

Rheumatology Continuing Professional Development for Primary Care Clinicians:  
A Systematic Review

By

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## DEDICATION

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## ABSTRACT

**Title:** Rheumatology Continuing Professional Development for Primary Care Clinicians: A Systematic Review

**Introduction:** A 2015 workforce study conducted by the American College of Rheumatology estimated that in 2030, the United States (US) alone will have a shortage of about 4,700 rheumatologists. As such, primary care clinicians (PCCs) may find themselves taking the initial steps to diagnose and treat some rheumatologic disorders. PCCs can participate in rheumatology focused continuing professional development (CPD), which may help mitigate this shortfall. However, there is no recent synthesis of the literature describing these initiatives or their efficacy. This risks the use of suboptimal instructional methods and missed opportunities for providers.

**Methods:** The authors conducted a systematic review of CPD focused on rheumatology topics for PCCs. A librarian systematically searched PubMed, Embase, Web of Science, ERIC, CINAHL, and PsycINFO. Studies were limited to those conducted in North America after 1993. An extraction form that included the Medical Education Research Study Quality Instrument was created through an iterative process and applied to the included articles.

**Results:** 725 articles were retrieved, of which nine were included. Results showed that CPD was directed more at non-inflammatory arthritis than inflammatory arthritis. Four studies partially focused on teaching arthrocentesis. Autoimmune diseases were underrepresented; four studies discussed rheumatoid arthritis, and one additional study examined rheumatologic

topics broadly. Newer research tended to include multi-modal approaches that combined strategies (such as didactics and active learning), whereas older research was less focused on interactive learning showing an evolution towards more active learning. Though online learning is increasingly popular, interventions were predominantly face-to-face with only a single example of e-learning. Studies were predominantly of moderate quality.

**Discussion:** Rheumatology-focused CPD for PCCs is moving towards more interactive teaching modalities and is typically conducted in-person though virtual options for rheumatology-focused CPD should be explored to improve access to CPD. Autoimmune disease is an uncommon topic in CPD and represents an opportunity for future expansion. Efficacy was difficult to assess given that only a single study reported patient outcomes.

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## CHAPTER 1: INTRODUCTION

The burden of rheumatologic disease is ever increasing. The American College of Rheumatology (ACR) and the European League Against Rheumatism (EULAR) recognize over 200 conditions that are considered to be rheumatic and musculoskeletal diseases (RMD) (1). The vast majority of these conditions are chronic, often affecting individuals for the remainder of their life after onset, requiring chronic medications or therapy. The subsequent disability that often accompanies RMDs burdens not only the individual, but society more broadly with loss of work force and productivity and resultant economic impact (1, 2). Further highlighting economic impact, direct and indirect costs of care related to RMDs in the United States (US) alone is estimated to be \$213 billion annually, and when decreased wages are included, the cost rises to a staggering \$874 billion annually (3). With an aging population and a society that is increasingly obese and sedentary, the cost and impact to society will continue to worsen (2-4).

Despite the importance and worsening burden of RMDs, there is an ever-growing shortage of rheumatologists in the US. The 2015 workforce study conducted by the ACR revealed that, at the time, there were 4,997 full-time rheumatologists when the patient population demanded 6,115 (5, 6). It is estimated that in 2030, the country will have a shortage of about 4,700 rheumatologists (5). The Department of Defense (DOD) is no exception to this shortage. In 2022 there are less than 30 active-duty rheumatologists providing care for 9.6 million Tricare beneficiaries throughout the DOD.

