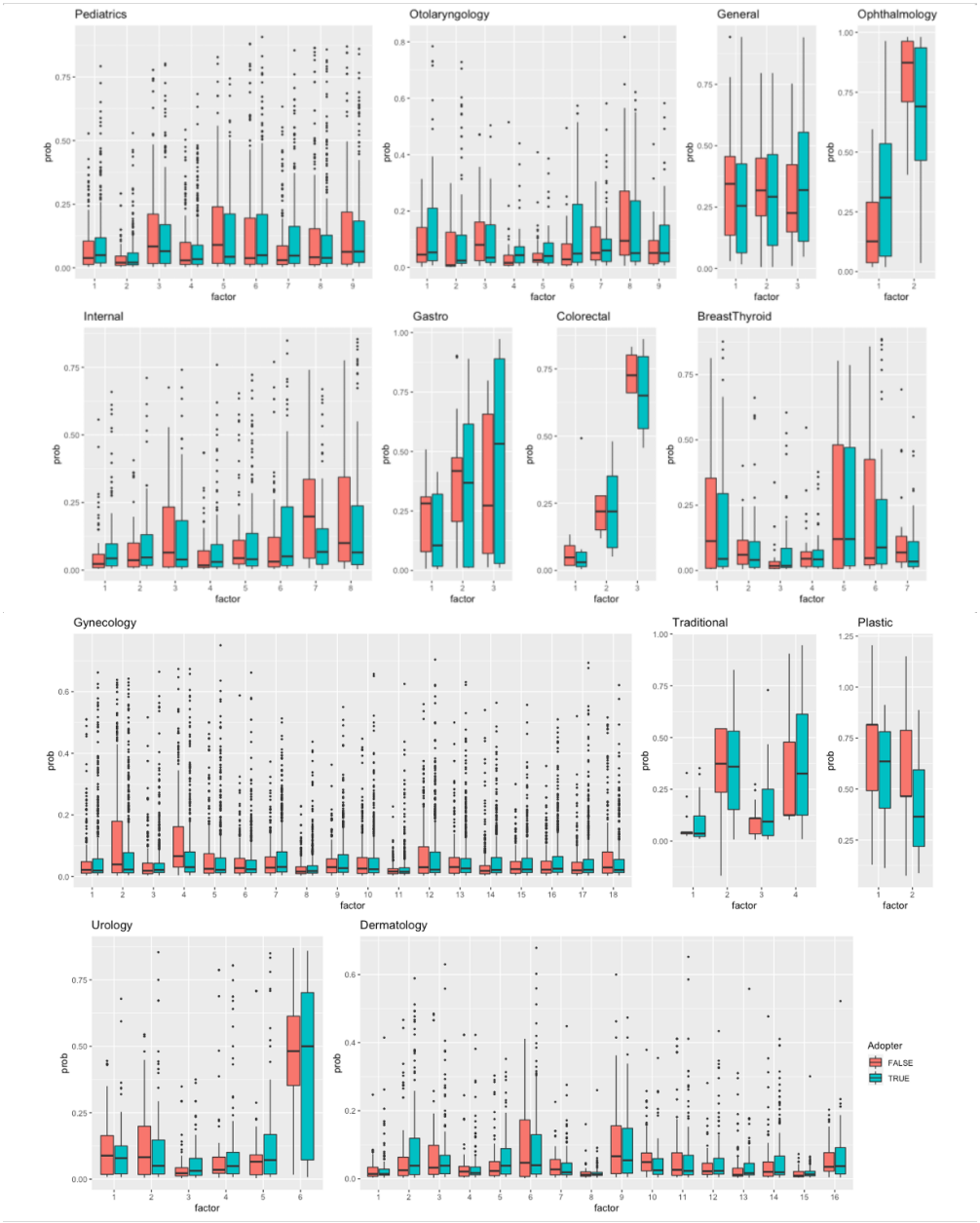


Figure A4 Comparison between Adopters and Matching Candidates of Non-Adopters for Topic Distributions for Each Medical Specialty.

appointments for the matched sample. This underscores the importance of Q&A in influencing the online and offline visits. The direct effect of coupons is even weaker for the full sample. Coupons have no effect on online consultations and a marginally positive effect on online consultations.

