Understanding the Factors that Affect the Appropriateness of Rheumatology Referrals

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Abstract

Background: Reducing inappropriate referrals to specialists is a challenge for the healthcare system as it seeks to transition from volume to value-based healthcare. Given the projection of a severe shortage of rheumatologists in the near future, innovative strategies to decrease demand for rheumatology services may prove more fruitful than increasing the supply of rheumatologists. Efforts to increase appropriate utilization through reductions in capacity may have the unintended consequence of reducing appropriate care as well. This highlights the challenges in increasing the appropriate use of high cost services as the health system transitions to value based care. The objective of this study was to analyze factors affecting appropriateness of rheumatology services.

Methods: This was a cross-sectional study of patients receiving Rheumatology services between November 2013 and October 2019. We used a proxy for “appropriateness”: whether or not there was any follow-up care after the first appointment. Results from regression analysis and physicians’ chart reviews were compared using an inter-rater reliability measure (kappa). Data was drawn from the EHR 2013-2019.

Results: We found that inappropriate referrals increased 14.3% when a new rheumatologist was hired, which increased to 14.8% after wash-out period of 6 months; 15.7% after 12 months; 15.5% after 18 months and 16.7% after 18 months. Other factors influencing appropriateness of referrals included severity of disease, gender and insurance type, but not specialty of referring provider.

Conclusions: Given the projection of a severe shortage of rheumatologists in the near future, innovative strategies to decrease demand for rheumatology services may prove more fruitful than increasing the supply of rheumatologists. Innovative strategies to decrease demand for rheumatology services may prove more fruitful than increasing the supply of rheumatologists. These findings may apply to other specialties as well. This study is relevant for health care systems that are implementing value-based payment models aimed at reducing inappropriate care.

Background

Using specialist-trained physicians appropriately is a challenge for the healthcare system. Specialists have greater knowledge of particular diseases and conditions and can, for some patients, provide superior care to primary care physicians (1). But specialists are also more expensive (2, 3), use more ancillary services (4), and often provide care outside their narrow provider specialty (5). And, beyond those issues, the availability of many specialists is limited, with projections of shortages for many specialist types (6, 7).

The appropriate use of specialists is not a primary problem for many healthcare systems in a volume-based system. Under Fee-For-Service (FFS), reimbursement rates were higher for specialists than primary care providers were, so “over” utilization of specialists generated higher revenues for the system. But as the healthcare system begins to transition away from volume and toward value based care (8–12), the

financial incentives for the use of specialty care are also transitioning (13–15), leading to a need for more effective targeting of patients to specialists.

Yet most specialists actually have limited control over the demand for their services. Patients do sometime self-refer to specialists (16–18), but many specialists receive referrals from primary care providers (19). To effectively target patients and resolve potential or actual shortages of services, it is therefore necessary to understand what patient, provider and clinic factors effect patient referrals.

One additional complication is the possibility of “supplier induced demand” (20–22). This is the idea that the number of referrals may be endogenous to the number of providers. Given that there is discretion in when a referral is “needed”, the availability of capacity may induce inappropriate utilization.

One specialty where the referral challenge is particularly acute is rheumatology. An aging population and declining work force are creating shortages of providers in some areas, with demand for rheumatology services already exceeding supply by about 13%, or approximately 700 full-time equivalent (FTE) rheumatologists (1). By 2030, demand is expected to outpace supply by 4,133 FTEs (102%).

The ability to increase the supply of rheumatologists is limited by a number of factors, including restrictions on fellowship program positions, inadequate fellowship program fill-rates, a trend toward part-time work, and challenges surrounding international medical graduates’ ability to remain in the US (23). Given the projection of a severe shortage of rheumatologists in the near future, innovative strategies to decrease the demand for rheumatology services by targeting services to patients who will benefit the most may prove more fruitful than increasing the supply of rheumatologists.

A review of the literature on interventions that address specialty referral management found that about one-third of referrals to rheumatologists are unnecessary or inappropriate (24). Several studies have evaluated interventions to improve the quality of referrals to rheumatologists. The most effective interventions combine iterative rheumatologist feedback to the referring provider, along with clear referral criteria or evidence-based guidelines (24–26). A study by Lohr et al. compared the quality of referrals from physicians, physician assistants and nurse practitioners and found that referrals from physicians were of better quality (measured by a number of factors) and were less likely to be unnecessary (27). Little is known regarding other (physician) factors that affect the appropriateness or quality of referrals.

