Healthcare at the Crossroads: Impacts of Online Health Community on Offline Healthcare Quality and Equity

Online Appendices

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Appendix A. Screenshot of the Online Healthcare Community (OHC)

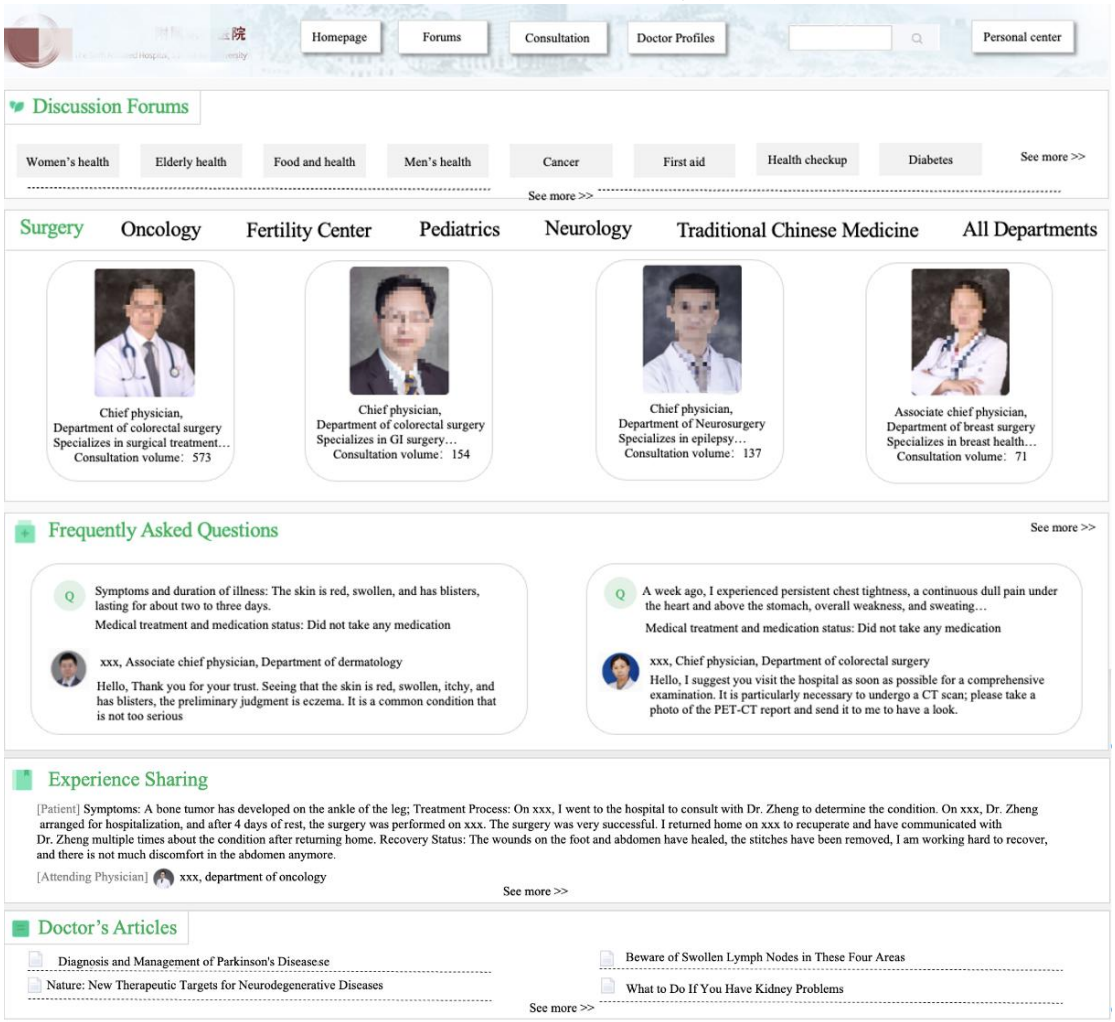


Figure A1. The homepage of the OHC (Translated from Chinese Version)

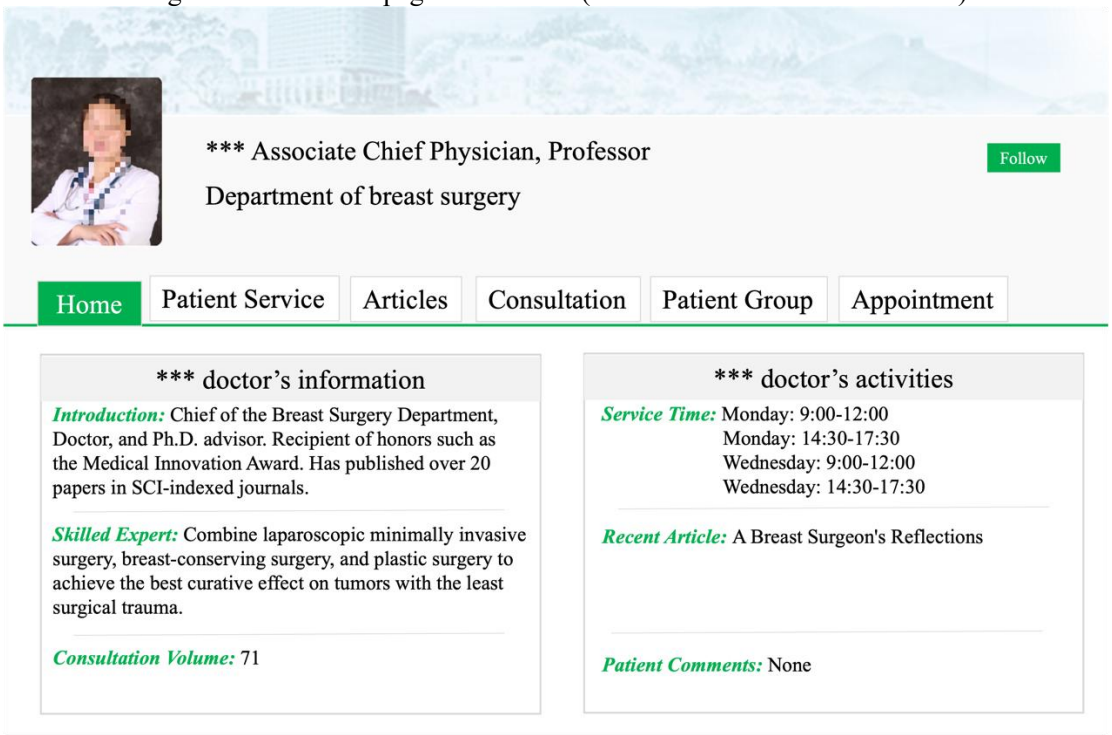


Figure A2. A doctor's personal webpage on the OHC (Translated from Chinese Version)

Appendix B. Physician Collaboration Network

Uddin et al. (2013) assumed that collaborations among physicians emerge when they visit common hospitalized patients. It is a standard professional practice around the world that, when physicians visit patients, they give advice or suggestions based on the patients' health conditions and previous medication history deposited in the patient logbook. All previous advice or suggestions by any physician to a patient have been taken into consideration during subsequent visits by other physicians to the same patient. This culture of practice in healthcare organizations or hospitals enables the mapping and modeling of physician collaboration networks (PCNs).

Uddin et al. (2013) then proposed an approach to map the collaboration network among physicians from patients' visit patterns. We adopt the method proposed by Uddin et al. (2013) to construct our PCNs. Figure B1 illustrates an example of such a PCN construction. In a hospital (e.g., H1), patient Pa1 is visited by physicians Ph1, Ph2, and Ph4, and patient Pa2 is visited by physicians Ph2, Ph3, and Ph4. Additionally, physicians Ph3 and Ph4 visit patient Pa3. This is depicted in the patient-physician network shown in Figure B1(a). The corresponding PCN for this patient-physician network is demonstrated in Figure B1(b). Figure B2 shows the PCN in our study.

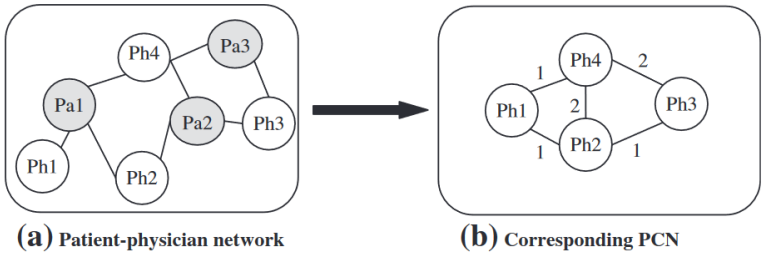


Figure B1. Conceptualization of the collaboration network among physicians (a) Patient-physician network, and (b) Corresponding PCN (Pa stands for patient, and Ph stands for physician.)

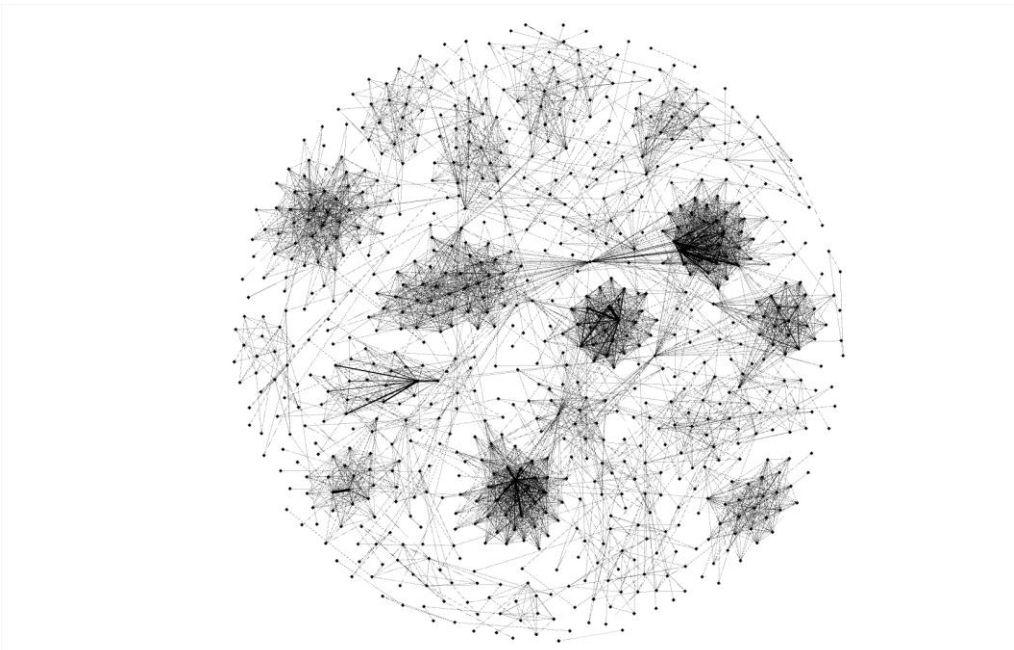


Figure B2. The PCN in our research

Appendix C. Propensity Score Matching

Table C1. Variable definition for PSM

Variable	Description of Variable	Descriptive Stat.
Work experience	Number of years physicians have worked	11.082 (10.059)
Average workload	The average number of distant patients under the direct care of a physician simultaneously during a time period	3.758 (2.358)
Weekend schedule	The number of days that a physician worked at weekend to his/her total number of working days during a time period	0.171 (0.155)
Patient mortality	The number of patients who under the direct care of a physician and died to his/her total number of patients during a time period	0.027 (0.119)
Patient severity	The average severity of patients that under the direct care of a physician during a time period	0.802 (0.259)
Patient loyalty	The average number of times of a physician has cared for his/her patients	3.597 (2.522)
Physician age	Physician age	38.747 (7.767)
Physician gender	Binary indictor of whether physicians are female	Female (50.28%), Male (49.72%)
Physician title	Physician professional level (1: instructor (19.73%), 2: assistant (30.33%), associate (23.86%), prof (26.80%))	
Physician education	Physician's education (1: bachelor (27.51%), 2: master (62.22%), 3: PhD (10.37%))	
Department	The departments that physicians work	Not report

Notes: The hospital has 35 inpatient departments, and we generated department code vectors for physicians by considering the working departments.

