



Value of Mid-Level Practitioners in the Subspecialty Practice: The Case of Cardiology

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Overview

The workforce assessment conducted for the ACC addressed the following topics:

- Current Supply
- Current Demand
- Projections of Supply and Demand
- Subspecialty Choice
- Retirement and Part-time Work
- *Practice Efficiency*
- International Medical School Graduates (IMGs), Women, and Underrepresented Minority (URMs) in Cardiology

Practice Efficiency and the Value of Mid-Level Practitioners

Background

- The aging of the population will increase the demand for most health care services, including the services of many subspecialists
- At the same time, many baby-boom era practitioners will be retiring
- Greater use of mid-level practitioners is one way to increase the effective supply of services
- Purpose is to gain insights on factors affecting the efficiency of cardiology practices and the role of mid-level practitioners in the cardiology practice

Economic Theory

- An efficient practice is one that chooses a mix of resources that minimizes the cost of producing a given amount of care, holding quality constant
 - “Output” is measured here as revenue or as RVUs of care.
- Notional production or revenue function is of the general form:
$$Revenue_i = f(\text{Card}, \text{otherphysicians}, \text{NPs}, \text{PAs}, \dots \text{other_characteristics})$$
- We compute the revenue added by an additional cardiologist as:
$$\partial Revenue / \partial \text{Cardiologist} = \partial f / \partial \text{Cardiologist}$$
- Or, added by a nurse practitioner:
$$\partial Revenue / \partial PA = \partial f / \partial PA$$

Theory (continued)

- The efficient mix of resources, then, is the one which minimizes

$$w_C C + w_{np} NP + w_{PA} PA$$

$$\text{subject to } R = R^*$$

- The first order conditions from minimizing this expression, where “w” represents the price (or wage) of the respective practitioners, can be solved for the “cost function” for the practice:
 - The cost function provides the minimum cost necessary to generate a given level of care (or revenue)
 - The cost function can also be used to solve for derived demand for resources, including mid-level practitioners,
- The cost function is, itself, the result of a minimization or optimization process

Methods

- Three ACC practice surveys (private practice, academic practice, and pediatric practice) are used for descriptive and multivariate analysis of factors influencing practice total gross revenue, gross revenue per FTE and total RVUs earned.

- Factors assessed include:
 - Number of full-time/part-time cardiologists and other physicians;
 - Number of nurse practitioners and physicians assistances;
 - Number of full-time/part-time/outreach offices;
 - The degree to which the practice location is urban; and
 - Type of practice (e.g., multispecialty group, single specialty group, solo practice, academic practice).

Methods (continued)

- We use the survey data to provide a linear approximation to the “production function” $f(\dots)$
- Least squares regression is used to estimate the function, using as dependent variables:
 - Practice revenue
 - Practice RVUs
- The estimates allow us to infer how the mid-level practitioners contribute to the practice
- They provide information regarding efficient practice sizes, size at which mid-level practitioners are most advantageous, and other information regarding practice efficiency