The objective of this study was to identify factors that affect the appropriateness of rheumatology referrals from primary care providers. We used a quantitative analysis using quasi-experimental design and regression analysis. To understand whether induced demand for rheumatology care leads to an increase in inappropriate referrals, we looked at the effect of the start of an additional rheumatologist on the appropriateness of referrals. We looked at this effect 2 months after the start of the rheumatologist (assuming that there would be at least 2 months between a referral and a first appointment) and during a washout period of 6 months, 12, 18 and 24 months, enabling us to analyze the referrals pattern over a period of time.

Methods

all methods were carried out in accordance with relevant guidelines and regulations. The institutional review boards of the Central Vermont Medical Center and the University of Vermont approved this study. We used de-identified data from electronic health records; no consent to participate was needed or received for this study.

Data

Our primary source of data for this study was Electronic Health Records (EHRs). Our sample included all patients who visited the Central Vermont Medical Center (CVMC) between November 1, 2013 and October 31, 2019. Our sample inclusion criteria was an appointment in CVMC Rheumatology, providing an initial sample size of 3,387 referrals. Exclusion criteria included: patients who did not complete their initial Rheumatology appointment and those with no-shows and cancellations. We also limited the final data set to be one occurrence per unique patient during the study period (n = 2,765). Approximately a third of referrals were internal providers (n = 916) and two thirds were external (n = 1,849).

Design and Study Setting: Defining Appropriate Referral

To determine whether a referral was appropriate, three Rheumatology rheumatologists at the medical center performed chart reviews and made independent assessments about appropriateness. The inter-rater reliability of the comparison was calculated using Cohen's kappa (K). Kappa measures the concordance between two different measures of two raters. It adjusts for the rate of agreement expected by random chance using Eq. (1):

$$(1) \qquad K = \frac{P0 - Pe}{1 - Pe} = 1 - \frac{1 - P0}{1 - Pe}$$

where P_0 is the observed agreement among raters, and P_e is the hypothetical probability of chance agreement, which is defined by using the observed data to calculate the probabilities of each observer randomly seeing each referral. If the raters are in complete agreement, then K=1.

The results of the chart reviews, indicating which referrals were "appropriate" according to clinician's judgment, were also compared to the proxy measure from the EHR data using an inter-measure reliability measure.

We also used proxy for "appropriateness" of referrals: whether or not there was any follow-up care for the patient after the first rheumatologist visit. The logic of this measure is that if the patient required continuing care from the rheumatologist, the referral was appropriate. If no continuing care was offered, then the referral was not appropriate.

Analytically, we used logit models to identify factors affecting the appropriateness of referral. Control variables included patient characteristics (age, gender, CCI and county), insurance status and provider characteristics (whether the referring person was a physician or Advanced Practice Provider (APP) and

service line (family practice, internal medicine, other specialty or naturopath). In addition, we used 10 years of discharge diagnoses for patients with Rheumatology appointments to develop a Charlson Comorbidity Index (CCI) based on their ICD-10 codes reported in the EHR during this 10-year period. The dependent variable in the analysis was whether or not the referral was identified as appropriate.

We used a Difference-in-Differences (DiD) model to analyze if there were changes in referral-appropriateness when the new rheumatologist started, hypothesizing that increased supply may lead to induced demand.

The difference-in-differences model is estimated as follows in equation (2):

$$(2) \quad p(Inappropriate\ referral) = Constant + IR\ \beta_1 + rheumatologist\ \beta_2 + IR\ x\ rheumatologist\ \beta_3 + Control\ Variables\ \beta_{Control} + u$$

where IR = 1 if the patient was internally referred, according to the EHR, and 0 if a patient was identified as externally referred, and rheumatologist = 1 after the date the extra rheumatologist started and 0 otherwise. The coefficient of the treatment variable, β1, is the estimated mean difference in inappropriate referrals between the internally and externally referred patients. It represents whatever "baseline" differences existed between the groups before the new rheumatologist was added. β2 is the expected mean change in outcome from before to after the start of the new rheumatologist. The rheumatologist effect on inappropriate referrals is measured by β3, the coefficient on the interaction term (IR x rheumatologist) which measures the “difference-in-differences”. It tells us whether the expected mean change in the probability of having an inappropriate referral from before to after the rheumatologist started was different in the two groups. We used marginal effects for all models, which measure the discrete change.