Table C2. Results of estimated logit models

	Dynamic matching		Look-ahead matching	
	Parameter	Std. error	Parameter	Std. error
Work experience	-0.132	0.085	-0.153*	0.087
Average workload	-0.105**	0.042	-0.121***	0.046
Weekend schedule	1.488**	0.687	1.096*	0.568
Patient mortality	0.884	2.541	-0.655	1.078
Patient severity	1.112**	0.587	1.803*	0.965
Patient loyalty	1.648***	0.671	1.305**	0.534
Physician age	0.279**	0.105	0.211**	0.106
Physician gender	0.572	0.377	0.304	0.401
Physician title				
Asst Prof	1.274*	0.708	2.399**	1.194
Assoc Prof	2.596***	0.809	2.821**	1.213
Prof	4.013***	0.962	3.609***	1.326
Physician education				
Master	-0.136	0.377	-0.072	0.384
Doctoral	0.457*	0.254	0.345	0.263
Department dummies	Yes		Yes	
Constant	-1.064***	0.391	-1.243**	0.493
Pseudo-R^2	0.492		0.395	

Notes: The results of the first logistic regression used for dynamic matching and look-ahead matching are presented. * p<0.1, ** p<0.05, *** p<0.01.

Table C3. Covariate comparison before and after matching

Panel A: Dynamic matching							
	Treatment group	Control group					
	Mean	Mean	Mean diff.	*t* stat.	Mean	Mean diff.	*t* stat.
Work experience	16.113	8.589	7.524	17.74***	17.117	-1.004	-0.85
Average workload	3.321	4.001	-0.680	-3.01***	3.416	-0.095	-0.36
Weekend schedule	0.168	0.178	0.011	-1.65*	0.170	-0.002	-0.29

Patient mortality	0.016	0.048	-0.032	-2.78***	0.012	0.004	0.33
Patient severity	0.866	0.783	0.183	3.66***	0.893	-0.027	-1.07
Patient loyalty	1.618	1.506	0.112	3.34***	1.582	0.036	0.63
Physician age	45.62	35.16	10.46	18.04***	47.33	-1.71	-1.66
Physician gender	0.625	0.401	0.224	4.74***	0.552	0.073	1.35
Physician title							
Asst Prof	0.092	0.420	-0.328	-7.81***	0.104	-0.012	-0.37
Assoc Prof	0.301	0.245	0.056	1.28	0.294	0.007	0.12
Prof	0.588	0.485	0.103	3.51***	0.532	0.056	1.01
Physician education							
Master	0.380	0.751	-0.371	-8.46***	0.453	-0.073	-1.35
Doctoral	0.165	0.067	0.098	3.37***	0.184	-0.019	-0.44
Department	Not report	Not report		Sig.	Not report		Ins.
Panel B: Look-ahead matching							
Work experience	19.104	11.632	7.472	6.81***	19.637	-0.533	-0.37
Average workload	3.186	3.889	-0.703	-2.45**	3.461	-0.275	-0.50
Weekend schedule	0.169	0.175	-0.006	-0.90	0.152	0.017	0.55
Patient mortality	0.032	0.045	-0.013	-2.87***	0.025	0.007	0.52
Patient severity	2.001	1.815	0.186	2.93***	1.998	0.003	0.74
Patient loyalty	1.622	1.515	0.107	3.08***	1.597	0.025	0.71
Physician age	44.259	37.639	6.620	7.35***	44.579	-0.320	-0.34
Physician gender	0.629	0.447	0.182	3.01***	0.651	-0.022	-0.25
Physician title							
Asst Prof	0.148	0.340	-0.192	-3.44***	0.159	0.011	0.15
Assoc Prof	0.272	0.263	0.009	0.15	0.316	0.043	0.56
Prof	0.567	0.166	0.401	8.29***	0.663	-0.066	-0.72
Physician education							
Master	0.432	0.662	-0.230	-3.95***	0.415	0.017	0.18
Doctoral	0.160	0.089	0.071	1.93*	0.144	0.016	0.27
Department	Not report	Not report		Sig.	Not report		Ins.

Notes: * p<0.1, ** p<0.05, *** p<0.01; To ensure that the matched sample achieved balance on the department variable, we examined the cross-sectional variation of department codes between the treatment and control groups. To this end, we employed Hotelling's T^2 tests to assess potential differences among department code vectors (Redinger 2011). Hotelling's T^2 tests have been widely adopted to evaluate the potential differences between two vectors (e.g., Colin et al. 2015). The results of the Hotelling's T^2 tests (1.17, p=0.453>0.1 in dynamic matching; 1.24, p=0.368>0.1 in look-head matching) indicate that the differences in department codes between the treatment and control groups are statistically insignificant under various matching approaches.

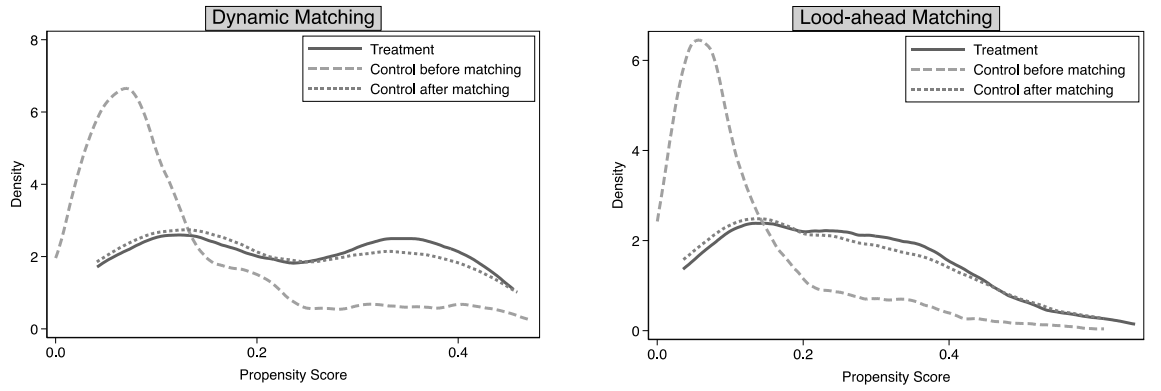


Figure C1. Distribution of propensity scores for treatment groups and control groups

Appendix D. Full Results of the Effect of OHC Participation on Offline Care Quality

Table D1. Full results of the effect of physicians' OHC participation on offline patient mortality

	Non-participating patients			Participating patients		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
OHC participation	-0.0316	-0.0358	-0.0234	-0.0654***	-0.0488**	-0.0397**
	(0.0246)	(0.0267)	(0.0326)	(0.0195)	(0.0239)	(0.0223)
Physician workload	0.0455**	0.0441*	0.0388*	0.0103***	0.0161***	0.0145***
	(0.0186)	(0.0245	(0.0204)	(0.0017)	(0.0032)	(0.0027)
Length of stay	-0.0401***	-0.0221	-0.0038	-0.0757***	-0.0674*	-0.0150***
	(0.0132)	(0.0174)	(0.0562)	(0.0133)	(0.0375)	(0.0033)
Hospital visit	0.0805***	0.0559**	0.0741***	0.0601***	0.0891***	0.0484***
	(0.0188)	(0.0263)	(0.0253)	(0.0058)	(0.0128)	(0.0108)
Surgery	-0.1536***	-0.0463*	-0.0565	-0.0809***	-0.1017***	0.0266
	(0.0241)	(0.0272)	(0.0387)	(0.0092)	(0.0247)	(0.0181)
Transfer	0.1156***	0.0856**	0.1178**	0.0977***	0.1093***	0.0818***
	(0.0179)	(0.0415)	(0.0508)	(0.0102)	(0.0294)	(0.0263)
Moderate severity	-0.5218***	-0.7025***	-0.9516***	-0.3635***	-0.6309***	-0.5703***
	(0.1036)	(0.1226)	(0.1274)	(0.0493)	(0.0687)	(0.0545)
Weekend	0.0425***	0.0789**	0.0674*	0.0904***	0.0798***	0.0893***
	(0.0167)	(0.0362)	(0.0406)	(0.0078)	(0.0215)	(0.0155)
Work experience	-0.0445	-0.0124	-0.0151	-0.0109***	0.0263	-0.0158***
	(0.0479)	(0.0093)	(0.0169)	(0.0036)	(0.0694)	(0.0047)
Patient age	0.0342***	0.0602***	0.0751***	0.0413***	0.0572***	0.0457***
	(0.0055)	(0.0133)	(0.0182)	(0.0026)	(0.0075)	(0.0063)
Patient gender	0.1581	-0.0823	-0.2162	0.0345	0.2009	0.0501
	(0.1482)	(0.3419)	(0.4269)	(0.0683)	(0.1902)	(0.1463)
Marital status	-0.1042	-0.1418*	-0.8793	-0.2301	-0.2674*	-0.3185
	(0.5262)	(0.0763)	(0.8315)	(0.2958)	(0.1390)	(0.3337)
Patient SES	0.0206***	0.0316***	0.0316**	0.0104***	0.0122***	0.0264***
	(0.0048)	(0.0085)	(0.0154)	(0.0018)	(0.0049)	(0.0047)
Inpatient department	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓
Constant	-0.4355**	-0.0362	-0.2531	-0.6982***	-1.3488	0.4882***
	(0.0179)	(0.0387)	(0.2683)	(0.0783)	(1.1972)	(0.1729)
Pseudo R-squared	0.581	0.447	0.419	0.450	0.409	0.351
Observations	123,331	57,442	24,353	112,837	45,649	22,813

Notes: Model 1 & Model 4: without matching; Model 2 & Model 5: dynamic matching; Model 3 & Model 6: look-ahead matching. * p<0.1, ** p<0.05, *** p<0.01.

