

# Identifying Content Themes in Primary Care Physician and Rheumatologist Communications Within Electronic Consultations: A Qualitative Study

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**Objective.** Electronic consultation (eConsult) communications between primary care physicians (PCPs) and rheumatologists may reveal common knowledge gaps and educational opportunities. The aim of our study was to identify content themes in PCP questions and rheumatology recommendations through analysis of eConsult and the need for rheumatology appointments and facilitated urgent visits post-eConsult.

**Methods.** A descriptive cross-sectional study involving qualitative and quantitative analysis of rheumatology eConsults in a single center was performed from May 1, 2019, to January 9, 2020. Conventional content analysis was used to derive content themes in PCP questions and rheumatology recommendations. We evaluated the proportion of eConsults, which included a need for rheumatology appointments and expedited visits through frequency counts.

**Results.** Among 120 rheumatology eConsults, six PCP questions and five rheumatology recommendation content themes were identified. The most common PCP question themes were the following: 1) joint pain, 2) suspected rheumatic disease differential, and 3) abnormal laboratory tests. The most common rheumatology recommendation or teaching themes were the following: 1) education on differential diagnoses of rheumatic diseases, 2) education on the specific rheumatic disease, and 3) laboratory test interpretation. The majority of eConsults (82%) recommended a subsequent rheumatology appointment, and 27% facilitated an expedited appointment.

**Conclusion.** In this analysis of eConsults, we identified common knowledge gaps in PCPs and rheumatology educational topics, including differentiating inflammatory from noninflammatory arthritis, using caution in interpreting abnormal laboratory tests without clinical manifestations, managing chronic gout, evaluating elevated creatine phosphokinase levels, and differentiating C-reactive protein (CRP) from high-sensitivity CRP. Timely feedback through eConsult recommendations may allow for focused educational opportunities.

## INTRODUCTION

A growing elderly US population and the projected shortage of the rheumatology workforce by 2030 is expected to pose a challenge for rheumatology care (1). Electronic consultation (eConsult) is a communication tool that has been developed to formalize timely exchange between primary care and specialty care physicians within the electronic health record and has been proposed as a potential strategy to address access to rheumatologists (2). eConsults have increased the ability of primary care physicians (PCPs) to manage patient care, decreased wait time for subspecialty visits, and improved satisfaction of PCPs (3–5). However, less recognized is the potential of rheumatology eConsults to be used as an educational tool by providing direct answers to queries

by the PCPs in a timely manner (6–8). Surveys of PCPs in one health system revealed that eConsults uniquely allowed for direct incorporation of teaching into subspecialty recommendations and helped identify PCP knowledge gaps (6). To our knowledge, the evaluation of eConsult communication to identify recurrent themes in PCP questions and rheumatologist recommendations that may ultimately be used to develop targeted educational content is unknown.

Several studies have investigated common rheumatology eConsult diagnoses and PCP questions that were associated with avoiding face-to-face appointments with the rheumatologist in the setting of limited resources (2,9). There is also a need to better understand what proportion of eConsults can be completed without a subsequent patient visit to assess if eConsults can help

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### SIGNIFICANCE & INNOVATIONS

- This is the first study to our knowledge that examined in detail content themes in primary care physician (PCP) questions and electronic consultant recommendations in electronic consultations (eConsults).
- Our study identified common primary care knowledge gaps of rheumatic disease and recurring recommendation themes in eConsults that can be used to develop educational content and uniquely allow for learner-directed teaching for PCPs.
- Potential rheumatology topics for PCP continuing education include differentiating inflammatory from noninflammatory arthritis, using caution in interpreting abnormal laboratory test results without clinical manifestations, managing chronic gout in chronic kidney disease, evaluating elevated creatine phosphokinase levels, and differentiating C-reactive protein (CRP) from high-sensitivity CRP.
- The majority of eConsults (82%) recommended a rheumatology appointment, which highlights the importance of a detailed physical examination and subtle history in rheumatic disease diagnosis that often requires face-to-face evaluation.

replace patient appointments with rheumatologists. There may also be value in using eConsults to triage the urgency of appointments, which may improve timely care in rheumatology.