As such, primary care clinicians (PCCs), particularly those at smaller facilities or in rural settings, may find themselves taking the initial steps to diagnose and treat basic rheumatologic disorders until their patients can see a rheumatologist (6). Though there is an increasing need for PCCs to take preliminary steps in managing RMDs, there is evidence that education in musculoskeletal disease is inadequate throughout undergraduate and graduate training, which is compounded after completion of training (2, 7). Studies have found that PCCs may have less comfort with the diagnosis and management approaches for rheumatologic conditions(8-10), as well as lack of confidence with arthrocentesis of various joints, and musculoskeletal exam (2, 7). With RMDs making up 10-30% of PCC visits (2) and symptomatic knee osteoarthritis increasing in prevalence (4) it is critical for PCCs to be able to perform musculoskeletal exams, arthrocentesis, and discern autoimmune disease from mechanical injury or non-inflammatory arthritis.

Lack of PCC comfort with these critical rheumatology skills may delay treatment of RMDs, which increases the risk for subsequent long-term harm to the patient (11-18). Delays in initiation of treatment for rheumatoid arthritis (RA) may reduce the chance that the patient's disease will be controlled by a single drug regimen(11). Patients who receive prompt and early therapy for their RA tend to have lower disease activity scores and improved disease outcomes compared with patients who have delays in initiation of therapy with resultant worsened disability (12-14). Improved outcomes with early recognition and treatment of RMDs is not limited to RA. There is evidence supporting improved outcomes with early diagnosis and treatment in

systemic lupus erythematosus (15, 18), ankylosing spondylitis (16), and large vessel vasculitides (17) to name only a few.

Recognizing PCC's discomfort with musculoskeletal skills and rheumatology diagnoses, initiatives in the form of continuing professional development (CPD), to provide PCCs training in rheumatology topics and techniques have been implemented to extend these providers' skills in this specialty area. Continual professional development is defined by Peck et al. as the maintenance and "acquisition of new knowledge, skills, and attitudes required to enable competent medical practice (19)." Prior research has shown that CPD can improve physician performance and improve patient outcomes, though these two goals are most effectively achieved when interactive teaching methodologies are used (20). For example, Battistone and colleagues implemented a program to educate PCCs on MSK physical exams and joint injections. This initiative aimed to better equip PCCs with the skills to manage the myriad arthritic and other MSK complaints that are commonly seen in primary care (21-24). Additionally, Battistone, Barker, and Durning reviewed the national educational initiatives available at the Veterans Administration (VA). Although they reviewed rheumatology-focused CPD, these were specific to the VA and included both CPD and graduate medical education (GME) (25). While rheumatology-focused CPD is a logical approach to address PCCs' lack of comfort with RMDs, overall, the nature of such training and its efficacy is unknown. The resultant knowledge gap raises the risk that suboptimal continuing professional development (CPD) could be implemented and challenges educators to identify effective training. Thus, this systematic review synthesizes and evaluates the available evidence on rheumatology-focused

CPD offered to PCCs. In doing so, the goal of this systematic review is to provide evidence for future rheumatology curricula for PCCs, thus potentially improving the care of patients while they wait to see a rheumatologist.

Knowledge syntheses on rheumatology-based CPD for PCCs are limited and dated, with the latest published in 1995 (26). This earlier review included eight studies, with all but one published prior to 1990. As such, this review by Glazier, et al does not consider recent changes in GME, which necessitate that learners have exposure to rheumatology (27). Additionally, the included studies predate recent changes to maintenance of certification (MOC) by the American Board of Internal Medicine (ABIM), thus raising concerns about their applicability in current times (28). While this review was likely valuable closer to its publication, it is necessary to revisit this topic in order to provide an overview of the most relevant rheumatology-focused CPD for PCCs. Thus, it is time to conduct a systematic review to meticulously synthesize the more recent literature encompassing rheumatology-focused CPD for primary care. Through systematic review, we hope to accentuate strengths in current CPD endeavors and highlight areas of weakness in an effort to guide future endeavors to create and deliver rheumatology-focused CPD. Our research seeks to answer the question: What is the quality of rheumatology-focused CPD for PCCs in improving the care of patients with rheumatic diseases?