Table D2. Full results of the effect of physicians' OHC participation on offline patient recovery

	Non-participating patients			Participating patients		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
OHC participation	0.0346*	0.0316	0.0252	0.0614***	0.0566***	0.0453**
	(0.0202)	(0.0194)	(0.0243)	(0.0181)	(0.0185)	(0.0193)
Physician workload	-0.0152**	-0.0384***	-0.0178*	-0.0164***	-0.0048	-0.0112*
	(0.0075)	(0.0106)	(0.0112)	(0.0052)	(0.0054)	(0.0061)
Length of stay	0.0427***	0.0317***	0.0149**	0.0105**	0.0088*	0.0121**
	(0.0062)	(0.0078)	(0.0077)	(0.0049)	(0.0051)	(0.0054)
Hospital visit	-0.0069*	-0.0091	-0.0113**	-0.0136***	-0.0149***	-0.0315***
	(0.0039)	(0.0057)	(0.0058)	(0.0023)	(0.0025)	(0.0062)
Surgery	0.1552***	0.1756***	0.1698***	0.1097***	0.1016***	0.1002***
	(0.0443)	(0.0363)	(0.0473)	(0.0235)	(0.0249)	(0.0241)
Transfer	-0.1177**	-0.1247	-0.0276***	-0.2887***	-0.3435***	-0.3011***
	(0.0603)	(0.0841)	(0.0083)	(0.0415)	(0.0597)	(0.0619)
Moderate severity	0.2389***	0.1853***	0.2092***	0.3303***	0.2808***	0.3065***

	(0.0654)	(0.0592)	(0.0712)	(0.0349)	(0.0374)	(0.0437)
Weekend	-0.0168***	-0.0615	-0.0132	-0.0661**	-0.1649***	-0.0093
	(0.0040)	(0.0570)	(0.0569)	(0.0305)	(0.0341)	(0.0325)
Work experience	0.0581***	0.0529***	0.0375**	0.0129*	0.0062	0.0135
	(0.0101)	(0.0144)	(0.0146)	(0.0075)	(0.0093)	(0.0092)
Patient age	-0.0121***	-0.0075***	-0.0065***	-0.0057***	-0.0056***	-0.0053***
	(0.0011)	(0.0017)	(0.0016)	(0.0084)	(0.0087)	(0.0091)
Patient gender	-0.0407	0.0457	-0.0403	-0.0213	-0.0274	-0.0317
	(0.0316)	(0.0478)	(0.0468)	(0.0236)	(0.0243)	(0.0258)
Marital status	0.0337***	0.0182*	-0.1675	0.3912***	0.3055***	0.3214***
	(0.0076)	(0.0105)	(0.1036)	(0.0611)	(0.0636)	(0.0699)
Patient SES	-0.0245***	-0.0352***	-0.0335***	-0.0713***	-0.0658***	-0.0685***
	(0.0054)	(0.0119)	(0.0124)	(0.0064)	(0.0068)	(0.0069)
Inpatient department	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓
Constant	-0.3240***	-0.0781	0.0553	-0.7393***	-0.4137***	0.6751
	(0.0372)	(0.0583)	(0.0711)	(0.0461)	(0.0530)	(0.5701)
Pseudo R-squared	0.305	0.279	0.265	0.251	0.239	0.225
Observations	123,331	57,442	24,353	112,837	45,649	22,813

Notes: Model 1 & Model 4: without matching; Model 2 & Model 5: dynamic matching; Model 3 & Model 6: look-ahead matching. * p<0.1, ** p<0.05, *** p<0.01.

Appendix E. Ruling Out Pretreatment Trends

Table E1. Dynamic treatment effect of physician's OHC participation on care quality

	DV: Mortality		DV: Recovery	
	Model 1	Model 2	Model 3	Model 4
7+ months until OHC participation	0.0026	0.0084	0.0291	0.0132
	(0.0164)	(0.0135)	(0.0218)	(0.0239)
6 months until OHC participation	0.0228	0.0169	0.0287	-0.0355
	(0.0197)	(0.0173)	(0.0258)	(0.0305)
5 months until OHC participation	0.0134	-0.0226	0.0287	0.0149
	(0.0204)	(0.0171)	(0.0276)	(0.0295)
4 months until OHC participation	-0.0131	-0.0022	-0.0449	0.0334
	(0.0207)	(0.0175)	(0.0295)	(0.0298)
3 months until OHC participation	-0.0149	0.0027	-0.0218	0.0143
	(0.0183)	(0.0177)	(0.0271)	(0.0284)
2 months until OHC participation	0.0064	0.0117	0.0451	-0.0099
	(0.0215)	(0.0189)	(0.0307)	(0.0319)
1 month until OHC participation	Omitted			
0 month since OHC participation	-0.0687*	-0.0226	0.0405	0.0344
	(0.0199)	(0.0172)	(0.0278)	(0.0292)
1 month since OHC participation	-0.0301	-0.0379**	0.0562**	0.0641**
	(0.0197)	(0.0172)	(0.0254)	(0.0305)
2 months since OHC participation	-0.0431**	-0.0580***	0.0626***	0.0602**
	(0.0196)	(0.0178)	(0.0251)	(0.0298)
3 months since OHC participation	-0.0521***	-0.0434**	0.0506**	0.0486*
	(0.0201)	(0.0172)	(0.0247)	(0.0283)
4 months since OHC participation	-0.0637***	-0.0335**	0.0589**	0.0710**
	(0.0195)	(0.0164)	(0.0246)	(0.0284)
5 months since OHC participation	-0.0589***	-0.0492**	0.0707***	0.0583**
	(0.0202)	(0.0166)	(0.0243)	(0.0279)
6 months since OHC participation	-0.0545***	-0.0408**	0.0752***	0.0512*
	(0.0201)	(0.0170)	(0.0213)	(0.0277)
7+ months since OHC participation	-0.0365**	-0.0254*	0.0871***	0.0405*
	(0.0162)	(0.0143)	(0.0207)	(0.0236)
Controls	×	✓	×	✓
Physician FEs	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓
Constant	3.4411***	-0.3034**	-0.2542	5.8093***
	(0.8297)	(0.1426)	(0.2138)	(1.1556)
Pseudo R-squared	0.225	0.246	0.262	0.298

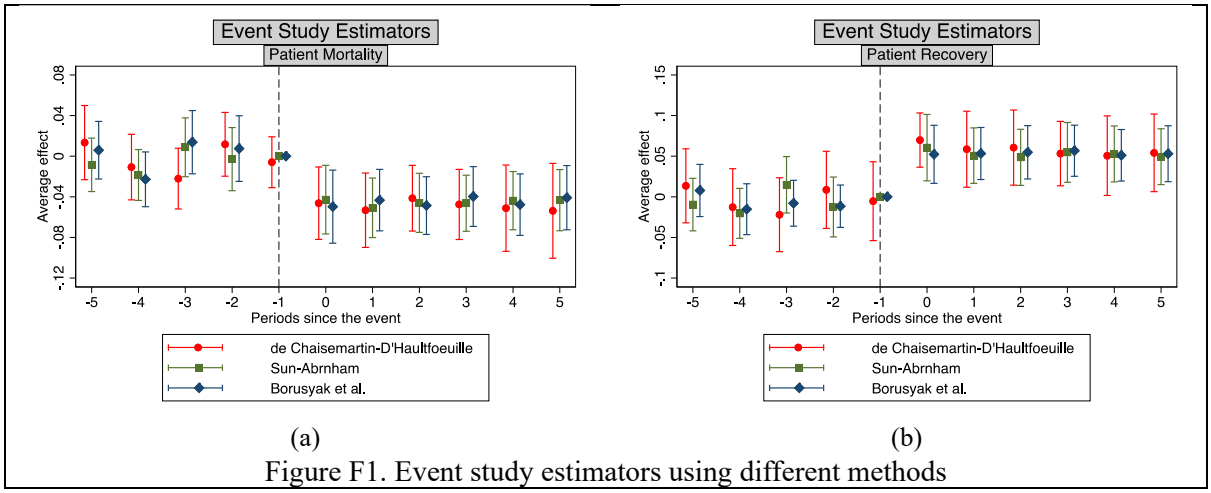
Notes: * p<0.1, ** p<0.05, *** p<0.01; We observe that the immediate treatment effects right after the physicians' engagement in the OHC and the lack of strengthening over time. One possible explanation for the immediate effect is that after participating in the OHC, the OHC platform may provide immediate access to a wealth of resources and peer support, which can help physicians quickly improve their practice (Liederman et al. 2003). For example, they can access the best practices, latest research, and patient personal information, which can be immediately applied to patient care (Liu et al. 2020). The lack of a strengthening effect over time could be due to the overall healthcare system and physician behavior. For example, while patients may be actively using the OHC, physicians may not fully engage with the platform, limiting the potential for further improvements in care quality and equity.

Appendix F. Reliability of Two-Way Fixed-Effect Estimation

Table F1. The effect of physicians' OHC participation on offline care quality (staggered DiD)

	DV: Mortality		DV: Recovery	
	Coeff.	SE	Coeff.	SE
Overall treatment effect	-0.0212**	0.0101	0.0753***	0.0276
Physician workload	0.0098***	0.0027	-0.0012	0.0011
Length of stay	-0.0012***	0.0004	0.0026**	0.0012
Hospital visit	0.0071***	0.0015	-0.0060	0.0058
Surgery	-0.0157***	0.0016	0.1046***	0.0128
Transfer	0.0303***	0.0063	-0.0407***	0.0106
Moderate severity	-0.0420***	0.0069	0.2678***	0.0502
Weekend	0.0011***	0.0002	-0.0104*	0.0060
Work experience	-0.0021	0.0023	0.0087**	0.0042
Patient age	0.0030***	0.0004	-0.0011***	0.0002
Patient gender	0.0023	0.0085	-0.0031	0.0030
Marital status	-0.0048***	0.0015	0.0022**	0.0012
Patient SES	0.0057	0.0036	-0.0029**	0.0015
Inpatient department	✓		✓	
Physician FEs	✓		✓	
Month dummy	✓		✓	
R-squared	0.365		0.255	
Observation	112,837		112,837	

Notes. SE: robust standard errors clustered by physicians. *** p<0.01; ** p<0.05, * p<0.1



(a) (b)

Figure F1. Event study estimators using different methods

Notes: This figure overlays the event-study plots constructed using three different estimators: De Chaisemartin and d'Haultfoeuille (2020) (in red line with circle markers), Sun and Abraham (2021) (in green line with square markers), and Borusyak, Jaravel, and Spiess (2021) (in navy with diamond markers). The figure (a) uses patient mortality as health outcome, whereas the figure (b) uses patient recovery as the measure of care quality.