The overall purpose of our study was to identify rheumatology topics for PCP continuing education and increase the efficiency of eConsults. The specific aims of our study were to identify 1) themes in eConsult questions by PCPs to rheumatologists, 2) themes in rheumatology electronic consultant (eConsultant) recommendations to address these questions, 3) the need for appointments following an eConsult, and 4) the proportion of eConsults for which urgent evaluation was facilitated.

## MATERIALS AND METHODS

**Study design and setting.** This descriptive cross-sectional study evaluated qualitative and quantitative data from rheumatology eConsult encounters from May 1, 2019, to January 9, 2020, at Montefiore Medical Center (Montefiore), which is a tertiary referral academic medical center in Bronx, NY.

**eConsult program description.** Montefiore initiated the eConsult program to improve access to specialty expertise (10). The division of rheumatology was one of the first subspecialties to participate in the eConsult program and designated two attending physician rheumatology eConsultants to answer eConsults within three business days and to facilitate expedited appointments if necessary. PCPs included teaching and nonteaching primary care

providers, including attending physicians, internal medicine residents, nurse practitioners, and physician assistants. PCPs have an option to place a rheumatology eConsult order by providing a brief summary of the patient and a focused question as an alternative to a referral for a rheumatology appointment. The specialist can then provide evidence-based recommendations in an eConsult encounter integrated into the Epic electronic medical record (EMR) and recommendations regarding the need for a rheumatology appointment.

**Data collection.** Data were extracted from the Epic EMR for eConsults to rheumatology ordered by PCPs, which included internal medicine and family medicine providers. For each eConsult, we collected the full text of the eConsult order, the full text of the eConsult recommendation, patient demographics (age and sex), PCP name, PCP type (physician or nurse practitioner/physician assistant), and rheumatologist's suggestion for an appointment. Appointment suggestion was selected from a templated list and included the following: expedited visit, routine visit, no appointment needed with this specialty, alternate specialty, or more information needed. The expedited visit was defined as an appointment within 2 weeks of eConsult. The routine visit was defined as the next available rheumatology appointment, which was generally within 4 to 6 weeks.

This study was approved by the Office of Human Research Affairs of Montefiore Medical Center and Albert Einstein College of Medicine, the Institutional Review Board.

**Data analysis.** Qualitative conventional content analysis (10) was used to analyze the text data in the communication between PCPs and the rheumatology eConsultant. Because there were no existing eConsult themes, our study used an inductive approach, extracting directly from the data. Two raters (J.L. and R.J.) independently read the eConsults to gain a sense of the content. The content from the questions asked by the PCP and the eConsultant recommendations were then coded into labels describing the key concepts. Codes with similar content were then grouped into categories. The two raters discussed the categories and developed an initial codebook. The two raters then independently reviewed additional eConsult encounters, implementing the coding scheme. Any content that could not be coded with the original coding scheme was given a new code. Once no further new codes emerged, the two raters agreed on the theoretical saturation of data (11). Subsequently, the codes were defined and organized into themes and subthemes. Each eConsult could have multiple PCP question content themes or eConsultant recommendation themes.

The number of content themes identified in PCP questions and eConsultant recommendations was counted and reported as the average calculated between the two raters. The content themes were reported in the order of frequency counts from

highest to lowest to help prioritize high-yield content for continuing medical education. Interrater reliability between the two raters for the qualitative data analysis was measured using the Cohen's kappa coefficient ( $\kappa$ ). To account for the eConsults with multiple codes, interrater reliability was confirmed using weighted  $\kappa$ . Statistical analysis was performed using SAS version 9.4 (SAS Institute, Inc).

The percentage of the types of recommendations, PCP and eConsultant characteristics, and patient demographics were measured by frequency counts.

## RESULTS

From May 1, 2019, to January 9, 2020, there were 120 eConsults from PCPs to rheumatologists. There were 73 unique PCPs, composed of 65 attending physicians and 8 nurse practitioners/physician assistants, who ordered eConsults. Attending PCPs may have supervised multiple resident physicians. Among these 73 PCPs, the average number of rheumatology eConsults per PCP was 1.7 (SD, 1.2; range 1-6). Two rheumatologists completed eConsult recommendations; 83% were completed by R.J.