## CHAPTER 2: SUBMITTED MANUSCRIPT

### ABSTRACT

**Title:** Rheumatology Continuing Professional Development for Primary Care Clinicians: A Systematic Review

**Introduction:** A 2015 workforce study conducted by the American College of Rheumatology estimated that in 2030, the United States (US) alone will have a shortage of about 4,700 rheumatologists. As such, primary care clinicians (PCCs) may find themselves taking the initial steps to diagnose and treat some rheumatologic disorders. PCCs can participate in rheumatology focused continuing professional development (CPD), which may help mitigate this shortfall. However, there is no recent synthesis of the literature describing these initiatives or their efficacy. This risks the use of suboptimal instructional methods and missed opportunities for providers.

**Methods:** The authors conducted a systematic review of CPD focused on rheumatology topics for PCCs. A librarian systematically searched PubMed, Embase, Web of Science, ERIC, CINAHL, and PsycINFO. Studies were limited to those conducted in North America after 1993. An extraction form that included the Medical Education Research Study Quality Instrument was created through an iterative process and applied to the included articles.

**Results:** 725 articles were retrieved, of which nine were included. Results showed that CPD was directed more at non-inflammatory arthritis than inflammatory arthritis. Four studies partially

focused on teaching arthrocentesis. Autoimmune diseases were underrepresented; four studies discussed rheumatoid arthritis, and one additional study examined rheumatologic topics broadly. Newer research tended to include multi-modal approaches that combined strategies (such as didactics and active learning), whereas older research was less focused on interactive learning showing an evolution towards more active learning. Though online learning is increasingly popular, interventions were predominantly face-to-face with only a single example of e-learning. Studies were predominantly of moderate quality.

**Discussion:** Rheumatology-focused CPD is moving towards more interactive teaching modalities and is typically conducted in-person though virtual options for rheumatology-focused CPD should be explored to improve access to CPD. Autoimmune disease is an uncommon topic in CPD and represents an area for future expansion. Efficacy was difficult to assess given that only a single study looked at patient outcomes.

## **INTRODUCTION**

In the United States (US), there is an ever-growing shortage of rheumatologists. The 2015 workforce study conducted by the American College of Rheumatology (ACR) revealed that, at the time, there were 4,997 full-time rheumatologists when the patient population demanded 6,115 (5, 6). It is estimated that in 2030, the country will have a shortage of about 4,700 rheumatologists (5). As such, primary care clinicians (PCCs), particularly those at smaller facilities or in rural settings, may find themselves taking the initial steps to diagnose and treat basic rheumatologic disorders until their patients can see a rheumatologist (6). Studies have

found that PCCs may have less comfort with the diagnosis and management approaches for rheumatologic conditions(8-10). This may delay treatment, which increases the risk for subsequent long-term harm to the patient (11-16). Recognizing this issue, initiatives to provide PCCs training in rheumatology topics and techniques have been implemented to extend these providers' skills in this specialty area. While this is a logical approach, overall, the nature of such training and its efficacy is unknown. This knowledge gap challenges educators to identify effective training and risks that suboptimal continuing professional development (CPD) could be implemented. Continual professional development is defined by Peck et al. as the maintenance and "acquisition of new knowledge, skills, and attitudes required to enable competent medical practice (19)." Thus, this systematic review synthesizes and evaluates the available evidence on rheumatology-focused CPD offered to PCCs. In doing so, the goal of this systematic review is to provide evidence for future rheumatology curricula for PCCs, thus potentially improving the care of patients while they wait to see a rheumatologist.

Knowledge syntheses on rheumatology-based CPD for PCCs are limited and dated, with the latest published in 1995 (26). This earlier review included eight studies, and all but one was published prior to 1990. As such, this review does not consider recent changes in graduate medical education, which necessitate that learners have exposure to rheumatology (27). Additionally, the included studies predate recent changes to maintenance of certification (MOC) by the American Board of Internal Medicine (ABIM), thus raising concerns about their applicability in current times (28). While this review was likely valuable closer to its publication, it is necessary to revisit this topic in order to provide an overview of the most relevant rheumatology-focused CPD for PCCs.