Appendix G. Falsification Tests

Table G1. Results of the Placebo Test from Random Implementation

	DV: Mortality	DV: Recovery
Placebo effect (mean)	0.0593	0.0149
Placebo effect (std)	0.2078	0.1695
Actual treatment effect (coeff)	-0.0582**	0.0673***
Actual treatment effect (se)	0.0296	0.0217
Replication	1,000	1,000
z-score	-5.163	6.737
p-value	$p<0.001$	$p<0.001$

Note: ** p<0.05, *** p<0.01.

Table G2. Estimation results with a sample of inactive community participators

	DV: Mortality		DV: Recovery	
	Coeff.	SE	Coeff.	SE
OHC participation	-0.0389	0.0271	-0.0126	0.0183
Physician workload	0.0142***	0.0041	-0.0095	0.0106
Length of stay	0.0268	0.0413	0.218**	0.0110
Hospital visit	0.0923***	0.0171	-0.0159***	0.0057
Surgery	-0.0866**	0.0301	0.1201***	0.0334
Transfer	0.1132***	0.0342	-0.1406**	0.0635
Moderate severity	-0.6304***	0.0463	0.0568	0.0634
Weekend	0.0856***	0.0258	-0.116*	0.0667
Work experience	-0.0168	0.0923	0.0313***	0.0022
Patient age	0.0477***	0.0098	-0.0189***	0.0021
Patient gender	0.0344	0.0242	-0.0613	0.0591
Marital status	-0.0324	0.1061	0.2644**	0.1334
Patient SES	0.0105*	0.0056	-0.0108***	0.0035
Inpatient department	✓		✓	
Physician FEs	✓		✓	
Time dummies	✓		✓	
Constant	-1.5467	1.6563	1.1716***	0.1056
Pseudo R-squared	0.301		0.254	

Note: * p<0.1, ** p<0.05, *** p<0.01.

Appendix H. Linear Probability Model (LPM) Specification

Table H1. Effect of OHC participation on offline patient mortality with LPM specification

	Model 1		Model 2		Model 3	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
OHC participation	-4.12E-03***	7.73E-04	-1.95E-03**	7.56E-04	-1.62E-03**	8.01E-04
Physician workload	7.34E-04***	1.76E-04	7.28E-04***	1.91E-04	9.27E-04***	1.78E-04
Length of stay	-1.26E-03***	2.98E-04	-3.23E-04	2.63E-04	-9.32E-04***	2.78E-04
Hospital visit	8.19E-04***	1.02E-04	5.38E-04***	1.23E-04	2.74E-04**	1.26E-04
Surgery	-6.71E-03***	9.91E-04	-4.39E-03***	1.09E-03	-3.52E-04	1.23E-03
Transfer	3.59E-02***	3.79E-03	6.84E-03**	2.81E-03	6.21E-03*	3.34E-03
Moderate severity	-3.53E-02***	1.01E-02	-6.45E-02***	1.73E-02	-6.09E-02***	1.32E-02
Weekend	1.31E-02***	1.30E-03	3.34E-03***	1.02E-03	7.45E-03***	1.36E-03
Work experience	-1.31E-03***	2.44E-04	6.02E-05	2.04E-04	3.49E-04	2.83E-04
Patient age	4.56E-04***	3.05E-05	1.69E-04***	2.86E-05	2.51E-04***	3.34E-05
Patient gender	3.54E-04	7.74E-04	1.05E-03	6.83E-04	3.62E-03	8.99E-03
Marital status	-1.12E-03	1.37E-03	-3.63E-03	2.02E-03	-4.38E-03***	1.18E-03
Patient SES	1.42E-03***	3.25E-04	5.33E-04*	2.96E-04	1.66E-03***	3.34E-04
Department	✓		✓		✓	
Physician FEs	✓		✓		✓	
Time dummies	✓		✓		✓	
Constant	3.01E-01***	1.13E-02	6.42E-01***	5.48E-02	7.06E-01***	4.78E-02
R-squared	0.245		0.202		0.201	

Notes: Model 1: without matching; Model 2: dynamic matching; Model 3: look-ahead matching. * p<0.1, ** p<0.05, *** p<0.01.

Table H2. Effect of OHC participation on offline patient recovery with LPM specification

	Model 1		Model 2		Model 3	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
OHC participation	1.23E-02***	2.73E-03	1.10E-02***	2.68E-03	1.07E-02***	2.84E-03
Physician workload	-2.79E-03***	9.67E-04	-8.73E-04	1.01E-03	-7.92E-04	1.03E-03
Length of stay	1.56E-03	9.53E-04	1.38E-03	1.03E-03	1.50E-03	9.91E-04
Hospital visit	-2.62E-03***	5.17E-04	-2.75E-03***	5.38E-04	-6.19E-03***	5.01E-04
Surgery	2.33E-02***	5.95E-03	2.19E-02***	6.30E-03	2.13E-02***	6.52E-03
Transfer	-5.73E-02***	1.23E-02	-6.29E-02***	1.24E-02	-5.58E-02***	1.27E-03
Moderate severity	5.31E-02***	1.88E-02	4.75E-02***	1.36E-02	4.84E-02***	1.25E-02
Weekend	-1.14E-02***	6.12E-03	-3.12E-02***	6.21E-03	2.19E-04	6.38E-03
Work experience	2.51E-03	1.49E-03	2.69E-03	1.67E-03	3.66E-03**	1.79E-03
Patient age	-1.24E-03***	1.71E-04	-1.18E-03***	1.73E-04	-1.04E-03***	1.83E-04
Patient gender	-4.32E-03	4.85E-03	-2.96E-03	4.88E-03	5.96E-03	5.10E-03
Marital status	7.27E-03***	1.06E-03	5.05E-03***	1.07E-03	4.89E-03***	1.15E-03
Patient SES	-1.32E-02***	1.22E-03	-1.21E-02***	1.28E-03	-1.12E-02***	1.27E-03
Department	✓		✓		✓	
Physician FEs	✓		✓		✓	
Time dummies	✓		✓		✓	
Constant	-8.24E-01***	6.92E-02	-2.68E-01***	8.24E-02	7.19E-01***	8.02E-02
R-squared	0.155		0.172		0.176	

Notes: Model 1: without matching; Model 2: dynamic matching; Model 3: look-ahead matching. * p<0.1, ** p<0.05, *** p<0.01.

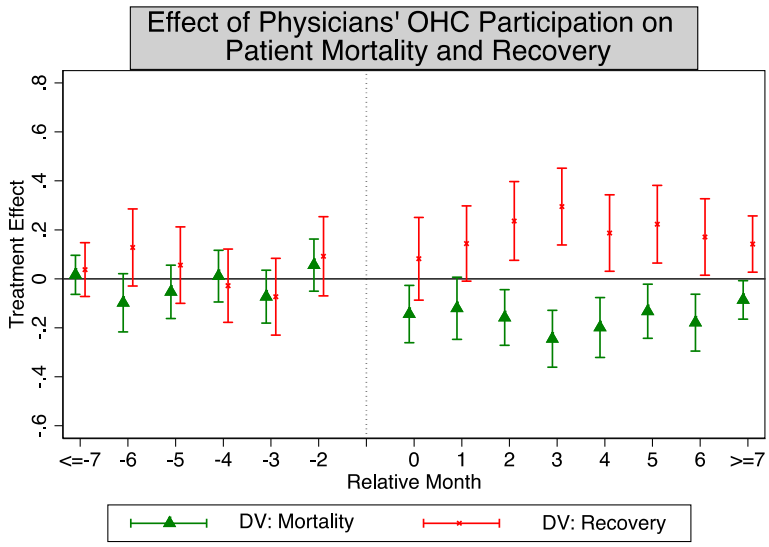


Figure H1. Estimated effects of OHC participation using LPM specification

Appendix I. Alternative Use of Dependent Variable

Table I1. Effect of OHC participation on care quality with 30-days readmission as DV

	M1		M2		M3	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
OHC participation	-0.0645***	0.0106	-0.0617***	0.0153	-0.0505**	0.0145
Physician workload	0.0837***	0.0072	0.1019***	0.0067	0.0591***	0.0051
Length of stay	0.0443***	0.0070	0.0362***	0.0063	-0.0055	0.0043
Hospital visit	0.0991***	0.0129	0.0852***	0.0237	0.0557***	0.0180
Surgery	-0.0942**	0.0462	-0.1011**	0.0422	-0.0822**	0.0219
Transfer	0.0283***	0.0085	0.0311***	0.0786	0.0192***	0.0054
Moderate severity	-0.1115**	0.0455	-0.1372***	0.0407	-0.0535***	0.0073
Weekend	0.0902**	0.0443	0.0692*	0.0418	0.0224	0.0299
Work experience	-0.0126**	0.0058	-0.0360***	0.0107	-0.0446***	0.0070
Patient age	0.0055***	0.0013	0.0045***	0.0013	0.0065***	0.0009
Patient gender	-0.0281	0.0383	-0.0335	0.0338	0.0053	0.0218
Marital status	-0.0984**	0.0468	-0.0673***	0.0208	-0.0563	0.0342
Patient SES	-0.0343***	0.0092	0.0251***	0.0084	-0.0377***	0.0059
Inpatient department	✓		✓		✓	
Physician FEs	✓		✓		✓	
Time dummies	✓		✓		✓	
Constant	1.7505**	0.8601	1.3921**	0.5789	-1.7752***	0.2499
Pseudo R-squared	0.185		0.195		0.156	

Note: ** p<0.05, *** p<0.01; Model 1: without matching; Model 2: dynamic matching; Model 3: look-ahead matching

Appendix J. Entropy Balancing

Table J1. Entropy balancing

	Treatment group		Control group			
			Before reweighting		After reweighting	
	Mean	Variance	Mean	Variance	Mean	Variance
Physician workload	5.263	10.04	4.469	6.856	5.263	10.61
Length of stay	9.705	39.71	9.880	29.491	9.705	41.21
Hospital visit	3.455	26.99	3.623	23.150	3.455	25.51
Surgery	0.324	0.234	0.236	0.246	0.324	0.234
Transfer	0.044	0.043	0.040	0.039	0.044	0.042
Moderate severity	0.898	0.012	0.807	0.028	0.898	0.016
Weekend	0.117	0.146	0.092	0.128	0.117	0.146
Work experience	13.991	51.58	10.330	62.43	13.991	51.71
Patient age	52.432	26.15	58.993	31.69	52.432	34.82
Patient gender	0.378	0.235	0.531	0.249	0.378	0.252
Marital status	0.832	0.062	0.934	0.063	0.832	0.062
Patient SES	0.572	0.245	0.651	0.229	0.572	0.218