**Table 1.** Primary care physician question content themes

Content themes and subthemes	n (%)	Example quotes
Joint pain	60 (37)	
Abnormal serologic test result, uric acid level >6 mg/dl, CRP/hs-CRP	40	"Patient with history of diabetes presenting with right hand pain, swelling, and numbness with mild elevation of rheumatoid factor. What further work up should I do?" "New patient who is self-referred to me recently for chronic back pain. She also complains of chronic pain in her finger joints. Rheumatoid factor positive. Would be appropriate to refer to rheumatology?"
Normal serologic test result, uric acid level <6 mg/dl or CRP/hs-CRP	4	"Bilateral MCP/PIP pain for 3 years, worse in the morning, better during the day, work up for RA in 2016 negative, repeat ESR, CRP and hand X-ray negative, no other joint pain. Would seronegative RA be a consideration for him?"
Serologic test or CRP/hs-CRP level not checked or reported in the history	16	"57 yo man with chronic lower back pain for 1 year, progressively debilitating, imaging with chronic changes in lumbar/sacral region and bilateral lower extremity tingling. Any additional studies for ankylosing spondylitis?"
Suspected rheumatic disease differential	44 (27)	"25 yo woman with history of heart failure, proteinuria, and family history of lupus presenting with anemia, proteinuria, and oral ulcers. No history of rash or joint pain/swelling. Abnormal labs include elevated ESR, CRP, and total complement. What further work up?"
Abnormal laboratory test results	28 (17)	
Abnormal serologic test results (such as ANA/RF)	16	"80 yo F with history of diabetes and ILD presenting with weight loss. ANA and RNP positive. X-ray of knees showing bone infarcts. What further work up?"
Elevated levels of inflammatory markers	5	"54 yo F with history of left eye keratoconjunctivitis sicca presenting with worsening left eye/temple pain, radiating down towards angle of jaw, pain 10/10, lasting seconds, exacerbated by mild touch, no visual changes. TMJ tenderness on exam. ESR 32 and CRP > 5. I favored trigeminal neuralgia initially...but given the high CRP (despite almost normal ESR), should I start prednisone and send her to Rheum/Ophtho for evaluation for GCA?"
Elevated CPK/aldolase levels	7	"Several years of 'muscle pains in both of his upper arms.' CPK negative but aldolase mildly high at 9.7. What other work-up is appropriate this time?" "Bilateral muscle pains of the upper arms, exam showed full strength and ROM but patient was unable to put jacket on. Workup showed normal CPK, ESR 54, aldolase 12.5. Holding his statin did not help. I started treatment for polymyalgia rheumatica with prednisone 15mg. He is now reporting improvement 3 weeks into treatment. Would you continue prednisone at this time? Is methotrexate an option?"
Management of established rheumatic disease	18 (11)	"Patient with history of heart failure, CKD Stage 3, and gout presenting with gout attack. Most recent uric acid was 8. I am concerned given his CKD and diuretic use and hesitant to increase his allopurinol much further. What would be the recommended dose for this patient? Would you recommend another agent?"
Rash or biopsy result	9 (6)	"Diagnosed with leukocytoclastic vasculitis by Derm. Please advise if any further testing needed as to etiology."
Imaging findings	3 (2)	"Patient with history of HTN, DM2, smoker, AAA, presenting with abdominal pain. CT abdomen showed inflammatory type changes involving aorta with reported elevated ESR and CRP. I am concerned about possible aortitis or large vessel inflammatory disease. Can an appointment for evaluation be arranged?"

**Note.** Abnormal serologic test results included positive ANA, extractable nuclear antigen antibodies, RF, cyclic citrullinated peptide antibody, HLA antigen B27, and immunoglobulin G4. An elevated uric acid level was defined as greater than 6 mg/dl according to the American College of Rheumatology guidelines. Elevated levels of inflammatory markers included both CRP and hs-CRP, which were used interchangeably by primary care physicians.

Abbreviations: AAA, abdominal aortic aneurysm; ANA, antinuclear antibody; CKD, chronic kidney disease; CPK, creatine phosphokinase; CRP, C-reactive protein; CT, computerized tomography; Derm, dermatology; DM2, Type 2 Diabetes; ESR, erythrocyte sedimentation rate; F, female; hs-CRP, high-sensitivity CRP; HTN, hypertension; ILD, interstitial lung disease; MCP, metacarpophalangeal joints; RA, rheumatoid arthritis; RF, rheumatoid factor; Rheum/Ophtho, rheumatology/ophthalmology; RNP, anti-ribonucleoprotein antibody; TMJ, temporomandibular joint; yo, years old.

and 17% by A.B. The patient demographics of the eConsult set consisted of 76% women. The average age was 57.5 years (SD, 16.3). The majority of patients were African Americans and Hispanic, representing the Bronx, NY, population.