Descriptive Statistics: Private Adult Practice

	Practice Size (Number of Full-time Physicians)					
	Solo	2-5	6-9	10-19	20-49	50+
Number of Practices	23	77	63	79	60	24
Practice Staffing Levels						
# of FT Cardiologists	1.00	3.30	7.13	13.29	22.46	28.63
# of PT Cardiologists	0.17	0.43	0.46	1.42	2.05	1.04
# of FT Other Specialty Physicians	0.00	0.18	0.30	0.39	6.01	102.13
# of PT Other Specialty Physicians	0.00	0.03	0.05	0.53	0.52	6.88
Use of Mid-Level Practitioners						
% Not Reporting NP or PA Data	8.7%	13.0%	11.1%	17.7%	10.0%	4.2%
% Do Not Use NPs or PAs	65.2%	36.4%	22.2%	3.8%	10.0%	8.3%
# of PAs in Practice with NP or PA	0.67	0.77	1.38	1.68	2.69	3.38
# of NPs in Practice with NP or PA	0.67	1.18	2.07	3.55	5.46	4.62
Number of Offices						
Number of Full-time Offices	0.91	1.18	1.75	2.53	4.53	11.25
Number of Part-time Offices	0.43	0.29	0.73	0.77	0.87	1.00
Number of Outreach Offices	0.09	1.04	1.24	1.65	2.97	3.58
Practice Type						
Single Specialty Group	8.7%	76.6%	92.1%	87.3%	71.7%	29.2%
Multi-Specialty Group	0.0%	6.5%	3.2%	5.1%	13.3%	41.7%
Medical School	4.3%	0.0%	3.2%	3.8%	1.7%	12.5%
Solo	82.6%	6.5%	0.0%	1.3%	3.3%	0.0%
Hospital	0.0%	1.3%	0.0%	1.3%	3.3%	8.3%
Government	4.3%	9.1%	1.6%	1.3%	6.7%	8.3%
Urbanicity						
Large Urban	82.6%	48.1%	34.9%	51.9%	45.0%	41.7%
Small Urban	13.0%	36.4%	30.2%	27.8%	33.3%	33.3%
Region						
West	13.0%	15.6%	15.9%	19.0%	13.3%	16.7%
South	30.4%	39.0%	30.2%	29.1%	38.3%	37.5%
NE	26.1%	20.8%	20.6%	30.4%	25.0%	33.3%
Practice County Characteristics						
Mean Cardiologists per Population	10.74	9.51	9.63	9.33	11.01	9.84
Percent Uninsured	11.8%	13.2%	12.6%	13.2%	12.8%	13.3%
Median Household Income (in Thousands)	\$46.29	\$42.39	\$42.64	\$45.00	\$43.82	\$46.11
Percent Medicare Beneficiaries	14.6%	15.4%	15.0%	14.2%	15.4%	14.6%

Descriptive Statistics: Academic Practices

	Number of Full-time Physicians	
	3-15	16+
Number of Practices	10	17
Practice Staffing Levels		
# of FT Cardiologists	8.70	27.82
# of PT Cardiologists	1.50	3.88
# of FT Other Specialty Physicians	0.10	1.88
# of PT Other Specialty Physicians	0.00	0.00
Use of Mid-Level Practitioners		
% Not Reporting NP or PA Data	10.0%	29.4%
% Do Not Use NPs or PAs	40.0%	23.5%
# of PAs in Practice with NP or PA	0.83	1.58
# of NPs in Practice with NP or PA	2.33	6.33
Number of Offices		
Number of Full-time Offices	1.50	3.35
Number of Part time Offices	0.50	0.82
Number of Outreach Offices	0.80	2.12
Urbanicity		
Large Urban	70.0%	64.7%
Small Urban	20.0%	23.5%
Region		
West	10.0%	11.8%
South	50.0%	35.3%
NE	20.0%	17.6%
Practice County Characteristics		
Mean Cardiologists per Population	10.43	13.91
Percent Uninsured	15.7%	14.1%
Median Household Income (in Thousands)	37.52	41.49
Percent Medicare Beneficiaries	14.6%	13.4%