Although our sample is balanced across different coupon treatments, there are systematic differences between Q&A adopters and non-adopters in the full sample, as shown in Table A14(a). These differences disappear when we use a matched sample (Table A14(b)). The observed differences can be attributed to unobserved variations in health conditions. Typically, users with immediate health

Table A12 The Results of the Experiment – Full Sample.

	First Stage	**Second Stage**	
	Q&A	*Consultation*	*Appointment*
GroupA	0.000099*		
	(0.000065)		
GroupB	0.000049		
	(0.000043)		
Q&A		0.50	0.64**
		(0.43)	(0.28)
N	3567924	3567924	3567924
adj. R^2	0.043	0.0090	0.0022

Note: Standard errors in parentheses are clustered at the user level. All regressions contain individual and time fixed effects.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table A13 The Direct Impact of Coupons on Consultations and Appointments during the Experiment.

	Matched Sample		Full Sample	
	Consultation	*Appointment*	*Consultation*	*Appointment*
GroupA	0.025772*	0.052686*	0.000054	0.00063*
	(0.014)	(0.026)	(0.000049)	(0.00032)
GroupB	0.025611*	0.048477*	0.000047	0.00025
	(0.014)	(0.026)	(0.000049)	(0.00028)
N	2832	2832	3567924	3567924
adj. R^2	0.140	0.056	0.544	0.237

Note: Standard errors in parentheses are clustered at the user level. All regressions contain individual and time fixed effects.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

needs are more likely to adopt the Q&A service. Even when coupons are randomly allocated, those with urgent health requirements are more inclined to use them. As a result, users who claim coupons are typically those with immediate medical needs, while those who do not claim the coupons are likely to have no immediate health concerns. In contrast, the group of users without coupons would include both those with and without immediate medical needs due to randomization.

Regarding the differences in effect sizes between the main analysis (Table 3) and the experimental results (Table 25), these differences are likely driven by variations in sample sizes and the popularity of different services over time. Our main analysis covers the entire panel period from March 2016 to April 2019, whereas our experimental sample is from September 2019. To address this concern, we estimated the impact of Q&A on consultations and appointments for a subsample of matched users during the experiment period who did not claim the coupons (Table A15). The estimated effect of Q&A on online consultations and appointments for this subsample is of the same order of magnitude as observed in the experimental results (Table 25).

Table A14 Balance Check for the Full and the Matched Samples during the Experiment.

	(a) Full Sample					(b) Matched Sample				
	Non-Adopter		Adopter			Non-Adopter		Adopter		
Variable	**Mean**	**SD**	**Mean**	**SD**	**Test**	**Mean**	**SD**	**Mean**	**SD**	**Test**
Age	36	17	32	13	t=6.08***	34	15	34	13	t=0.15
Gender					χ^2=37.48***					χ^2=1.534
... Female	57%		70%			72%		74%		
... Male	41%		29%			27%		25%		
... Unknown	2%		1%			0%		1%		
Tenure	324	249	280	243	t=4.03***	254	225	271	233	t=1.15
Q&A (1 month prior)	0.00099	0.034	0.093	0.36	t=60.77***	0.033	0.24	0.055	0.27	t=1.34
Consultation (1 month prior)	0.0064	0.11	0.17	0.73	t=34.48***	0.094	0.61	0.14	0.71	t=1.12
Appointment (1 month prior)	0.14	0.56	0.76	1.5	t=25.49***	0.63	1.5	0.61	1.4	t=0.25

Note: The numbers of Q&As, consultations and appointments are the numbers of such activities in 1 month before the experiment. The tenure of a user is measured in days since the users joined the platform and until the starting date of the experiment.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table A15 The Impact of Q&A on Consultations and Appointments for Unclaimed Matched Users in the Experiment.

	Consultation	*Appointment*
Q&A	0.18***	0.23***
	(0.017)	(0.031)
N	2392	2392
adj. R^2	0.26	0.29

Note: Standard errors in parentheses are clustered at the user level. All regressions contain individual and time fixed effects.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$