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Supplier-Induced Demand and Telemedicine In Rural Illinois: An Exploratory Analysis

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Adee Athiyaman¹

Abstract

This paper explores the market for telehealth in rural Illinois; specifically, the argument that medical practitioners have the ability to generate demand for telemedicine services is empirically tested using data from the Medicare Beneficiary Survey, Bureau of Labor Statistics, and telemedicine use data from Center for Medicare Services. Results suggest that telemedicine use in the rural Midwest is around 40%, Covid-19 made one-in-three Midwesterners aware about telemedicine, and the service is associated with communities that have fewer healthcare professionals.

Introduction

In economics, demand-supply analysis is premised on independent demand and supply. This assumption has been questioned in the field of health economics; research suggests that medical practitioners have the ability to shift consumers' demand curve².

The first such evidence came from a study that demonstrated positive association between patient visits and number of

¹ Professor, Illinois Institute for Rural Affairs, Western Illinois University.

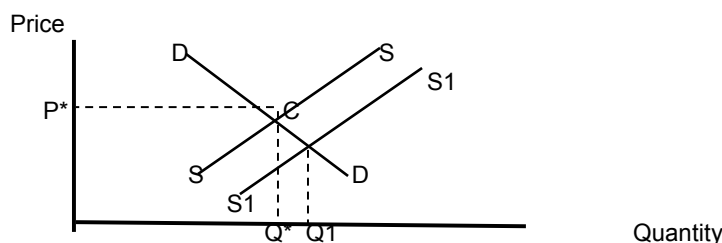
² See, for example, Stadhouders, N., Kruse, F., Tanke, M., Koolman, X., & Jeurissen, P. (2019). Effective healthcare cost-containment policies: a systematic review. *Health Policy*, 123(1), 71-79.

physicians³. A major criticism against this study is that it doesn't account for the 'availability effect'⁴, the reasoning that improved availability of health services may increase per capita usage because of, for example, shorter waiting time. A subsequent study by Fuchs which controlled for method variance found that a 10% increase in surgeon/population ratio results in a 3% increase in per capita utilization of surgical procedures⁵. In general, the supplier-induced demand (SID) hypothesis suggests that more the healthcare professionals in a community, the more the demand for healthcare. This paper explores whether telemedicine uptake in rural Illinois could be described as a supplier-induced demand.

Theory

Consider the demand-supply curve given in Figure 1, the relationship between price and quantity; in a competitive market, market equilibrium is achieved at p^* and q^* , point C. If there is an increase in supply, S_1 , equilibrium quantity increases (Q_1), but we cannot say anything about the price; this is because the increase in demand puts upward pressure on price whereas increase in supply puts downward pressure on price. This theory is challenged in the healthcare market; more doctors (healthcare professionals) result not only in higher utilization of medical services, but also little or no reduction in healthcare costs (price).

Figure 1: Shifts in Supply



Methodology

Two sources of data are used to gain insights into the research question, is telemedicine use induced by physicians. First, survey data at the individual level

from the Centers of Medicare and Medicaid Services (CMS) are tabulated to gain insights into Medicare enrollees' awareness and use of telemedicine

³ Fuchs, V. R. & Kramer, M. J. (1972). Determinants of expenditures for physicians' services in the US 1948-1968. New York: NBER Occasional Paper, No. 117.

⁴ Enthoven, A. C. (1981). The behavior of health-care agents: Provider behavior, in J.

Vander Gagg and Perlman, M., eds., *Health Economics and Health Economics*, Amsterdam: North Holland.

⁵ Fuchs, V. R. (1978). The supply of surgeons and the demand for operations. *Journal of Human Resources*, Fall, 35-36.

services⁶. Next, meso data on Illinois' nonmetro counties are used to compute rank correlations between telemedicine use and changes to the number of

healthcare professionals in the counties. Table 1 provides operational definitions of the variables.