Table 1 shows question content themes along with examples of associated questions asked by the PCP. Six major themes were identified: 1) joint pain, 2) suspected rheumatic disease differential, 3) abnormal laboratory tests, 4) management of an established rheumatic disease, 5) rash or biopsy result, and 6) imaging findings. Interrater reliability for PCP question content themes between J.L. and R.J. was 94%, with a  $\kappa$  statistic of 0.99 (95% confidence interval [CI]: 0.97-1) and weighted  $\kappa$  of 0.90 (95% CI: 0.83-0.97).

The most common theme was centered on establishing a diagnosis for joint pain (37%), which was further divided into subgroups of whether abnormal serologic test results, elevated uric acid levels, or elevated levels of inflammatory markers were reported or checked by the PCP.

The second most common PCP question content theme was differential diagnosis about suspected rheumatic disease (27%). For example, a PCP suspecting systemic lupus erythematosus as a possible diagnosis provided pertinent positives ("anemia, proteinuria, and oral ulcers") and pertinent negatives ("no history of rash or joint pain or swelling") with directed questions about what further evaluation was needed to confirm a diagnosis or if the patient could, in fact, have the specific rheumatic disease in question.

Another recurring PCP content theme included questions about the significance of abnormal laboratory test results (17%), often without reporting the history or physical examination findings in the question that prompted ordering the laboratory test. These tests included: abnormal serologic test results, elevated levels of inflammatory markers, or elevated creatine phosphokinase (CPK)/aldolase levels. Less common PCP question themes were about the management of an established rheumatic disease (11%), rash or biopsy results (6%), and imaging findings (2%).

Table 2 shows the rheumatology eConsultant recommendation content themes along with examples. Five major themes were identified: 1) education on differential diagnoses of rheumatic diseases, 2) education on specific rheumatic diseases, 3) laboratory test interpretation, 4) management of specific rheumatic diseases, and 5) imaging findings in rheumatic disease. Interrater reliability for eConsultant recommendation content themes was 94.7%, with a  $\kappa$  statistic of 1 and weighted  $\kappa$  of 0.94 (0.89-0.99).

The most common eConsultant recommendation theme was education on the differential diagnoses of rheumatic diseases (25%), with more than half centered on understanding the differences between inflammatory versus noninflammatory arthropathy. These recommendations and teaching points were given primarily in response to PCP questions centered on joint pain. eConsultant recommendations discussed elements of inflammatory arthritis, such as distribution of joint pain, presence of morning stiffness for more than 45 minutes, presence of systemic features, and how to differentiate true arthritis from periarticular tissue pain.

Rheumatologists also provided differential diagnoses for elevated CPK levels, which included nonrheumatic etiologies and the distinct features of inflammatory myositis.

Another eConsultant recommendation theme included education on specific rheumatic diseases (24%). Crystalline arthropathy was most common. For example, eConsultant recommendations highlighted the importance of achieving a goal uric acid level of less than 6 mg/dl because PCPs had the misconception that a uric acid level between 6 and 7 mg/dl was normal. Other common rheumatic diseases discussed in eConsultant recommendations were myositis and polymyalgia rheumatica. There were clarifications of differentiating proximal muscle weakness often seen in inflammatory myositis versus myalgias seen in polymyalgia rheumatica.

In terms of laboratory test interpretation (23%), eConsultants frequently discussed the importance of interpreting anti-nuclear antibody (ANA) within a clinical context and the role of serology to support a clinical suspicion instead of vice versa in rheumatology. PCPs also used C-reactive protein (CRP) interchangeably with high-sensitivity CRP (hs-CRP), which is used to risk stratify coronary artery disease. Elevated hs-CRP levels did not always correlate with high CRP levels, and eConsultants communicated the differences between the two laboratory tests.