Descriptive Statistics: Pediatric Practices

Characteristic	Number of Full-time Physicians	
	0-9	10+
Number of Practices	34	32
Practice Staffing Levels		
# of FT Cardiologists	3.91	18.59
# of PT Cardiologists	0.35	2.25
# of FT Other Specialty Physicians	0.09	6.06
# of PT Other Specialty Physicians	0.03	0.84
Use of Mid-Level Practitioners		
% Not Reporting NP or PA Data	44%	34%
% Do Not Use NPs or PAs	35%	13%
# of PAs in Practice with NP or PA	0.57	1.53
# of NPs in Practice with NP or PA	2.00	4.41
Number of Offices		
Number of Full-time Offices	1.09	2.16
Number of Part time Offices	1.79	3.50
Number of Outreach Offices	1.50	4.19
Practice Type		
Hospital	47.1%	84.4%
Private	52.9%	15.6%
Urbanicity		
Large Urban	70.6%	81.3%
Small Urban	23.5%	15.6%
Region		
West	20.6%	12.5%
South	44.1%	37.5%
NE	23.5%	25.0%
Practice County Characteristics		
Mean Cardiologists per Population	9.47	13.66
Percent Uninsured	14.2%	14.4%
Median Household Income (in Thousands)	\$44.84	\$42.31
Percent Medicare Beneficiaries	15.3%	14.1%

Descriptive Statistics: Revenue and RVUs per FTE Physician: Private Practice

	Practice Size (Number of Full-time Physicians)					
	Solo	2-5	6-9	10-19	20-49	50+
RVUs per FTE						
Less than 9,000	33%	32%	24%	21%	35%	23%
9,000-9,999	17%	9%	24%	24%	8%	15%
10,000-10,999	33%	32%	34%	18%	13%	23%
Greater than or equal to 11,000	17%	27%	17%	38%	45%	38%
Number of Practices	6	22	29	34	40	13
Gross Revenue per FTE						
Less than \$1 million	59%	33%	29%	22%	35%	64%
\$1 million to \$1.999 million	29%	36%	32%	47%	40%	18%
\$1.2 million to \$1.399 million	0%	20%	6%	20%	5%	0%
Greater than \$1.4 million	12%	11%	32%	11%	20%	18%
Number of Practices	17	55	34	45	20	11

Descriptive Statistics: Revenue and RVUs per FTE Physician: Academic Practice

	Number of Full-time Physicians	
	3-15	16+
RVUs per FTE		
Less than 9,000	40.0%	52.9%
9,000-9,999	10.0%	17.7%
10,000-10,999	20.0%	11.8%
Greater than or equal to 11,000	10.0%	5.9%
Don't Record RVUs	20.0%	11.8%
Gross Revenue per FTE		
Less than \$1 million	90.0%	64.7%
\$1 million to \$1.1999 million	10.0%	29.4%
\$1.2 million to \$1.399 million	0.0%	5.9%

Descriptive Statistics: Revenue and RVUs per FTE Physician, Pediatric Practice

	Number of Full-time Physicians	
	0-9	10+
RVUs per FTE		
1,000-2,499	11.8%	9.7%
2,500-3,999	5.9%	9.7%
4,000-8,999	11.8%	16.1%
Greater than or equal to 9,000	8.8%	3.2%
We Don't Measure RVUs	61.8%	61.3%
Gross Revenue per FTE		
\$100,000-\$249,999	24.2%	30.0%
\$250,000-\$499,999	33.3%	40.0%
\$500,000-\$999,999	36.4%	16.7%
Greater than \$1.0 million	6.1%	13.3%

Use of Mid-Level Practitioners Varies

- Among private practices larger practices were more likely to indicate use of mid-level practitioners.
 - Approximately 65% of solo and 36% of practices with 2-5 full-time physicians indicated they had no mid-level practitioners.
 - Only 10% of practices with over 20 full-time physicians indicated no use of mid-level practitioners.
- Among practices using mid-level practitioners, smaller practices have higher ratios of mid-level practitioners per full-time physicians
 - Nevertheless, overall smaller practices are less likely to employ mid-level practitioners
 - This suggests that, due to discontinuities in employment, there may be scale effects that make employment of mid-level practitioners more likely in larger practices.