Table J2. The effect of physicians' OHC participation on offline care quality based on entropy balancing

	DV: Mortality		DV: Recovery	
	Coeff.	SE	Coeff.	SE
OHC participation	-0.0446**	0.0206	0.0395***	0.0093
Physician workload	0.0120***	0.0034	-0.0252***	0.0058
Length of stay	-0.0162	0.0425	0.0089	0.0062
Hospital visit	0.0569***	0.0115	-0.0155***	0.0026
Surgery	0.0342	0.0227	0.1023***	0.0322
Transfer	0.0854***	0.0318	-0.3699***	0.0759
Moderate severity	-0.4735***	0.0329	0.2103***	0.0484
Weekend	0.0758***	0.0194	-0.0531	0.0379
Work experience	-0.0024	0.0580	0.0867***	0.0093
Patient age	0.0489***	0.0073	-0.0102***	0.0011
Patient gender	0.0362	0.1803	-0.0318	0.0270
Marital status	-0.0873	0.0599	0.0696***	0.0083
Patient SES	0.1091**	0.0552	-0.0816***	0.0082
Inpatient department	✓		✓	
Physician FEs	✓		✓	
Month dummy	✓		✓	
Constant	-2.3393	1.9208	-3.5819***	0.5766
Observation	112,837		112,837	

Notes. *** p<0.01; ** p<0.05

Appendix K. Empirical Validation Through a Field Survey: Testing Core Mechanisms

To investigate further into the underlying mechanism proposed in Section 2 that cannot directly be observed in the observational data, we conducted a field survey with a sample of physicians, focusing specifically on the role of COC. The survey was conducted at a large public general hospital in the northwest region of China. The hospital, which has around 500 physicians, is comparable in size and department structure to the focal hospital in our primary analysis. Moreover, the hospital launched a hospital-affiliated OHC program in April 2024. The OHC is equipped with features and functions that enable physicians to interact with patients. These features include interactive discussion forums where physicians can provide advice and answer questions and personalized messaging systems that allow for private communication. Additionally, the OHC also incorporate patient feedback mechanisms, enabling physicians to receive comments and insights accordingly.

As the OHC platform is progressively implemented in the hospital, during the time of the study, approximately half of the medical units adopted the OHC platform, whereas the other half was expected to use the system within six months. This context provided an excellent setting for our survey on physician engagement in OHCs. We collaborated with the hospital and selected its physicians as survey respondents. We provided the following eligibility criteria for participant selection to the survey provider: a physician should be under contract with the hospital (visiting physicians and interns were exclude from our survey) and the physician must be responsible for inpatient care. Our research setting at a single hospital minimized the influence of organizational-level variables (i.e., hospital size and hospital management support) on individual behavior.

To ensure reliability and validity, measures for each variable were adopted from previous research and rephrased to fit the healthcare context. Measures for community participation came from items and definitions found in the literature on online communities (Dutta-Bergman 2006, Chung et al. 2010). We crafted survey questions to ascertain whether physicians had registered to participate in the OHC. Participation in the community was measured by the questions “Have you registered as a member of the hospital-initiated OHC platform?” Responses were measured in a Yes/No dichotomous format. Items of COC were adopted from Uijen et al. (2011) and Perdok et al. (2018). To capture the perceived quality of offline care, we used the items from Franks et al. (2006). These items use a 7-point Likert scale ranging from “strongly disagree” to “strongly agree”. We also include control variables in the survey. Gender, age, tenure, and position were single-item measures used as control variables in the model.

In designing these measures, we consulted two senior IS researchers to identify and rectify potential problems in the framing and phrasing of questions. Minor modifications were made on certain items based on their suggestions. Considering that the original version was developed in English, while all the respondents are Chinese, the entire questionnaire was translated into Chinese and then back-translated for translation accuracy by four bilingual master students and two senior doctoral students. To obtain face validity, we also invited the Chief Information Officer in the hospital and two physicians to provide comments on the survey questionnaire. We used their suggestions as basis in modifying the OHC platform description and in the framing of the survey questions.

We comprised a cover letter specifying the research objective in the survey package. We highlighted the target respondents of the survey questionnaire on page 2 to make sure that the survey respondents align with our specified criteria. We also included a description of a typical OHC platform to enable the respondents to relate to the focal community used in the hospital. The authors then

distributed the survey package to the respondents in the surveyed hospital. For each completed questionnaire, 20 Yuan (equivalent to US $3.0) donation to a Chinese charity foundation was used as an incentive. The questionnaire did not ask personally identifiable information, including respondent's name or e-mail address to protect respondents' privacy. To increase the response rate, the authors made several visits to survey collaborators in the hospital. The participants were invited randomly to complete the survey during their break time.

In November 2024, a total of 400 questionnaires were distributed through hospital administrators. 271 responses were returned, which thereby yielded a response rate of 67.7%. Considering the tight schedules of the physicians, our response rate was satisfactory. Several survey responses were excluded because of missing data. The final sample was 139 and 114 for non-participating and participating physicians, respectively. Table K1 shows the demographics of the respondents.

Table K1. Sample demographics

		Nonparticipator		Participator	
Variable	Category	Frequency (136)	Precent	Frequency (114)	Percent
Gender	Male	72	52.9	55	48.2
	Female	64	47.1	59	51.8
Age	24-29	34	25.0	24	21.1
	30-34	37	27.2	30	26.3
	35-39	30	22.1	32	28.1
	40-44	14	10.3	13	11.4
	45-50	11	8.1	9	7.9
	>50	10	7.4	6	5.3
Education	Bachelor	57	41.9	47	41.2
	Master	66	48.5	52	45.6
	Doctor	13	9.6	15	13.2

Partial least squares method was used to perform the measurement model analysis. Table O2 presents the descriptive statistics of the key variables for both participating and non-participating physicians, respectively. Table K2 shows that the mean values of the studied variables for participating physicians are higher than the values for non-participating physicians. Table K2 provides preliminary evidence indicating that physicians who participate in the OHC demonstrate enhanced COC and higher perceived quality of care.

Table K2 Descriptive statistics of variables

variable	Nonparticipator		Participator	
	Mean	Std Dev	Mean	Std Dev
Information continuity (IC)	2.44	0.72	5.61	0.66
Management continuity (MC)	2.35	0.75	5.92	0.61
Relational continuity (RC)	2.29	0.81	5.71	0.73
Perceived quality of care (PQC)	2.38	0.89	5.63	0.92

For the dependent variable (i.e., perceived quality of care), which was measured using formative indicators, we examined its reliability and validity following the guidelines proposed by Petter et al. (2007). Table K3 shows the test results for weights, loading, and variance inflation factors (VIFs). All the VIFs are lower than 5, which is acceptable. Thus, multicollinearity was unlikely to be identified in our formative measurement. And the weights and loading presented in Table K3 are acceptable.

Table K3 Assessments of formative constructs

Formative Constructs	Items	Weights	Loading	VIFs
Perceived quality of care (PQC)	PQC1	0.239	0.628	4.63
	PQC2	0.356	0.737	3.13
	PQC3	0.548	0.876	2.16

	PQC4	0.327	0.689	4.02
	PQC5	0.455	0.774	3.76

For our reflective constructs (i.e., perceived continuity of care), we assessed convergent and discriminant validities in Table K4. Convergent validity reflects the uni-dimensionality of constructs (i.e., whether the indicators of a construct are more correlated with one another than with indicators of other constructs). Convergent validity was evaluated by using item reliability test, Cronbach's alpha (CA), composite reliability (CR) of constructs, and average variance extracted (AVE) according to (Russell 1978). High indicator loading (> 0.7) indicates that the items are highly correlated with the construct.

Table K4. Assessments of reflective constructs

Reflective Constructs	Items	Loading	AVE	CR	CA
Information continuity (IC)	IC1	0.819	0.623	0.832	0.825
	IC2	0.926			
	IC3	0.871			
	IC4	0.893			
Management continuity (MC)	MC1	0.926	0.605	0.824	0.812
	MC2	0.835			
	MC3	0.821			
	MC4	0.927			
Relational continuity (RC)	RC1	0.831	0.657	0.853	0.837
	RC2	0.898			
	RC3	0.911			
	RC4	0.893			

We tested two different structural models by using the data obtained from our field survey. We first examined the structural path that conceptualizes COC as an integrated measure, assessing how OHC participation influences COC and subsequently affects perceived quality of care. We then evaluated the alternative models, considering information continuity, management continuity, and relational continuity individually, as well as their respective mediating effects on the relationship between physicians' OHC participation and perceived quality of care. The full results of two structural models are shown in Table K5.

Table K5 Structural results of proposed models

	First alternative		Second alternative			
	COC	PQC	IC	MC	RC	PQC
OHC participation	0.338***	0.016	0.317***	0.257***	0.342***	0.018
COC		0.092***				
IC						0.221***
MC						0.232***
RC						0.454***
Gender	0.007	-0.013	0.025	0.020	-0.025	0.006
Age	0.027	0.019	0.002	0.005	0.003	-0.002
Tenure	-0.047	0.068	0.024	0.054	0.018	0.041*
Position	✓	✓	✓	✓	✓	✓
Education	✓	✓	✓	✓	✓	✓
R-squared	0.789	0.825	0.742	0.773	0.750	0.829

Note, * p< 0.1, *** p<0.01

The findings from our field survey demonstrate that physicians' OHC participation has a significant positive effect on perceived offline care quality. This beneficial impact is mediated through the enhancement of COC. The survey results confirm the main findings from our observational data,

which demonstrate the generality of our findings beyond the specific context of our observational study. In addition, by directly measuring COC from physicians' perspective, we validate the mediation effect of COC, which support our main hypotheses and complement the analysis in our observational study. Our survey study triangulates mediation mechanisms suggested by our secondary data analysis. However, our survey instrument did not test all hypotheses presented in this paper. Future research could systematically investigate how physician engagement in OHCs affects diverse patient groups through field surveys.

Appendix L. An Alternative Measure of Patient SES as Dichotomous Variable

In addition to measuring patients' SES as a continuous variable and employing an interaction term to test H3, we also divided the sample into two groups of approximately equal size based on patients' SES and conducted a segment-level analysis. This analysis allows us to compare the impact of physicians' OHC participation across different SES groups more effectively.

Specifically, MacDonald et al. (2009) suggested that the occupation-based SES index can be developed by ranking occupational groups according to skill, and they identified two "skill level" groups: professionals and persons working in jobs requiring less training (i.e., non-professionals). The skill-level groupings are always used as the dichotomous classifications of SES, and it is generally true that individuals in non-professional group are classified lower in the socioeconomic hierarchy than those in professional group (MacDonald et al. 2009). In our sample, 47.4% of patients belong to the professional group and 52.6% of patients belong to the non-professional group.