Despite the lack of an up-to-date synthesis, researchers have continued to study rheumatology-focused CPD for PCCs. For example, Battistone and colleagues implemented a program to educate PCCs on MSK physical exams and joint injections. This initiative aimed to better equip PCCs with the skills to manage the myriad arthritic and other MSK complaints that are commonly seen in primary care (21-24). Additionally, Battistone, Barker, and Durning reviewed the national educational initiatives available at the Veterans Administration (VA). Although they reviewed rheumatology-focused CPD, these were specific to the VA and included CPD and graduate medical education (GME) (25). Thus, it is time to conduct a systematic review to synthesize the more recent literature encompassing rheumatology-focused CPD for primary care. Our research seeks to answer the question: What is the quality of rheumatology-focused CPD for PCCs in improving the care of patients with rheumatic diseases?

## **METHODS**

A systematic review was conducted to evaluate studies of rheumatology-focused CPD for PCCs and its efficacy. This review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (29).

Data collection:

RR and a medical librarian co-designed a search strategy that utilized a combination of keywords and controlled vocabulary terms, including but not limited to: “continuing education,” “professional development,” “rheumatology,” “rheumatic and musculoskeletal diseases,”. Searches were optimized for each database. On August 14, 2020, the medical

librarian searched Medline via Ovid, Embase, Web of Science, ERIC, PsycINFO, CINAHL. (See online supplement A for full search strategies). Two additional citations were found through hand searching references. The titles and abstracts of retrieved citations were managed in Covidence, a systematic review software ([www.covidence.org](http://www.covidence.org)).

#### Inclusion/exclusion criteria:

The review included studies conducted in the US and Canada focused on CPD addressing rheumatology-relevant topics directed at PCCs. The review was limited to studies conducted in the US and Canada due to their use of the ABIM certification and their accompanying maintenance of certification program. Studies conducted prior to 1993 were excluded since the most recent synthesis of rheumatology-focused CPD was published in 1994 and included studies were published prior to 1993 (26). Non-English studies were also excluded. Titles and abstracts were independently screened by RR and JM for inclusion. AS and LM served as a tiebreaker as needed, and consensus was reached through group discussion. All full-text articles were then independently reviewed by RR and one other author for inclusion, with any discrepancies resolved via consensus.

#### Data extraction

Data extraction was performed in duplicate by RR and one additional author independently. An extraction form was created through an iterative process and applied to the included articles (30). The extraction form was designed based on the literature and through consensus within the author team. Each author piloted the extraction form on two articles to confirm accuracy in

interpretation of the form and to ensure that all necessary data were captured. From each of the articles, the authors extracted information about the participants (number of participants, specialty of participants, practice context of participants), the intervention (who educators were, learning environment, teaching modalities, educational topic(s), learner assessment), and the research study (study design, study outcomes, limitations, future directions) (see Supplement B for complete extraction form). The educational topics were categorized based on the ABIM Internal Medicine blueprint rheumatology sub-topics, which are the same for both initial certification and the maintenance of certification (MOC) exam (28, 31). The Kirkpatrick level of each study's outcome was also determined to assess the strength of outcomes. The Kirkpatrick model is a technique used to evaluate training sessions and divides them into four categories (see figure 1). Kirkpatrick's model was chosen due to its wide use throughout education and its ease of use (32). Studies were assigned a single Kirkpatrick level corresponding to the highest outcome level reported. Any discrepancies in data extraction were resolved via consensus. The quality of each study was assessed using the Medical Education Research Study Quality Instrument (MERSQI) (30). Each study was independently scored by RR, JM, and AS, with discrepancies resolved by LM.

## Analysis

Descriptive statistical analyses were performed using Excel. Due to the nature of the interventions and their assessment methods, the data were too heterogeneous to perform a meta-analysis.