Table 1: Variables and Data Sources

Variable and Definition	Data Source
ACV_TELMED: PCP offers telehealth appointments; binary, "yes" and "no" responses.	
ACV_TELMEDBE: PCP offered telehealth before Covid-19; binary, "yes" and "no" responses.	MCBS, 2020 Summer and Fall supplements and 2021 Winter.
ACV_TELMEDUS: Had telehealth visit; binary, "yes" and "no" responses.	
ACV_TELMEDT4: Type of telehealth visit; response options: telephone, video, and both.	
County employment in healthcare	BLS, quarterly employment by industry; data were sourced for the following NAICS codes: NAICS 621: Ambulatory healthcare services; NAICS 622: Hospitals; NAICS 623: Nursing and residential care (see Appendix 2 for data).
County-level telemedicine use	Author's research; see Footnote 9.

Results

Telemedicine in Rural Regions: Awareness and Utilization

Covid-19 increased rural Illinoisans' awareness and use of telemedicine⁷. Covid-19 was first detected in rural Illinois on March 15, 2020. Since then,

it has spread widely and as at December 1, 2021, 380,505 rural Illinoisans have contracted the virus and 7,357 have lost their life (Appendix 1).

Table 2 shows the telemedicine awareness levels of metro and nonmetro residents in the Midwest, computed using data from the Covid-19

⁶ <https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/MCBS>.

⁷ Approximately 360,000 Medicare enrollees were made aware of the service during Summer

2020; see Athiyaman, A. (2021). Consumer awareness of telemedicine during the Covid-19 pandemic: Demographic influences. *Research Brief*, 3(1), 1-6.

Summer 2020, Fall 2020, and Winter 2021 supplements to the Medicare Current Beneficiary Survey⁸. The Chi-square test did not reject the independence hypothesis; awareness levels did not differ between metro and

nonmetro, for any of the time periods. In general, 1/3rd of the Medicare population were made aware of telemedicine because of Covid-19.

Table 2: Awareness about Telemedicine in the Midwest: Metro and Nonmetro Differences

	Summer '20		Fall '20		Winter '21	
	Metro	Nonmetro	Metro	Nonmetro	Metro	Nonmetro
Covid-19 induced awareness	33%	28%	36%	28%	33%	33%
Pre-Covid-19 awareness	67%	72%	64%	72%	67%	67%
N	5,217,331	1,894,912	5,258,895	1,793,196	5,719,073	1,707,581

Table 3 shows telemedicine use in the metro and the nonmetro regions; two-in-five residents use the service. Although telemedicine use hasn't changed much from Fall 2020 to Winter 2021, CMS data suggest that telemedicine use in

the nonmetro regions registered a 329% growth during 2019 - 2020⁹. This time-period will be the focus of our statistical analysis next, to understand SID for telemedicine.

Table 3: Telemedicine Use: Midwest, Metro and Nonmetro Regions

	Fall '20		Winter '21	
	Metro	Nonmetro	Metro	Nonmetro
Telehealth Visit				
Yes	40%	39%	39%	38%
No	60%	61%	61%	62%
N	5,214,797	1,786,096	5,657,322	1,695,790

Note: χ^2 insignificant, variables are independent.

⁸ See reference in Footnote 6 for details about the MCBS supplement surveys.

⁹ Athiyaman, A. (2021). The Value of Telemedicine, *Research Brief*, 3(3), February 3,

1-25. Available online: http://www.iira.org/wp-content/uploads/2021/02/Telemedicine_ResBrief_3_Feb3_2021.pdf.