Results

Descriptive statistics for the sample are provided in Table 1. Of the additional scheduled appointments in the EHR during the research period, 70 percent were completed, 9 percent were cancelled by the patient, 13 percent were rescheduled, 4 percent of patients did not show up for the appointment and 4 percent were office cancellations. After the non-completed referrals were excluded, the total sample size was 2,765 patients, of which about a third internally referred (n = 916) and two thirds were externally referred (n = 1,849).

Table 1
Summary Statistics by Appropriateness of Referral

	Appropriate (n = 1,921) % (n)	**Inappropriate (n = 844) % (n)**
Age (yrs) *		
< 40	13.7 (264)	19.1 (161)
40–49	13.8 (265)	15.2 (128)
50–59	23.3 (448)	21.8 (184)
60–69	25.0 (481)	23.2 (196)
70–79	16.3 (313)	12.9 (109)
80+	7.8 (150)	7.8 (66)
Gender *		
Male	30.6 (588)	26.5 (224)
Female	69.4 (1333)	73.5 (620)
Insurance Type*		
Medicare	10.2 (196)	14.1 (119)
Medicaid	45.2 (869)	41.1 (347)
Private or other	44.6 (856)	44.8 (378)
CCI*		
Zero	39.3 (369)	55.9 (254)
One	31.7 (297)	24.4 (111)
Two	13.1 (123)	6.8 (31)
Three or More	15.9 (149)	12.8 (58)
Provider Characteristics		
Referred by rheumatologist or DO		
Family Practice	0.66 (654)	0.66 (257)
Internal Medicine	0.26 (252)	0.23 (89)
Specialty	0.08 (77)	0.11 (44)
Naturopath	0 (0)	0 (0)

	Appropriate (n = 1,921) % (n)	Inappropriate (n = 844) % (n)
Referred by APP or other		
Family Practice	0.33 (314)	0.33 (148)
Internal Medicine	0.03 (29)	0.03 (13)
Specialty	0.04 (33)	0.04 (16)
Naturopath	0.02 (16)	0.03 (12)
Not Specified other	0.58 (546)	0.58 (256)

***** Chi-square, $p < .05$

After comparing rheumatologist's chart reviews (n = 102) for the appropriateness of referrals, we found that there was 84.3 percent actual agreement and 72.2 percent expected agreement. The inter-rater reliability measure kappa, therefore, was 0.68, which represents "substantial agreement" (10). We found that there was 88 percent agreement between the reviewers and the follow-up proxy measure in the EHR data. The inter-measure kappa (comparing the reviewer rating and whether a follow-up was scheduled) is 0.65, which again represents substantial agreement.

There were more females with inappropriate referrals (73.5%) than with appropriate referrals (69.4%). A higher comorbidity index was associated with a greater likelihood of an appropriate referral (i.e., for CCI = 1, appropriate referrals 31.7% versus 24.4% for inappropriate referrals; 13.1% versus 6.8% for CCI = 2 and 15.9% versus 12.8% for CCI > 2). There were fewer Medicare enrollees (10.2% versus 14.1%) and more Medicaid enrollees (45.2% versus 41.1%) in the group with appropriate referrals. The number of patients with private or other insurance did not significantly differ between groups (44.6% versus 44.8%). The rate of inappropriate referrals was higher for external referrals compared to internal referrals (72% vs. 28%) chi-sq, p = .03). There was a significantly higher percentage of patients under the age of 40 in the group that had inappropriate referrals (19.1%) than in the group with appropriate referrals (13.7) as well as in the age-group 40 to 50 (15.2% versus 13.8%).

Regression Analysis

We analyzed factors affecting appropriateness of referrals and the effect of introducing an additional rheumatologist (Table 2). We found that patient gender, severity of disease (comorbidities represented by the CCI) insurance status, and where patients live/were referred were predictive of inappropriate referrals. Females had 4.2% higher probability of inappropriate referrals than men did (p = 0.03). Patients with a CCI of 1 had a 15.1% lower probability ($p < 0.01$) of getting an inappropriate referral compared to those

with a CCI of 0. This relationship remained for the other comparisons of non-zero CCI compared with CCI = 0. Specifically, the probability of an inappropriate referral was 16.7% lower for CCI = 2 compared to CCI-0 ($p < .01$); 13.6% lower for CCI = 3 ($p < .01$) and 18.8% for CCI = 4 and 13.9 for patients with CCI = 5 or higher ($p < 0.01$).