Furthermore, 21% of eConsultant content themes described the management of a specific rheumatic disease. eConsultants frequently clarified and provided education that allopurinol can be safely used in patients with chronic kidney diseases while monitoring closely to minimize the risk of allopurinol hypersensitivity syndrome.

The majority of eConsults resulted in recommending patient visits (82%) for these patients (Figure 1). Fifty-five percent of eConsults recommended a routine appointment, and 27% recommended an expedited appointment. Eleven percent of eConsults recommended an alternate specialty, 4% required further information, and 3% did not need an appointment with rheumatology.

## DISCUSSION

Our study identified common themes in both PCP questions and rheumatologist recommendations through analysis of eConsults. The most common PCP question theme was centered on joint pain, and the most common eConsultant recommendation theme was education on differential diagnoses of rheumatic disease, specifically related to inflammatory versus noninflammatory arthropathy. The majority of PCP questions describing joint pain (67%) involved abnormal serologic test results, elevated uric acid levels, or high levels of inflammatory markers. However, many of these eConsults did not include characterization of inflammatory features that may have triggered obtaining laboratory tests in the first place. Lack of understanding of the differences between inflammatory and noninflammatory arthropathy may be a potential

**Table 2.** Electronic consultation recommendation content themes

Content themes and subthemes	n (%)	Example quotes
Education on differential diagnoses of rheumatic diseases	49 (25)	
Inflammatory versus noninflammatory arthropathy	30	"In inflammatory back pain (seen in patients with axial spondyloarthropathy), patients usually have morning stiffness (at least 45 min) and improvement with activity. Patients with axial SpA tend to have second half of the night awakening due to pain, and often 'cannot wait' to get out of bed in the morning since movement helps. Prolonged sitting can exacerbate the pain. This is in contrast to mechanical forms of lumbar-sacral spine disease where the pain is usually worsened with activity, alleviated with rest."
Elevated CPK/aldolase levels/myalgias	9	"Elevated CPKs can result from medications, metabolic causes, or even heavy exercise. He should have TSH, ESR/CRP checked and make sure that he is not taking herbal/protein supplements or shakes. Patients with rheumatic, inflammatory causes of myopathy tend to have proximal muscle weakness (both upper and lower) along with systemic features such as rash, weight loss, fever, Raynaud's, periungual erythema."
Rheumatic causes of skin rash	6	"Leukocytoclastic vasculitis (LCV) can be seen in certain autoimmune disease, infections, medication-related causes or without any underlying systemic cause. Because LCV is a symptom, and not a diagnostic feature of a disease, it is important to exclude any other underlying cause. In terms of rheumatic diseases in which LCV can be seen, most common include Sjögren's syndrome, SLE, and small vessel vasculitis."
Inflammatory eye disease	2	"Underlying rheumatologic diseases may be a cause for recurrent uveitis, along with infectious causes or idiopathic. A thorough history and examination to look for any subtle clinical, systemic clues for a rheumatic disease is recommended. Uveitis may be seen in patients with spondyloarthropathies, Behcet's disease, sarcoidosis and less commonly vasculitis."
Nonrheumatic causes	2	"Since the symptoms are localized to one hand and given the absence of pallor or redness, secondary Raynaud's is less likely. Would consider vascular/neurologic etiologies or thoracic outlet syndrome."
Education on specific rheumatic disease	47 (24)	
Crystalline arthropathy	9	"There are still risks of gout flares in patients with uric acid levels above 6 (even though the value appears to be in the normal range in the reference lab)."
Myositis	6	"Statins can cause myalgias, but usually improved by 3 months post cessation. Less commonly, statins can cause a necrotizing myositis where patients usually have high CPKs (in the thousands) and muscle weakness. In rheumatic causes of inflammatory myopathy, there may be other systemic features associated such as rash, constitutional symptoms. Also, patients tend to have painless muscle weakness affecting the proximal muscles rather than predominance of only muscle pain."
SLE	5	"In SLE, malar rashes are photosensitive, and often do not cross the nasolabial folds. Furthermore, there may be other systemic features that may help us attribute the rash to lupus such as arthralgias, discoid lesions, family history, Raynaud's, oral ulcers, patchy alopecia, recurrent miscarriages, thrombosis, etc."
RA	5	"The diagnosis of RA is predominantly clinical, with lab tests to help support suspicion of this disease. RA tends to have symmetric inflammatory arthritis involving the wrists, MCPs, PIPs, elbows, shoulders, MTPs, and eventually hip/knees. A positive RF alone does not 'rule in' or 'rule out' the disease."
Vasculitis	5	"Clinical features of temporal arteritis include temporal artery pain/tenderness in the temporal region, diplopia, visual loss, jaw pain on eating, scalp tenderness, hoarseness of voice in some cases. Patients are often overall unwell because of the systemic inflammation, and can have poor appetite, weight loss, fevers, other constitutional symptoms. Lab abnormalities include elevated ESR and/or CRP, and thrombocytosis can be seen."
Polymyalgia rheumatica	3	"PMR is a disease of exclusion and there are no diagnostic tests or biomarkers. Proximal muscle weakness may also 'appear' in patients with arthritis symptoms; where the seeming 'weakness' is really secondary to effort because the patient has pain from shoulder inflammation that restricts movement rather than true muscle weakness."
MCTD	3	"Anti-RNP ab can be seen in patients with mixed connective tissue disease (MCTD, a mix of lupus, scleroderma, myositis with features occurring all together or sequentially in a given time). Autoantibodies may be positive in malignancies, infection, and asymptomatic patients. This is why the clinical history and detailed exam to look for systemic clues for MCTD is important. Checking ECHOs every few years to make sure there is no pulmonary hypertension (a feature that is seen in MCTD) may be useful and checking yearly U/A to look for any subclinical glomerular disease which can sometimes be a manifesting symptom of lupus."
Sjögren syndrome	3	"Patients with Sjögren's syndrome often have dry mouth and/or dry eyes and can have other systemic features such as parotid swelling/tenderness, neuropathy, rash, headaches, fatigue, and inflammatory arthritis. Often, they have ANA + along with anti-SSA/anti-SSb ab +; some can have RF +. In the absence of other systemic features and normal lab tests, it is important to look for any other causes of sicca symptoms such as medications. For the sicca symptoms of Sjögren's syndrome, the treatment is symptomatic (eye drops, Ophtho eval for dry eye, biotene, xylimelts, ice chips, etc). Traditional DMARDs do not always help with sicca symptoms."