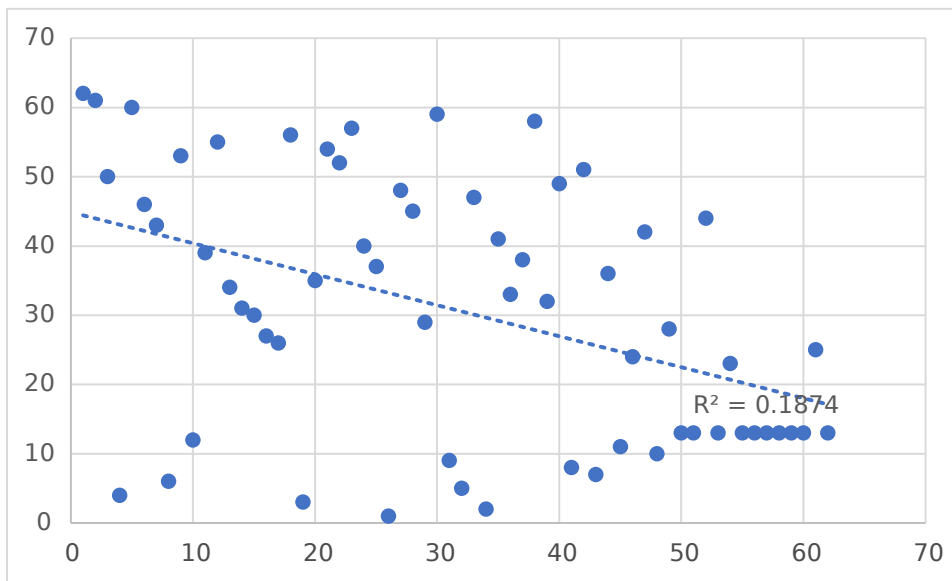
Test of SID

The argument for SID will be strengthened if there is a positive correlation between telemedicine use and number of healthcare professionals.

Figure 2

shows the strength of the relationship between the two variables; the correlation is negative. In other words, telemedicine is used in communities that lack healthcare professionals.

Figure 2: Telemedicine Use and Number of Healthcare Professionals: Scatter Plot



Summary and Conclusion

A much-debated question in health economics is about the ability of physicians to create demand for their services. This paper explored supplier induced demand for telemedicine in rural Illinois. The Covid-19 pandemic has influenced two-in-five Midwesterners to use telehealth services; conservative estimates place the growth of

Telemedicine in rural Illinois, from 2019 to 2020, at more than 300%¹⁰. This growth is not induced by physicians; I find little empirical support for the assertion that healthcare professionals create demand for telehealth services. In fact, empirical analysis suggests that Rural Illinoisans use telehealth services to compensate for lack of healthcare professionals in their community.

¹⁰ Same reference as footnote 9.

Appendix 1: Covid-19 Cases and Deaths in Illinois: Rural Counties

2020

County	No. of Cases	No. of Deaths	Rank, Cases	Rank, Deaths
Adams	6582	82	21	24
Brown	451	11	92	89
Bureau	2813	72	44	31
Carroll	1333	31	68	64
Cass	1586	29	60	69
Christian	2600	66	48	34
Clark	1212	25	74	75
Clay	1198	36	75	61
Coles	4294	71	27	33
Crawford	1578	31	61	64
Cumberland	937	25	83	75
Douglas	1854	28	56	70
Edgar	1344	42	66	53
Edwards	397	6	94	96
Effingham	3860	57	30	43
Fayette	2664	49	47	48
Franklin	3362	56	35	44
Fulton	2342	31	49	64
Gallatin	330	4	98	97
Greene	1115	41	77	55
Hamilton	601	10	88	90
Hancock	1316	30	69	68
Hardin	217	7	101	94
Henderson	397	13	94	87
Iroquois	2323	51	50	46
Jasper	894	14	85	85
Jefferson	2926	82	42	24
Jo Daviess	1388	24	65	78
Johnson	982	15	82	84
Knox	4059	126	29	18
LaSalle	8363	230	18	10
Lawrence	1985	27	53	72
Lee	2707	64	45	36
Livingston	3140	58	39	41
Logan	2705	51	46	46
Marion	3548	103	34	21
Mason	1026	38	81	59
Massac	893	28	86	70
McDonough	1978	46	54	51
Montgomery	2166	24	52	78
Morgan	3060	82	41	24
Moultrie	1260	27	71	72