Table 2
Rheumatologist *start - Base Model*

	(1)		
	Inappropriate		
Start new rheumatologist	0.1475***		
	(0.0187)		
Internally referred	0.0081	Rheumatologist or DO	0.0112
	(0.0238)		(0.0332)
CCI = 1 (ref CCI = 0)	-0.1507***	Family Practice	-0.0466*
	(0.0206)	*(incl Peds, NP, PA)*	(0.0238)
CCI = 2	-0.1670***	Internal Medicine	-0.0165
	(0.0305)		(0.0235)
CCI = 3	-0.1360***	Specialized Dept.	-0.0323
	(0.0383)		(0.0278)
CCI = 4	-0.1879***	Naturopath	-0.0315
	(0.0541)		(0.0389)
CCI = 5	-0.1393***	Lamoille county	-0.1007**
	(0.0427)		(0.0444)
female	0.0419**	New Hampshire	0.2419**
	(0.0191)		(0.1073)
age	-0.0014*	New York	-0.3035**
	(0.0007)		(0.1497)
Medicaid (ref: Medicare)	0.0112		
	(0.0332)		
Private ins (ref: Mcare)	-0.0466*		
	(0.0238)		
Observations	2,762		

Table 3
Difference-in-Differences: start of new rheumatologist

	DiD model		
Start rheumatologist	-0.0504	Rheumatologist or DO	-0.0150
	(0.0372)		(0.0235)
Internally Referred	0.1176***	Family Practice	-0.0316
	(0.0230)	*(incl Peds, NP, PA)*	(0.0278)
Interaction rheumatologist*internal	0.0856**	Internal Medicine	-0.0336
	(0.0405)		(0.0391)
CCI = 1 (ref CCI = 0)	-0.1502***	Specialized Dept.	0.0091
	(0.0203)		(0.0484)
CCI = 2	-0.1658***	Naturopath	0.0359
	(0.0302)		(0.0808)
CCI = 3	-0.1362***	Lamoille county	-0.0983**
	(0.0383)		(0.0440)
CCI = 4	-0.1813***	New Hampshire	0.2433**
	(0.0540)		(0.1000)
CCI = 5	-0.1387***	New York	-0.2962**
	(0.0421)		(0.1480)
female	0.0411**		
	(0.0191)		
age	-0.0014*		
	(0.0008)		
Medicaid (ref Medicare)	0.0111		
	(0.0332)		

Standard errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1
No significant effects for rheumatologist /DO and service line
Interaction effect goes up to 15% after 18 months and 18% after 24 months (p < .05)

	DiD model
Private/other insurance	-0.0461*
	(0.0240)
Observations	2,762
Standard errors in parentheses	
*** p < 0.01, ** p < 0.05, * p < 0.1	
No significant effects for rheumatologist /DO and service line	
Interaction effect goes up to 15% after 18 months and 18% after 24 months (p < .05)	

As in the previous models, we found no significant effect for whether or not the referring provider was a physician versus APP or other type of rheumatologist.

Discussion And Conclusions

In this paper, asked what proportion of rheumatology referrals are appropriate and which factors predict the appropriateness of referrals, such as insurance type, socio-demographics, and specialty capacity (i.e., wait time). We found moderately strong agreement among the rheumatologists about which cases should and should not have been referred, and the clinician's judgment agreed largely with the proxy EHR measure of inappropriateness.

Our findings suggest that there are high levels of inappropriate referrals and that there are systematic, modifiable factors that predict whether a referral is appropriate or not. We found that patient characteristics such as gender, age and comorbidities affect the probability of an inappropriate referral. Those who are privately insured were less likely to have an inappropriate referral than Medicare enrollees, the latter who may seek care without a referral from their primary care provider. We found no significant difference among referring physicians versus APPs and inappropriate referrals; we also did not find differences across services lines. We did find that internal referrals drive a large portion of the difference in the change in unnecessary referrals after adding another rheumatologist to the practice. This might occur because internal providers are more likely to be aware of the additional capacity than external providers are.

Reducing inappropriate referrals can happen in a multitude of ways. The challenge moving forward will be to prospectively identify the inappropriate referrals and then reduce their volume. Moving toward adopting a system where we are able to provide additional training and guidance to primary care providers may help. eConsult is a structure from which this teaching may occur (28). Specifically, consult questions are sent to the specialist and cases are then reviewed based on the available information. Back and forth, communication can then occur between the PCP and specialist until either the issue is resolved

or there is a decision to have an in-person visit. Over time, possible benefits include increased PCP knowledge, reduced wait times, and reduction in inappropriate in-person visits.