(Continued)

**Table 2.** (Cont'd)

Content themes and subthemes	n (%)	Example quotes
Spondyloarthropathy	2	"Given his age > 45, history of diabetes and the radiographic findings of right sided anterior longitudinal calcification in upper lumbar spine and T spine (which spares the lower lumbar spine and with normal SI joints) along with lack of other systemic features such as hx of uveitis, psoriasis or IBD, he may have DISH (diffuse idiopathic skeletal hyperostosis) rather than true ankylosing spondylitis."
Fibromyalgia	2	"Fibromyalgia is a diagnosis of exclusion. Vit D and Vit B12 levels should be at the correct levels, and evaluation for thyroid disease, anxiety or depression considered. Sleep apnea should be excluded in case it could be contributing to fatigue/headaches/pain."
Other connective tissue disease	2	"Patients with some forms of a genetic connective tissue disorder called Ehlers Danlos syndrome may sometimes have cerebral aneurysms. However, they may also have other clinical features such as other areas of aneurysms, dissections, easy bruising, characteristic facial features."
Scleroderma	1	"Anti-centromere + may be seen in patients with limited systemic sclerosis. Patients can have skin tightening over their hands up to mid forearms, feet to mid-calf and around face. Raynaud's, GERD, and telangiectasias on face along with calcinosis may be seen. Patients with limited scleroderma may have pulmonary hypertension for which ECHO is useful for screening."
Sarcoidosis	1	"ACE level by itself does not diagnose sarcoidosis."
Laboratory test interpretation	44 (23)	
Autoantibodies/serologic tests in rheumatic diseases	30	"In rheumatology, diagnosis of diseases is based on constellations of clinical features with lab tests to confirm the suspicion of the disease. The lab tests alone (such as positive ANA) is not sufficient to make a diagnosis. This is because autoantibody tests such as ANA can be falsely positive or may be positive in patients with history of malignancy, infections and age above 70. Furthermore, sometimes patients can have an ANA for years, but never develop clinical features of an ANA related rheumatic disease (i.e. SLE, scleroderma, MCTD, Sjögren's)."
Inflammatory markers (ESR and CRP vs. hs-CRP)	14	"We do not routinely use the high sensitivity CRP in our assessment of systemic inflammation- this is a marker of cardiovascular risk."
Management of specific rheumatic disease	40 (21)	"Colchicine should be given with caution in patients with renal insufficiency. Allopurinol may be given in patients with CKD, and the dose can be uptitrated to a goal uric acid of < 6."
Imaging findings in rheumatic disease	14 (7)	"While the Xrays were not normal, the more typical signs of RA such as radiocarpal narrowing or ulnar flattening were not seen. The cystic changes at the base of the thumb can be seen in advanced/ erosive DJD as well."