Ogle	4102	65	28	35
Perry	2185	52	51	45
Pike	1395	41	64	55
Pope	196	1	102	100
Pulaski	560	3	90	99
Putnam	319	0	100	102
Randolph	3324	47	36	49
Richland	1309	37	70	60
Saline	1764	40	58	58
Schuyler	543	14	91	85
Scott	327	1	99	100
Shelby	1793	34	57	63
Stephenson	3242	62	38	37
Union	1697	31	59	64
Wabash	1048	13	79	87
Warren	1496	36	63	61
Washington	1225	24	73	78
Wayne	1336	41	67	55
White	1122	27	76	72
Whiteside	4956	160	25	16

2021

County	No. of Cases	No. of Deaths	Rank, Cases	Rank, Deaths
Adams	14429	188	21	23
Brown	1116	18	92	93
Bureau	4900	111	49	36
Carroll	2648	42	72	74
Cass	2769	40	69	76
Christian	5835	101	41	44
Clark	2981	51	64	68
Clay	2902	59	66	62
Coles	8685	138	26	28
Crawford	3539	47	58	69
Cumberland	2079	39	85	77
Douglas	3557	44	57	72
Edgar	2912	70	65	58
Edwards	1141	20	91	91
Effingham	7207	119	36	33
Fayette	4670	73	50	55
Franklin	7690	132	31	29
Fulton	5634	95	43	46
Gallatin	824	10	95	98
Greene	2180	53	84	67

Hamilton	1423	26	89	85
Hancock	3041	45	63	71
Hardin	671	16	100	95
Henderson	817	23	96	88
Iroquois	4661	85	51	52
Jasper	1738	23	87	88
Jefferson	6961	148	38	25
Jo Daviess	2604	32	75	83
Johnson	2463	38	76	78
Knox	7913	208	30	21
LaSalle	16155	351	20	13
Lawrence	3500	46	59	70
Lee	5148	104	48	42
Livingston	6348	117	40	34
Logan	5280	90	47	48
Marion	7505	159	33	24
Mason	2289	54	81	65
Massac	2325	57	79	63
McDonough	4062	78	54	53
Montgomery	5379	90	46	48
Morgan	5520	123	45	32
Moultrie	2631	42	73	74
Ogle	8614	104	27	42
Perry	4544	87	52	51
Pike	2883	61	68	61
Pope	594	6	102	100
Pulaski	1092	12	93	97
Putnam	643	6	101	100
Randolph	5744	109	42	38
Richland	3151	71	62	57
Saline	4543	89	53	50
Schuyler	1171	24	90	87
Scott	757	7	99	99
Shelby	3873	56	55	64
Stephenson	7181	124	37	31
Union	3291	54	60	65
Wabash	2248	22	82	90
Warren	2613	72	74	56
Washington	2243	36	83	81
Wayne	3266	66	61	60
White	2893	43	67	73
Whiteside	9304	231	24	18

Note: Total number of cases in rural Illinois, for 2020-2021 = 380,505; total deaths in the region = 7,357.