Results: Practice Revenue as Dependent Variable

Variable	All Practices		Small Practices 1-9 Physicians		Larger Practices 10 or More Physicians	
	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
Intercept	162	1,011	604 #	351	2,095	3,465
Number of Fulltime Cardiologists	717 **	34	871 **	50	705 **	48
Number of Parttime Cardiologists	78	94	365 **	119	100	125
Number of Fulltime Other Physician	710 **	20	948 **	135	683 **	30
Number of Parttime Other Physician	308 **	93	-416	531	259 *	126
Number of Physicians' Assistants	337 **	104	117	74	337 *	153
Number of Nurse Practitioners	298 **	95	184 *	88	269 *	136
Number of Fulltime Offices Owned	774 **	120	158	144	721 **	163
Number of Parttime Offices Owned	-151	123	133 #	72	-116	189
Number of Outreach Offices	-1	66	7	39	38	102
Type of Practice (Solo Adult or Academic Group Excluded)						
Multi-Specialty Group	4,826 **	1,348	747	541	6,785 #	3,631
Cardiology Only Group	1,644 #	923	657 *	320	1,596	3,295
Medical School	2,150	1,723	259	914	1,868	3,934
Hospital	439	2,045	-128	1,223	799	4,127
Government	2,175	1,445	-370	494	5,154	4,154
Other	-1,013	2,356	911	911	-2,879	5,090
Academic	1,055	1,344	-382	663	-1,293	3,613
Pediatric Hospital-Based	-6,463 **	1,198	-2,923 **	446	-10,347 **	3,538
Pediatric Private	-3,447 **	1,306	-1,533 **	424	-8,399 *	4,063
Urbanicity of Location (Non-Urban Excluded)						
Located in Large Urban Area	44	618	-499 *	243	498	1,148
Located in Small Metro Area	609	660	-237	257	1,066	1,232
Reported RVUs Only	-3,253 **	521	-1,702 **	205	-5,265 **	969
Missing PA Data	215	731	-91	318	-602	1,251
Missing NP Data	2,050 *	902	85	334	4,776 *	1,860
Number of Observations	400		195		205	

** Significantly different from zero at the 99% confidence level.

* Significantly different from zero at the 95% confidence level.

Significantly different from zero at the 90% confidence level.

Results: Practice Revenue per FTE Physician as Dependent Variable

Variable	All Practices		Small Practices 1-9 Physicians		Larger Practices 10 or More Physicians	
	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
Intercept	1,012 **	44	1,013 **	58	1,001 **	117
Number of Fulltime Cardiologists	-3 *	1	-13	8	-2	2
Number of Parttime Cardiologists	-7 #	4	-11	20	-7 #	4
Number of Fulltime Other Physician	0	0	3	22	-1	0
Number of Parttime Other Physician	-1	2	-88	88	-2	2
Number of Physicians' Assistants	11 *	4	20	12	9 #	5
Number of Nurse Practitioners	9 *	4	34 *	15	7	5
Number of Fulltime Offices Owned	9 *	4	28	24	9 *	4
Number of Parttime Offices Owned	11 *	5	29 *	12	6	6
Number of Outreach Offices	3	3	5	6	0	3
Type of Practice (Solo Adult or Academic Group Excluded)						
Multi-Specialty Group	105 #	54	114	90	103	119
Cardiology Only Group	120 **	40	122 *	53	109	113
Medical School	46	73	47	152	24	133
Hospital	-25	89	-61	203	-28	141
Government	-48	62	-105	82	25	137
Other	18	96	185	152	-99	159
Academic	-93	58	-92	110	-107	123
Pediatric Hospital-Based	-598 **	52	-621 **	74	-575 **	121
Pediatric Private	-447 **	57	-488 **	70	-335 *	136
Urbanicity of Location (Non-Urban Excluded)						
Located in Large Urban Area	-8	27	-25	40	-3	38
Located in Small Metro Area	9	28	2	43	11	41
Reported RVUs Only	-308 **	22	-324 **	34	-281 **	32
Missing PA Data	-23	31	5	53	-32	41
Missing NP Data	54	39	24	56	104	63
Number of Observations	409		195		214	