Abbreviations: ACE, angiotensin-converting enzyme; ANA, antinuclear antibody; anti-RNP, anti-ribonucleoprotein antibodies; axial SpA, axial spondyloarthropathy; CKD, chronic kidney disease; CPK, creatine phosphokinase; CRP, C-reactive protein; DJD, degenerative joint disease; DMARD, disease-modifying antirheumatic drug; ECHO, echocardiogram; ESR, erythrocyte sedimentation rate; GERD, gastroesophageal reflux disease; hs-CRP, high-sensitivity CRP; hx, history; IBD, inflammatory bowel disease; LCV, leukocytoclastic vasculitis; MCP, metacarpophalangeal joints; MCTD, mixed connective tissue disease; MTP, metatarsophalangeal joints; Ophtho, ophthalmology; PIP, proximal interphalangeal joints; PMR, polymyalgia rheumatica; RA, rheumatoid arthritis; RF, rheumatoid factor; SI, sacroiliac; SLE, systemic lupus erythematosus; TSH, thyroid stimulating hormone; U/A, urinalysis; Vit, vitamin.

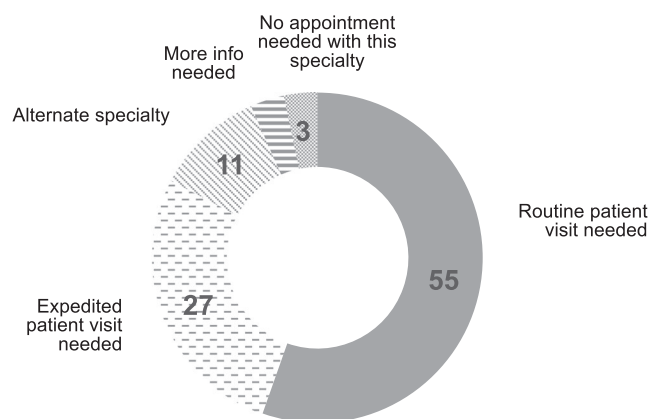
knowledge gap in PCPs. Based on the recurrence of this theme in our analysis, an important rheumatology continuing education topic would focus on the approach to joint pain and differentiating inflammatory from noninflammatory arthropathy.

Similarly, there were recurring PCP questions about abnormal laboratory test results. We identified misconceptions about the use of ANA as a screening test for rheumatic disease, the interchangeable use of hs-CRP and CRP, and the workup for elevated CPK levels. Potential continuing educational topics can include interpreting a positive ANA result, differentiating between hs-CRP and CRP, and evaluating elevated CPK levels in rheumatic diseases. In addition, an important overarching teaching point regarding abnormal laboratory test results is the importance of prioritizing clinical features for diagnosis in rheumatic disease and the supportive role of laboratory tests and imaging rather than the laboratory tests alone in the diagnosis of disease.

Another common content theme in PCP questions and eConsultant recommendations was gout management. We identified

knowledge gaps that a uric acid level greater than 6 mg/dl was thought to be normal. One reason for this might be that our Epic EMR does not flag values from 2.5 to 7.5 mg/dl to be abnormal. Another possibility is that this misconception may reflect the confusion that arises from conflicting guidelines. Although the American College of Rheumatology and European League Against Rheumatism guidelines strongly recommend a "treat-to-target" strategy with a uric acid goal level of less than 6 mg/dl, the American College of Physicians in 2017 suggested a "treat to avoid symptoms" strategy and voiced uncertainty about endorsing a uric acid goal level. A rheumatologist's approach to gout management, such as a uric acid goal level and use of allopurinol in chronic kidney diseases, may be a helpful continuing education topic for PCPs.