Appendix 2: Healthcare Employment Numbers, Rural Illinois

Year / Qtr. County	2019				2020				2021	
	1	2	3	4	1	2	3	4	1	2
Adams	3,183	3,108	3,093	3,110	3,103	2,979	2,880	2,899	2,866	2,851
Brown	112	110	110	113	115	101	105	109	106	88
Bureau	609	419	431	424	606	360	388	374	408	427
Carroll	162	154	150	165	242	177	243	173	171	179
Cass	190	187	186	182	185	176	168	161	157	161
Christian	1,168	1,128	1,133	1,147	1,096	937	972	1,022	1,126	1,142
Clark	234	227	244	243	242	190	169	163	155	154
Clay	262	208	204	210	271	242	192	183	218	200
Coles	1,991	2,011	2,042	2,015	1,936	1,839	1,802	1,780	1,940	1,886
Crawford	224	231	231	238	389	364	371	305	342	353
Cumberland	0	0	0	0	0	0	0	0	0	0
Douglas	214	216	222	219	284	193	141	116	187	184
Edgar	467	465	443	429	458	377	366	161	166	167
Edwards	21	26	25	22	22	19	17	17	18	18
Effingham	2,781	2,807	2,800	2,796	2,854	2,268	2,652	2,748	2,819	2,843
Fayette	281	285	295	301	301	119	146	154	156	153
Franklin	279	317	325	320	316	246	286	0	294	294
Fulton	1,012	1,028	1,039	1,037	1,045	979	934	879	929	925
Gallatin	0	0	0	0	0	0	0	0	0	0
Greene	34	36	37	34	33	28	32	30	35	36
Hamilton	126	123	121	123	125	17	16	18	19	19
Hancock	219	220	211	198	176	159	152	163	159	145
Hardin	0	0	0	0	0	0	0	0	0	0
Henderson	0	0	0	0	0	0	0	0	0	0
Iroquois	1,011	1,002	971	1,021	1,012	914	880	816	768	756
Jasper	0	0	0	0	0	0	0	0	0	0
Jefferson	3,332	3,309	3,324	3,325	3,292	2,987	3,057	3,131	3,169	3,095
Jo Daviess	317	308	312	327	313	247	249	279	273	284
Johnson	83	86	89	103	168	161	82	76	70	73
Knox	3,634	3,697	3,728	3,531	3,756	3,557	3,461	3,407	3,302	3,313
LaSalle	3,723	3,718	3,690	3,721	2,370	2,023	2,111	2,079	2,028	2,010
Lawrence	353	354	355	365	379	325	328	311	304	313
Lee County	1,005	978	986	989	983	916	937	946	951	974
Livingston	986	986	1,001	1,030	974	945	980	1,007	961	987
Logan	932	939	927	886	879	833	888	878	698	676
Marion	1,180	1,255	1,419	1,484	1,155	1,166	1,199	1,197	1,171	1,130
Mason	231	236	250	264	234	63	72	80	71	67
Massac	350	357	357	366	353	330	363	370	365	360
McDonough	644	656	663	682	667	537	524	536	570	552
Montgomery	1,014	1,017	907	896	897	837	834	830	833	813
Morgan	874	892	917	929	846	830	805	777	839	845
Moultrie	446	502	509	447	529	443	331	280	388	349
Ogle	947	975	980	955	985	936	886	858	854	814
Perry	384	430	228	242	238	201	228	232	225	223
Pike	247	245	243	242	231	315	204	280	305	200
Pope	0	0	0	0	0	0	0	0	0	0

Pulaski	7	7	7	7	8	7	7	8	7	7
Putnam	19	18	20	20	20	19	21	0	21	19
Randolph	685	697	706	716	731	654	677	691	414	634
Richland	339	344	350	369	392	367	165	168	169	169
Saline	562	683	744	722	849	853	832	810	780	784
Schuyler	0	0	0	0	0	0	0	0	0	0
Scott	0	0	0	0	9	0	0	0	0	0
Shelby	279	286	307	313	307	95	106	110	106	104
Stephenson	1,204	1,207	1,200	1,200	1,203	1,038	1,142	1,151	1,136	1,224
Union	801	812	812	808	811	794	777	756	687	668
Wabash	221	224	217	221	219	206	211	222	221	225
Warren	258	255	255	234	198	188	154	134	178	162
Washington	45	44	53	56	52	41	51	56	49	59
Wayne	136	139	138	143	145	137	144	154	151	145
White	442	438	450	416	404	402	394	393	234	171
Whiteside	1,605	1,637	1,632	1,624	1,613	1,354	1,362	1,352	1,423	1,439
Total, Nonmetro	41,863	42,040	42,088	41,975	41,019	36,493	36,492	35,830	35,990	35,869