Table L1 presents a descriptive statistic of the quality of care received by patients from different SES, indicating that, on average, patients with low-SES receive lower quality of care compared to those with high-SES. We then conduct disaggregated analyses across SES.

Table L1. Descriptive statistics of care quality for patients with different SES

	Patient mortality		Patient recovery	
	Low-SES	High-SES	Low-SES	High-SES
Before OHC participation	0.011 (0.109)	0.023 (0.146)	0.628 (0.481)	0.732 (0.496)
After OHC participation	0.018 (0.123)	0.024 (0.166)	0.674 (0.499)	0.713 (0.475)

Note: Mean (Std. Dev.)

The results of this segment-level analysis reported in Tables L2 and L3 indicate that while OHC participation enhances care quality for both low- and high-SES patient groups, the improvements are statistically significant only for low-SES patients. Physicians' OHC participation is associated with a 5.73% (8.62%) reduction (increase) in the relative risk (safety) of mortality (recovery) for low-SES patients. Collectively, the findings consistently suggest that physicians' involvement in OHC helps mitigate disparities in care quality for low-SES populations.

Table L2. The impact of physicians' OHC participation on offline patient mortality for patients with different SES

	Low-SES patients			High-SES patients		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
OHC participation	-0.1067***	-0.0728**	-0.0591**	-0.0488	-0.0224	-0.0340
	(0.0271)	(0.0298)	(0.0301)	(0.0283)	(0.0473)	(0.0378)
Physician workload	0.0519**	0.0211***	0.0178***	0.0164***	0.0082**	0.0129**
	(0.0231)	(0.0039)	(0.0036)	(0.0028)	(0.0037)	(0.0063)
Length of stay	-0.0948***	-0.0749*	-0.0743**	-0.0029	-0.0155**	-0.0251***
	(0.0153)	(0.0423)	(0.0375)	(0.0236)	(0.0078)	(0.0051)
Hospital visit	0.0659***	0.1006***	0.0803***	0.0945***	0.0530**	0.0442***
	(0.0072)	(0.0169)	(0.0206)	(0.0109)	(0.0221)	(0.0135)
Surgery	-0.1279***	-0.3982	-0.3413	-0.1016***	-0.1717***	-0.3206
	(0.0193)	(0.2944)	(0.3052)	(0.0178)	(0.0376)	(0.2387)
Transfer	0.1016***	0.1217***	0.0562**	0.0698***	0.1248**	0.0895***
	(0.0109)	(0.0356)	(0.0276)	(0.0259)	(0.0531)	(0.0323)
Moderate severity	-0.2962***	-0.6615***	-0.6067***	-0.6119**	-0.7766***	-0.6050***
	(0.1016)	(0.0546)	(0.0509)	(0.2521)	(0.0863)	(0.1407)
Weekend	0.0799***	0.0702***	0.1079***	0.1056***	0.0847**	0.0817***
	(0.0089)	(0.0260)	(0.0256)	(0.0169)	(0.0339)	(0.0208)
Work experience	-0.0123***	0.0112	0.0643	-0.0488	-0.0962	-0.0263***

	(0.0025)	(0.0948)	(0.0779)	(0.0532)	(0.1362)	(0.0065)
Patient age	0.0384***	0.0399***	0.0358***	0.0466***	0.0983***	0.0551***
	(0.0031)	(0.0094)	(0.0096)	(0.0065)	(0.0147)	(0.0077)
Patient gender	-0.0599	0.1394	0.1384	0.1993	0.3155	0.0758
	(0.3265)	(0.2429)	(0.2461)	(0.1559)	(0.3327)	(0.1961)
Marital status	-0.0387***	-0.0197	-0.0271	-0.0288	-0.0352	-0.0207
	(0.0076)	(0.0571)	(0.0319)	(0.0197)	(0.0450)	(0.0598)
Inpatient department	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓
Constant	-0.5352***	-0.4819***	0.1107	-0.2138	1.8123***	1.0241***
	(0.0962)	(0.1084)	(0.3262)	(0.2065)	(0.3954)	(0.2496)
Pseudo R-squared	0.479	0.298	0.276	0.362	0.265	0.223
Observations	29,761	13,593	8,109	26,818	12,250	7,308

Notes: Model 1 & Model 4: without matching; Model 2 & Model 5: dynamic matching; Model 3 & Model 6: look-ahead matching; * p<0.1, ** p<0.05, *** p<0.01

Table L3. The impact of physicians' OHC participation on offline patient recovery for patients with different SES

	Low-SES patients			High-SES patients		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
OHC participation	0.1306***	0.1043***	0.0827**	-0.0138	0.0226	0.0317
	(0.0304)	(0.0355)	(0.0337)	(0.0435)	(0.0419)	(0.0365)
Physician workload	-0.0206**	-0.0667***	-0.0498***	-0.0194***	-0.0092	-0.0073
	(0.0103)	(0.0125)	(0.0068)	(0.0064)	(0.0069)	(0.0050)
Length of stay	0.0815***	0.0814***	0.0765***	0.0012	0.0081*	0.0154***
	(0.0093)	(0.0104)	(0.0062)	(0.0071)	(0.0047)	(0.0053)
Hospital visit	-0.0437***	0.0063*	-0.0138***	-0.0398***	-0.0452***	-0.0590***
	(0.0030)	(0.0038)	(0.0021)	(0.0054)	(0.0051)	(0.0033)
Surgery	0.1014***	0.1003***	0.0925***	0.1538***	0.1389***	0.1316***
	(0.0329)	(0.0387)	(0.0272)	(0.0465)	(0.0453)	(0.0277)
Transfer	-0.3693***	-0.4142***	-0.3069***	-0.3477***	-0.4997***	-0.2414***
	(0.0861)	(0.0921)	(0.0596)	(0.0908)	(0.0908)	(0.0628)
Moderate severity	0.3915***	0.5288***	0.2316***	0.2892***	0.2524***	0.2863***
	(0.0493)	(0.0779)	(0.0827)	(0.0529)	(0.0483)	(0.0355)
Weekend	-0.0744*	-0.0471	-0.1411***	-0.1879***	-0.2347***	-0.0867***
	(0.0438)	(0.0480)	(0.0306)	(0.0495)	(0.0484)	(0.0323)
Work experience	0.0210*	0.0201*	0.0593***	0.0287**	0.0236***	0.0139***
	(0.0112)	(0.0121)	(0.0072)	(0.0128))	(0.0064)	(0.0034)
Patient age	-0.0009	0.0031**	0.0053	-0.0121***	-0.0109***	-0.0122***
	(0.0012)	(0.0013)	(0.0083)	(0.0014)	(0.0013)	(0.0011)
Patient gender	-0.0267	-0.0779	-0.2653	0.0810*	-0.0186	0.0102
	(0.0385)	(0.0598)	(0.0222)	(0.0482)	(0.0353)	(0.0233)
Marital status	0.4592***	0.2542***	0.3443***	0.2825***	0.1456	0.4298***
	(0.0934)	(0.0577)	(0.0656)	(0.0744)	(0.0930)	(0.0613)
Inpatient department	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓
Constant	-5.1604***	-3.9394***	-1.1059***	-2.0842***	-2.8751***	-0.9796**
	(0.6873)	(0.9713)	(0.2749)	(0.8012)	(0.8427)	(0.4606)
Pseudo R-squared	0.248	0.209	0.151	0.278	0.196	0.144
Observations	29,761	13,593	8,109	26,818	12,250	7,308

Notes: Model 1 & Model 4: without matching; Model 2 & Model 5: dynamic matching; Model 3 & Model 6: look-ahead matching; * p<0.1, ** p<0.05, *** p<0.01

Table L4. Robustness check for the interaction effect of patient SES

	DV: Mortality			DV: Recovery		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
OHC participation	-0.0578***	-0.0385*	-0.0258	0.0446**	0.332**	0.0302*
	(0.0202)	(0.0252)	(0.0232)	(0.0178)	(0.0148)	(0.0155)
OHC participation × SES	-0.0088***	-0.0092***	-0.0108***	0.0228***	0.0366***	0.0364***
	(0.0028)	(0.0027)	(0.0032)	(0.0081)	(0.0087)	(0.0090)
Physician workload	0.0942***	0.1614***	0.1334***	-0.0233***	-0.0161***	-0.0129**
	(0.0185)	(0.0344)	(0.0299)	(0.0039)	(0.0053)	(0.0057)
Physician workload × SES	0.1137**	0.0069	0.0168**	0.0212	-0.0048	0.0202
	(0.0570)	(0.0854)	(0.0077)	(0.0132)	(0.0171)	(0.0164)
Length of stay	-0.0433***	-0.0646***	-0.0723**	0.0153***	0.0138***	0.0110*
	(0.0149)	(0.0218)	(0.0289)	(0.0041)	(0.0053)	(0.0058)
Length of stay × SES	0.0358*	0.0131***	0.0133***	-0.0211**	-0.0226*	-0.0139
	(0.0202)	(0.0041)	(0.0035)	(0.0099)	(0.0135)	(0.0147)
Hospital visit	0.0528***	0.0911***	0.0489***	-0.0305***	-0.0145***	-0.0158***
	(0.0063)	(0.0134)	(0.0112)	(0.0017)	(0.0024)	(0.0026)
Hospital visit × SES	0.1033***	-0.0499	-0.0045	0.0228***	0.0096	0.0102
	(0.0209)	(0.0527)	(0.0471)	(0.0063)	(0.0091)	(0.0092)
Surgery	-0.1495***	-0.1232***	-0.0337*	0.1138***	0.1083***	0.1038***
	(0.0173)	(0.0242)	(0.0188)	(0.0193)	(0.0300)	(0.0313)
Surgery × SES	-0.1204**	-0.1901***	-0.1041*	0.0177***	0.0097	0.0185**
	(0.0516)	(0.0679)	(0.0624)	(0.0055)	(0.0082)	(0.0084)
Transfer	0.1028***	0.1381***	0.0973***	-0.3207***	-0.3566***	-0.4060***
	(0.0108)	(0.0307)	(0.0277)	(0.0453)	(0.0628)	(0.0651)
Transfer × SES	-0.0369	-0.2062**	-0.1274	0.0221	-0.0431***	-0.0396**
	(0.0294)	(0.1014)	(0.0889)	(0.1088)	(0.0162)	(0.0163)
Moderate severity	-0.3543***	-0.6617***	-0.5891**	0.2936***	0.3621***	0.3159***
	(0.0975)	(0.1383)	(0.2914)	(0.0864)	(0.0409)	(0.0438)
Moderate severity × SES	-0.0876***	0.0251	0.0375	0.0476**	0.2026**	0.1621*
	(0.0276)	(0.1158)	(0.1061)	(0.0200)	(0.0891)	(0.0865)
Weekend	0.0873***	0.0825***	0.0879***	-0.1003***	-0.0524	-0.1533***
	(0.0182)	(0.0211)	(0.0163)	(0.0224)	(0.0321)	(0.0329)
Weekend × SES	0.0416	-0.0997	0.0215	-0.0996	-0.1342	-0.1242
	(0.0267)	(0.0972)	(0.0628)	(0.0744)	(0.1096)	(0.1083)
Work experience	-0.1102***	0.0128	-0.1579***	0.0341***	0.0805***	0.1281***
	(0.0237)	(0.0705)	(0.0488)	(0.0049)	(0.0076)	(0.0082)
Work experience × SES	0.0120	0.1038**	0.0239	0.0074**	0.0155***	0.0178***
	(0.0148)	(0.0435)	(0.0292)	(0.0035)	(0.0052)	(0.0058)
Patient age	0.0421***	0.0622***	0.0491***	-0.0056***	-0.0046***	-0.0044***
	(0.0028)	(0.0082)	(0.0062)	(0.0006)	(0.0009)	(0.0009)
Patient age × SES	-0.0082	-0.0417*	-0.0390*	-0.0102***	-0.0112***	-0.0105***
	(0.0085)	(0.0234)	(0.0211)	(0.0019)	(0.0028)	(0.0028)
Patient gender	0.1035	0.2032	0.1813	-0.0172	-0.0198	-0.0224
	(0.0724)	(0.2035)	(0.2315)	(0.0163)	(0.0248)	(0.0256)
Patient gender × SES	-0.1396	-0.0571	0.3148	-0.0456	-0.0225	-0.1370*
	(0.2234)	(0.6093)	(0.5879)	(0.0511)	(0.0797)	(0.0784)
Marital status	-0.3575	-0.6291	-0.1367	0.0721*	0.0469***	0.0365***
	(0.5921)	(1.0453)	(0.6587)	(0.0407)	(0.0065)	(0.0067)
Marital status × SES	0.1354	0.1181	0.0792	0.0590***	0.0681***	0.0458**
	(0.0918)	(0.1896)	(0.1927)	(0.0138)	(0.0203)	(0.0201)
Patient SES	0.0141	0.1083	0.0299	-0.0562**	-0.1528*	-0.1931**
	(0.0118)	(0.0875)	(0.0796)	(0.0251)	(0.0922)	(0.0896)
Inpatient department	✓	✓	✓	✓	✓	✓
Inpatient department × SES	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓
Physician FEs × SES	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓

Time dummies × SES	✓	✓	✓	✓	✓	✓
Constant	-0.6911***	-1.3559	0.5253***	-0.2476***	-0.7647***	-0.4507***
	(0.0785)	(0.8549)	(0.1785)	(0.0192)	(0.0051)	(0.0582)
Pseudo R-squared	0.453	0.423	0.368	0.302	0.271	0.245
Observations	112,837	45,649	22,813	112,837	45,649	22,813

Notes: Model 1 & Model 4: without matching; Model 2 & Model 5: dynamic matching; Model 3 & Model 6: look-ahead matching. * p<0.1, ** p<0.05, *** p<0.01.

Appendix M. The Heterogenous Effects of OHC Participation Across Different Diseases Categories

Table M1. The impact of OHC participation on offline healthcare quality across disease categories

	DV: Mortality			DV: Recovery		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
			Cardiovascular Disease			
OHC participation	-0.0696**	-0.0631*	-0.0668**	0.0799***	0.795***	0.0747***
	(0.0319)	(0.0337)	(0.0354)	(0.0283)	(0.0291)	(0.0294)
			Musculoskeletal Disorders			
OHC participation	-0.0623*	-0.0603*	0.0508	0.0651**	0.0670**	0.0522*
	(0.0336)	(0.0338)	(0.0340)	(0.0274)	(0.0285)	(0.0289)
			Cerebrovascular Diseases			
OHC participation	0.0655**	0.0675***	0.0634**	0.0731***	0.0726**	0.0810***
	(0.0302)	(0.0311)	(0.0313)	(0.0280)	(0.0297)	(0.0314)
			Pneumonia			
OHC participation	-0.0581**	-0.0523*	-0.0594*	0.0436*	0.0471*	0.0484*
	(0.0296)	(0.0307)	(0.0309)	(0.0261)	(0.0263)	(0.0265)
			Upper Respiratory Infections			
OHC participation	-0.0647**	-0.0606*	-0.0482	0.0589**	0.0533*	0.0451
	(0.0322)	(0.0329)	(0.0335)	(0.0295	(0.0305)	(0.0322)

Notes: * p<0.1, ** p<0.05, *** p<0.01

Appendix N. Spillover Effect of OHC Participation on Non-participating Patients

Table N1. The spillover effect of OHC participation for highly engaged physicians

	DV: Mortality			DV: Recovery		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
OHC participation	-0.0521*	-0.0342	-0.0272	0.0257	0.0115	0.0073
	(0.0292)	(0.0357)	(0.3376)	(0.0372)	(0.0316)	(0.0623)
Physician workload	0.0931*	0.0243***	0.0167**	-0.0081	-0.0221	-0.0316*
	(0.0506)	(0.0087)	(0.0074)	(0.0135)	(0.0189)	(0.0188)
Length of stay	-0.0262**	-0.0106	-0.0316	0.0242***	0.0295***	0.0194***
	(0.0132)	(0.0326)	(0.0281)	(0.0047)	(0.0066)	(0.0062)
Hospital visit	0.0489***	0.0773***	0.0358*	-0.0130***	-0.0128**	-0.0057
	(0.0102)	(0.0231)	(0.0195)	(0.0039)	(0.0063)	(0.0055)
Surgery	-0.2314	-0.4749	-0.7056**	0.1392***	0.3394***	0.4453***
	(0.1562)	(0.4052)	(0.3190)	(0.0426)	(0.0685)	(0.0656)
Transfer	0.0644***	0.0781**	0.0685**	-0.1901***	-0.3458***	-0.2256***
	(0.0137)	(0.0358)	(0.0307)	(0.0523)	(0.0745)	(0.0733)
Moderate severity	-0.3624**	-0.526***	-0.4862***	0.2931***	0.2224***	0.2376***
	(0.0843)	(0.0514)	(0.0439)	(0.0742)	(0.0473)	(0.0413)
Weekend	0.1048***	0.1205***	0.1565***	-0.0106**	-0.0297***	-0.0272***
	(0.0136)	(0.0311)	(0.0246)	(0.0051)	(0.0072)	(0.0081)
Work experience	-0.0499	-0.0141	-0.0210*	0.0053	0.0161*	0.0112**
	(0.0422)	(0.1194)	(0.0105)	(0.0121)	(0.0095)	(0.0052)
Patient age	0.0309***	0.0293**	0.0221**	-0.0044***	-0.0038**	-0.0056***
	(0.0052)	(0.0116)	(0.0092)	(0.0012)	(0.0018)	(0.0017)
Patient gender	0.0132	-0.2206	0.0092	-0.0677*	-0.0583	-0.0261
	(0.1185)	(0.3004)	(0.2368)	(0.0354)	(0.0638)	(0.0515)
Marital status	-0.0533	-0.0482	-0.0332	0.0649***	0.0689***	0.0758***
	(0.0771)	(0.0545)	(0.0481)	(0.0103)	(0.0145)	(0.0143)
Patient SES	0.0211***	0.0194**	0.0278***	-0.0680***	-0.0537***	-0.0881***
	(0.0032)	(0.0081)	(0.0068)	(0.0082)	(0.0117)	(0.0213)
Inpatient department	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓
Constant	-0.7322***	-1.6860**	0.3962	-0.3807***	-0.4659***	-0.7823***
	(0.1527)	(0.8369)	(0.2808)	(0.0434)	(0.1129)	(0.0793)
Pseudo R-squared	0.419	0.366	0.320	0.221	0.187	0.163
Observations	20,651	9,433	5,627	20,651	9,433	5,627

Notes: Model 1 & Model 4: without matching; Model 2 & Model 5: dynamic matching; Model 3 & Model 6: look-ahead matching; * p<0.1, ** p<0.05, *** p<0.01

Appendix O. Robustness Checks in Patient Selection for Measuring COC

Table O1. Comparative analysis of characteristics between excluded and remained patients

Variable	Remained patient		Excluded patient		Difference
	Mean	Std. dev.	Mean	Std. dev.	t-statistics
Gender	0.497	0.489	0.469	0.494	-0.028
Age	53.606	19.537	52.746	17.356	-0.861
Marriage	0.909	0.240	0.892	0.311	-0.017
Length of stay	9.548	5.721	9.740	6.095	0.192
Hospital visit	3.658	4.950	3.889	4.010	0.231*
Severity	0.862	0.166	0.879	0.214	0.017
Transfer	0.041	0.114	0.043	0.208	0.002
Surgery	0.255	0.498	0.304	0.526	0.049*

Notes: * p<0.1

Table O2. The impact of physicians' OHC participation for new patients

	DV: Mortality			DV: Recovery		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
OHC participation	-0.0752*	-0.0534	-0.0277	0.0609**	0.0568*	0.0453
	(0.0413)	(0.0383)	(0.0332)	(0.0294)	(0.0329)	(0.0307)
Physician workload	0.0173***	0.0119**	0.0108***	-0.0122**	-0.0002	0.0004
	(0.0051)	(0.0050)	(0.0039)	(0.0053)	(0.0057)	(0.0056)
Length of stay	-0.0246	-0.0148**	-0.0476	0.0027	0.0021	0.0048
	(0.0556)	(0.0062)	(0.0363)	(0.0051)	(0.0055)	(0.0063)
Hospital visit	0.0711***	0.0379**	0.0102	-0.0092***	-0.0088***	-0.0307***
	(0.0187)	(0.0169)	(0.0115)	(0.0025)	(0.0027)	(0.0025)
Surgery	-0.0733**	0.0270	-0.0679***	0.1037***	0.0947***	0.0933***
	(0.0351)	(0.0317)	(0.0173)	(0.0301)	(0.0314)	(0.0325)
Transfer	0.0311	0.0752	0.1093**	-0.2567***	-0.2918***	-0.2694***
	(0.0919)	(0.0873)	(0.0482)	(0.0596)	(0.0616)	(0.0638)
Moderate severity	-0.6667***	-0.5643***	-0.4394***	0.3172***	0.2766***	0.3056***
	(0.0798)	(0.0574)	(0.0648)	(0.0688)	(0.0732)	(0.0438)
Weekend	0.0687**	0.0655**	0.0801***	-0.0885***	-0.1868***	-0.0313
	(0.0330)	(0.0288)	(0.0181)	(0.0322)	(0.0386)	(0.0342)
Work experience	-0.0248	-0.0041	-0.0251***	-0.0121	-0.0132	0.0125
	(0.1438)	(0.1203)	(0.0073)	(0.0078)	(0.0086)	(0.0090)
Patient age	0.0379***	0.0193*	0.0323***	-0.0058***	-0.0062***	-0.0052***
	(0.0126)	(0.0106)	(0.0067)	(0.0009)	(0.0009)	(0.0011)
Patient gender	0.4628	0.0487*	0.0301*	-0.0207	-0.0211	-0.0272
	(0.3397)	(0.0277)	(0.0168)	(0.0276)	(0.0690)	(0.0261)
Marital status	-0.1220	-0.4430	0.5852	-0.0464	0.3582***	0.3353***
	(0.1108)	(0.6090)	(0.7834)	(0.0651)	(0.0681)	(0.0733)
Patient SES	0.1323*	0.2349***	0.1582***	-0.0593***	0.2766***	0.0546***
	(0.0768)	(0.0754)	(0.0450)	(0.0065)	(0.0371)	(0.0072)
Inpatient department	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓
Constant	-0.9608	2.2434	-8.7344***	7.1310***	-4.2731***	0.4951
	(0.8977)	(3.6955)	(2.0475)	(0.4703)	(0.5438)	(0.5790)
Pseudo R-squared	0.383	0.415	0.285	0.215	0.127	0.126
Observations	56,258	19,806	7,396	56,258	19,806	7,396