We also find that capacity is strongly associated with inappropriate referrals. This suggests a dilemma for the health system moving forward. As capacity was added, the vast majority of the additional referrals were appropriate, for both internal and external referrals. Yet the proportion of inappropriate referrals increased. This suggests that efforts to increase appropriate utilization through reductions in capacity may have the unintended consequence of reducing appropriate care as well. This highlights the challenges in increasing the appropriate use of high cost services as the health system transitions to value based care.

Declarations

Ethics Approval and Consent to participate: The institutional review boards of the Central Vermont Medical Center and the University of Vermont approved this study, CHRMS (Medical): STUDY00000717 (Approval Date - January 8, 2020). We used de-identified data from electronic health records; the CHRMS waived the need for informed consent according to Sec.__.104(d)(4): Secondary research for which consent is not required.

Consent for publication: Not applicable.

Availability of data and materials: The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors contributions: EvdBA performed the quantitative data analysis. TF performed the chart reviews, TF and AA calculated the interrater reliability measure (kappa). EvdBA, AA, and TF wrote the main manuscript. NC performed additional analysis with the data and edited the main manuscript. All authors reviewed the manuscript.

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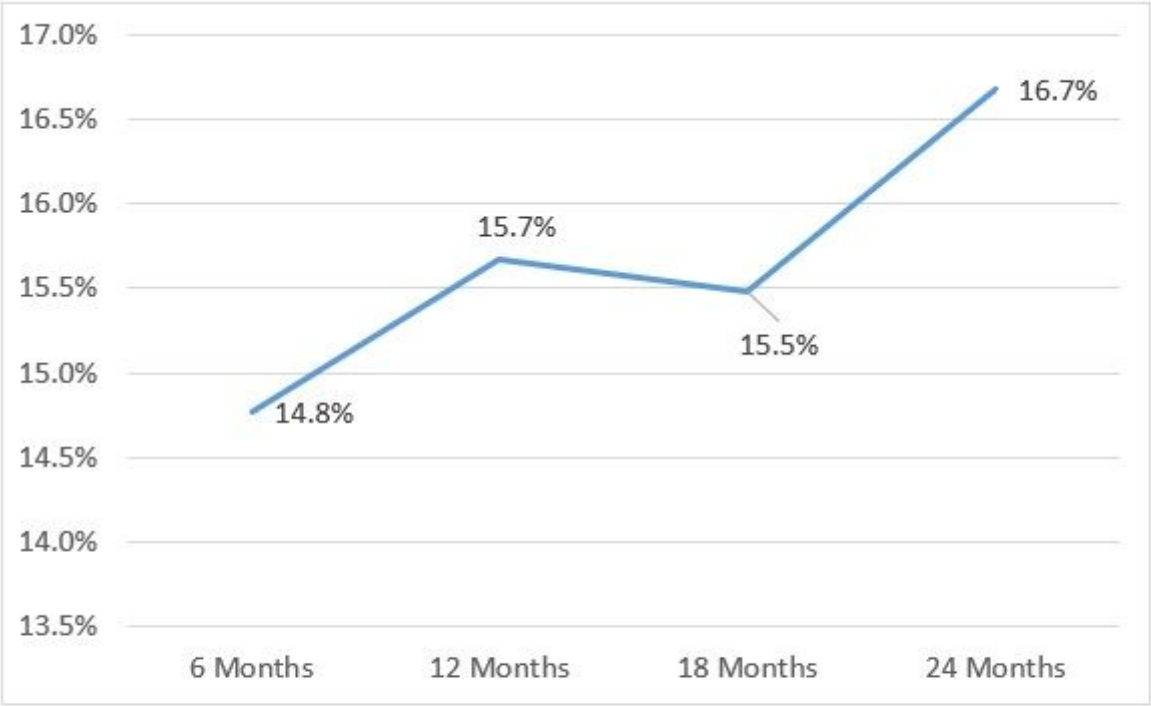
Figures



- Controlling for patient and provider factors as in other models
- Patient characteristics as well as private insurance (ref: Medicare) also significant at $p<.05$

Figure 1

Rheumatologist -washout results (6 months, 12, 18, 24)