A larger proportion of eConsults in our study (82%) required a patient visit than previously reported at other institutions. Rikin et al also showed that eConsults at our institution did not decrease traditional face-to-face referral rates (12). One possible explanation for the high subsequent patient visit is that our system uniquely



**Figure 1.** Electronic consultation recommendation for appointment need (%).

encouraged eConsults prior to potential in-person visits to better prepare for the initial consultation with recommended laboratory tests and imaging. Furthermore, our Bronx-based population, composed of Hispanic and African American patients, has a high number of advanced and complex connective tissue diseases, for which in-person visits were necessary for proper evaluation. Specialists were financially incentivized with a flat fee per eConsult regardless of subsequent in-person appointments. One study in Canada showed that 38% of traditional rheumatology referrals were avoided with eConsults, but the diagnoses in this study that had the highest rates of referral avoidance were osteoporosis and osteoarthritis (9), diseases that were not the source of PCP questions in our study. Previous studies have shown that fewer face-to-face rheumatology referrals were avoided compared with other subspecialties. Tran et al revealed that 24% of referrals were avoided in rheumatology, which was the lowest of nine subspecialties, compared with 49.5% in dermatology and 46.5% in hematology (13). Although our study showed fewer avoided face-to-face visits (17%) than previously reported, it demonstrates a similar trend toward requiring the majority of consultations to be face-to-face visits. This trend suggests that perhaps rheumatology requires patient visits more often than other specialties because of the importance of a detailed physical examination and history in rheumatic disease diagnosis, rather than laboratory tests alone, that demands face-to-face evaluation.

Finally, 27% of eConsults recommended an expedited appointment. This highlights the role of eConsults to improve efficiency with new patient rheumatology visits and facilitate access to specialty care.

There were several strengths in our study. To our knowledge, this is the first study to evaluate common rheumatology eConsultant recommendation themes. eConsults could be activated by a wide range of primary care providers, including nurse practitioners, physician assistants, internal medicine residents, and attending physicians. The breadth of providers allows for the generalizability of questions that reflect the knowledge of different general

practitioners. This study also used conventional content analysis to identify and code themes directly from eConsults rather than implementing predefined categories, as seen in previous studies. Finally, the coding scheme had excellent interrater reliability between two raters, with a  $\kappa$  and weighted  $\kappa$  of greater than 0.9.

There are limitations to this study. The sample of eConsults may not account for the true prevalence of specific question themes. Second, we recognize that our study evaluated eConsults for a limited period of time. The study end period was decided on January 2020 because thereafter, eConsult referral became available to noninternal medicine providers, such as surgery, obstetrics and gynecology, dermatology, and other subspecialties. This was to focus on the question types and content by internal medicine-trained providers. Third, this study did not subdivide whether question types and content were different among providers at different levels of training (ie, nurse practitioners vs. residents vs. attending physicians). Lastly, our study did not assess whether PCPs found educational value in the eConsultant recommendations, which would require surveying PCPs to see if they were able to apply lessons to similar cases in the future.

The common themes identified in this study may lead to focused educational opportunities, with a greater understanding of rheumatic diseases and a reduction in unnecessary laboratory testing. Future directions could include using the most common eConsultant educational themes to build case-based targeted teaching, such as through webinars for primary care providers. Although there are data that show high PCP satisfaction with eConsults (3) and acknowledgment of its educational value (6), it would be valuable to examine how much of the educational knowledge provided by eConsultants was retained by PCPs in months or years following an eConsult. The findings of this study can be used to create standardized eConsult recommendations for common themes to improve efficiency.

In conclusion, our study identified common primary care knowledge gaps of rheumatic disease and recurring recommendation themes provided by rheumatologists through analysis of eConsults. eConsults may have the potential to be used as an educational tool that uniquely allows for learner-directed teaching and instant application for PCPs. Future studies should investigate the educational value of rheumatology eConsults to providing patient care from the perspective of PCPs.

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## AUTHOR CONTRIBUTIONS

All authors drafted the article, revised it critically for important intellectual content, and approved the final version to be published. Jain, Lee, and Rikin had full access to all of the data in the study and takes

responsibility for the integrity of the data and the accuracy of the data analysis.

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