Results: Practice RVUs as the Dependent Variable

Variable	All Practices		Small Practices 1-9 Physicians		Larger Practices 10 or More Physicians	
	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
Intercept	-11,967	17,912	2,062	5,126	-26,320	52,554
Number of Fulltime Cardiologists	9,209 **	506	9,225 **	801	9,235 **	719
Number of Parttime Cardiologists	2,814 **	875	5,380 *	2,094	2,882 *	1,150
Number of Fulltime Other Physician	9,425 **	291	8,473 **	1,458	9,361 **	417
Number of Parttime Other Physician	4,107 **	1,085	3,974	6,172	3,823 **	1,444
Number of Physicians' Assistants	2,810 *	1,177	1,252	893	2,955 #	1,711
Number of Nurse Practitioners	-711	1,271	2,192	1,418	-1,023	1,779
Number of Fulltime Offices Owned	7,569 **	1,652	-1,864	2,085	7,431 **	2,243
Number of Parttime Offices Owned	2,976	2,571	768	1,255	3,163	3,901
Number of Outreach Offices	-209	763	-252	582	-206	1,091
Type of Practice (Solo Adult or Government Excluded)						
Multi-Specialty Group	25,023	21,049	12,849 #	6,669	44,531	54,827
Cardiology Only Group	5,790	16,806	4,997	4,795	20,048	50,854
Medical School	-24,718	22,948	5,269	8,585	-17,888	57,174
Hospital	-7,216	23,300	-2,250	10,293	4,091	55,074
Government	875	41,906	-4,913	9,682	NA	.
Other	-59,330 #	32,836	NA	.	-48,514	61,120
Academic	-16,541	18,989	7,618	6,894	-9,271	52,264
Urbanicity of Location (Non-Urban Excluded)						
Located in Large Urban Area	-19	8,158	-4,370	3,190	3,051	13,815
Located in Small Metro Area	849	8,871	-4,753	3,492	5,621	15,479
Missing PA Data	2,217	12,926	-2,708	5,308	1,978	22,223
Missing NP Data	440	15,505	7,440	5,791	2,896	28,992
Number of Observations	161		60		101	

Results: Summary

- An additional full time cardiologist adds, on average, about \$700,000 to the practice
 - This amount is higher for smaller practices, suggesting diminishing returns
- Multispecialty groups appear to generate more revenue than cardiology-only groups
 - Both do better than solo or academic groups
- Revenue per physician is largest in cardiology-only groups, followed by multi-specialty groups
- Adding cardiologists to a group, other things remaining the same, decreases revenue per physician
- Results for RVUs are very similar to results for revenue

Value of Mid-Level Practitioners

- Regression results indicate that each additional nurse practitioner or physician assistant adds about \$300,000 in gross revenue for the practice
 - This is about 40% of the earnings brought in by each additional physician.
- An additional NP or PA adds more total revenue to larger practices but more revenue per physician to smaller practices

Efficient Practice

- Using the production function approach, similar to the one applied here, one can solve for the efficient mix of physicians and mid-level practitioners
- Given an estimate of the production function, one can derive a “cost function” showing the minimum cost of providing a given level of care
- From “cost function”, we can derive the demand for mid-level practitioners and other health care resources
- A non-linear form of the production function, similar to the one estimated here, would allow us to do this
 - However, the regression approach itself estimates the “average” observed relationship between resources and care provided, not necessarily the relationship that is technically efficient

Summary

- Mid-level practitioners add significant value to the subspecialty practice
 - Our estimate for the case of cardiology is about \$300,000 per additional mid-level practitioner employed
 - An additional cardiologists adds about \$700,000
- Analysis of the case of cardiology suggests that mid-level practitioners are an efficient and possibly underutilized resource in cardiology practice
- The value of mid-level practitioners will depend on practice size and other factors
- The approach taken here to estimating a practice “production function” can provide insights on the efficient mix of practice resources and the demand for practitioners