Notes: The table presents findings that delineate the influence of physicians' participation in OHC on first-time hospital visitors. These 'new patients' are specifically identified as individuals who have attended the hospital's inpatient service for the first time in our dataset. Model 1 & Model 4: without matching; Model 2 & Model 5: dynamic matching; Model 3 & Model 6: look-ahead matching. * p<0.1, ** p<0.05, *** p<0.01.

Table O3. The impact of physician-patient interactions within the OHC for new patients

	DV: Mortality	DV: Recovery

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Passive interactions	-0.0194	0.0030	-0.0112	-0.0051	-0.0048	-0.0103
	(0.0147)	(0.0148)	(0.0145)	(0.0056)	(0.0063)	(0.0075)
Active interactions		-0.0123	-0.0121		0.0095	0.0126
		(0.0141)	(0.0139)		(0.0086)	(0.0087)
Directed interactions			-0.0259*			0.0109**
			(0.0144)			(0.0048)
Physician workload	0.1091**	0.0198	0.2023**	0.0089*	0.0121**	0.0634***
	(0.0508)	(0.0908)	(0.1031)	(0.0053)	(0.0053)	(0.0069)
Length of stay	-0.0735	-0.2266**	-0.1846	-0.0099	-0.0033	-0.0112*
	(0.0778)	(0.1152)	(0.1157)	(0.0058)	(0.0059)	(0.0063)
Hospital visit	0.0341**	0.0375	0.0492**	-0.0138***	-0.0109***	-0.0159***
	(0.0168)	(0.0390)	(0.0216)	(0.0024)	(0.0025)	(0.0024)
Surgery	0.2008	0.7950	0.9265	0.0973***	0.0968***	0.0897***
	(0.3196)	(0.6743)	(0.7017)	(00296)	(0.00297)	(0.0299)
Transfer	0.0725**	0.1053**	0.1482*	-0.2570***	-0.2337***	-0.2325***
	(0.0343)	(0.0445)	(0.0779)	(0.0593)	(0.0595)	(0.0598)
Moderate severity	-0.5817***	-0.5702***	-0.5549***	0.3023***	0.2583***	0.2434***
	(0.0596)	(0.1984)	(0.1883)	(0.0346)	(0.0357)	(0.0349)
Weekend	0.0636**	-0.0682*	-0.0763*	-0.0852***	-0.0721**	-0.0575*
	(0.0287)	(0.0389)	(0.0476)	(0.0319)	(0.0321)	(0.0322)
Work experience	-0.0232	-0.0850***	-0.0781**	0.0101	-0.0087	-0.0093
	(0.1223)	(0.0304)	(0.0302)	(0.0076)	(0.0079)	(0.0084)
Patient age	0.0218**	0.0445**	0.0396*	-0.0043***	-0.0043***	-0.0021**
	(0.0098)	(0.0212)	(0.0218)	(0.0008)	(0.0009)	(0.0009)
Patient gender	-0.0422	0.1134	0.0935	-0.0135	-0.0344	-0.0247
	(0.0601)	(0.1403)	(0.0650)	(0.0244)	(0.0256)	(0.0289)
Marital status	-0.0512*	-0.0354*	-0.0381*	0.0531***	0.0524***	0.6224***
	(0.0275)	(0.0186)	(0.0203)	(0.0064)	(0.0067)	(0.0066)
Patient SES	0.2227***	0.5818***	0.5442***	-0.0484***	-0.0468***	-0.0313***
	(0.0766)	(0.1518)	(0.1479)	(0.0065)	(0.0069)	(0.0067)
Inpatient department	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓
Constant	1.8203	7.5221	8.0198	-6.6067***	-8.3498***	-7.3422***
	(3.7008)	(8.4523)	(8.4862)	(0.4615)	(0.5166)	(0.5156)
Pseudo R-squared	0.416	0.430	0.488	0.205	0.218	0.235
Observations	56,258	19,806	7,396	56,258	19,806	7,396

Notes: The table presents findings that delineate the influence of physicians' participation in OHC on first-time hospital visitors. These 'new patients' are specifically identified as individuals who have attended the hospital's inpatient service for the first time in our dataset. Model 1 & Model 4: without matching; Model 2 & Model 5: dynamic matching; Model 3 & Model 6: look-ahead matching. * p<0.1, ** p<0.05, *** p<0.01.

Appendix P. Evaluating the Impact of OHC Activities at the Physician Level

Table P1. Descriptive statistics of physicians' community activities

	Mean	SD	Min	Max
Online time	5.172	20.852	0	298
Posts	14.294	39.006	0	144
Online consultations	3.246	13.228	0	96
Groups	1.732	3.021	0	12

Notes. Online time measures the average number of hours spent in the OHC by a physician; Posts measure the average number of articles shared by a physician; Online consultations measure the average number of online consultations conducted by a physician; Groups measure the average number of groups led by a physician.

Table P2. Effect of physician's OHC activities on offline care quality

	DV: Mortality				DV: Recovery			
	M1	M2	M3	M4	M5	M6	M7	M8
# of hours	0.117	0.065	0.018	0.161	0.067	0.063	0.048	0.059
	(0.086)	(0.121)	(0.121)	(0.130)	(0.088)	(0.101)	(0.105)	(0.105)
# of posts		0.101	0.081	0.021		0.016	-0.048	-0.039
		(0.068)	(0.068)	(0.073)		(0.038)	(0.041)	(0.043)
# of online consultations			-0.808**	-0.651*			0.148***	0.134***
			(0.351)	(0.383)			(0.034)	(0.034)
# of groups				-0.758***				0.512***
				(0.168)				(0.035)
Physician workload	0.146***	0.144***	0.142***	0.176***	-0.013**	-0.014**	-0.013**	-0.012**
	(0.032)	(0.032)	(0.032)	(0.034)	(0.006)	(0.006)	(0.006)	(0.006)
Length of stay	0.037***	0.036***	0.033**	0.042***	-0.043***	-0.044***	-0.044***	-0.037***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.003)	(0.003)	(0.003)	(0.003)
Hospital visit	0.028*	0.028*	0.031**	0.029**	-0.012***	-0.012***	-0.012***	-0.017***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.002)	(0.003)	(0.003)	(0.003)
Surgery	-0.700***	-0.692**	-0.654**	-0.655**	0.231***	0.232***	0.231***	0.226***
	(0.268)	(0.269)	(0.272)	(0.279)	(0.036)	(0.036)	(0.036)	(0.037)
Transfer	1.212***	1.193***	1.186***	1.201***	-0.279***	-0.282***	-0.275***	-0.332***
	(0.278)	(0.281)	(0.283)	(0.286)	(0.067)	(0.068)	(0.068)	(0.068)
Moderate severity	-2.786***	-2.778***	-2.738***	-2.690***	1.566***	1.573***	1.594***	1.515***
	(0.304)	(0.304)	(0.304)	(0.307)	(0.454)	(0.454)	(0.455)	(0.451)
Weekend	0.219	0.218	0.204	0.193	-0.112***	-0.113***	-0.111***	-0.123***
	(0.249)	(0.248)	(0.249)	(0.249)	(0.039)	(0.039)	(0.040)	(0.040)
Work experience	-0.164***	-0.174***	-0.160**	-0.186***	0.119***	0.117***	0.124***	0.113***
	(0.059)	(0.061)	(0.062)	(0.063)	(0.009)	(0.011)	(0.010)	(0.012)
Patient age	0.055***	0.056***	0.054***	0.052***	-0.001	-0.002*	-0.002*	-0.001
	(0.008)	(0.008)	(0.008)	(0.008)	(0.001)	(0.001)	(0.001)	(0.001)
Patient gender	0.539***	0.536***	0.476**	0.388**	-0.175***	-0.176***	-0.174***	-0.120***
	(0.187)	(0.188)	(0.188)	(0.189)	(0.027)	(0.027)	(0.027)	(0.027)
Marital status	0.267	0.186	0.237	0.215	0.440***	0.447***	0.461***	0.484***
	(0.291)	(0.293)	(0.292)	(0.292)	(0.071)	(0.072)	(0.072)	(0.072)
Patient SES	0.347	0.341	0.351	0.343	-0.102**	-0.101**	-0.098**	-0.101**
	(0.473)	(0.473)	(0.472)	(0.467)	(0.042)	(0.042)	(0.042)	(0.042)
Department	✓	✓	✓	✓	✓	✓	✓	✓
Physician FEs	✓	✓	✓	✓	✓	✓	✓	✓
Time dummies	✓	✓	✓	✓	✓	✓	✓	✓
Pseudo R^2	0.288	0.288	0.292	0.303	0.187	0.187	0.189	0.192

Notes: * p<0.1, ** p<0.05, *** p<0.01.

Appendix Q. OHC Usage by Low-SES Patients

We have provided additional evidence in how low-SES patients use OHCs. Our data indicate that patients from low-SES are more likely to pose questions compared to those from high-SES. Specifically, 73% of patients from low-SES have initiated inquiries in Q&A forums, a figure that stands in contrast to the 59% observed among patients from high-SES. Furthermore, patients from low-SES have an average of 3.13 questions asked in these forums, significantly higher than the 1.94 average questions asked by patients from high-SES. Conversely, patients from high-SES demonstrate a greater propensity to respond to questions. The average number of replies from patients with high-SES in the community is 5.66, markedly higher than the 2.75 average replies from patients with low-SES.

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