## RESULTS

Nine studies were identified from a pool of 727 citations as meeting inclusion criteria (See figure 2) (21-23, 33-38). All studies were conducted prior to the COVID-19 pandemic, with the most recent published by Barker et al. in Jan 2020 (21).

Six studies were conducted in Canada (33-38) and three studies in the US (21-23). Both rural (n=5) (21, 33-35, 38) and urban (n=6) (21, 22, 33-35, 38) PCC learners were represented, though three studies (23, 36, 37) did not clearly specify the geographic setting of the learners. Most studies specified the practice context of the learners, which included private practice (34, 37), university hospitals (21, 33, 37), government hospitals (21-23, 34), and community hospitals (33). Three studies did not describe learner practice contexts (35, 36, 38). The nine studies included a total of 2,183 learners that participated, with 1,775 learners completing the training and representing diverse health professionals (physicians, nurse practitioners, and physician assistants). Five studies were interprofessional, including physicians and a broad range of other health professionals (see table 1) (21-23, 34, 38). Five studies specified the medical specialty of their physician learners, which all identified as family medicine (33, 35-38). Instructor backgrounds were mentioned in six studies (22, 33-37). Physicians acted as instructors in six studies (22, 33-35, 37, 38) with four of those studies including rheumatologists as instructors (22, 33-35). Three studies (21, 23, 36) did not specify that the instructors were physicians. Lineker et al. did specify that there was an “ask the expert” feature with their online CPD where the expert was a physician and discussed having “content experts” in their topics, though they did not specify the specialty of those experts (38) (See Table 1).

The included CPD programs covered multiple educational topics: osteoarthritis (OA) (n=6) (23, 33-35, 37, 38), rheumatoid arthritis (RA) (n=4) (23, 33, 34, 38), arthrocentesis (n=4) (21-23, 37), osteoporosis (OP) (n=3) (21, 22, 36), musculoskeletal (MSK) exam (n=3) (21-23), serologies (n=1) (23), fibromyalgia (FMS) (n=1) (33), spondyloarthropathy (SpA) (n=1) (23), and gout (n=1) (23).

The majority of these programs (n=8) were conducted traditionally, in a face-to-face environment (21-23, 33-37). Only one study was conducted asynchronously online, and it was specifically intended to reach a remote, rural population (38). The most common setting for the educational interventions was a classroom setting (33-35) or a classroom in combination with another setting (21-23) such as a simulation lab. One study was conducted at the learner's clinical practice (37) while two studies (34, 36) did not specify their setting.

Educational interventions ranged from a single session case-based intervention to multi-day, multi-modality workshops that combined lectures with active learning (Table 2). Four studies (21-23, 34) used a multi-modality teaching approach that utilized a combination of multiple educational techniques (e.g., a mix of lectures, simulations, and peer learning as part of a single intervention). Case-based teaching was the most commonly used technique (n=6) (22, 23, 33, 35, 36, 38). Four studies used lectures as a teaching method (21-23, 34). Three studies involved simulations (21-23). One study specified "hands-on learning," though it was unclear what this entailed (34). Two studies involved observed structured clinical exams (OSCEs) (21, 22). One study used small group, interactive learning, followed by training on arthrocentesis using a live

patient (37). One study included a follow-up reinforcement activity six months after the original training (34).

Needs assessments were conducted in six of the nine studies (21, 33, 35-38). Two studies performed a partially qualitative needs assessment through the use of a focus group (33) or open-ended questioning (35). Learner outcomes varied widely. One study reported only learner satisfaction with the CPD intervention (Kirkpatrick Level 1) (33). Five studies investigated learners' knowledge acquisition (Kirkpatrick level 2) (21, 22, 34, 36, 38). Two studies evaluated learner behavior change (Kirkpatrick level 3), such as an increase in the number of arthrocenteses performed or changes in prescribing practices (23, 35). Only one study evaluated patient outcomes (Kirkpatrick level 4) by assessing changes in the injected patients' knee pain after teaching arthrocentesis as the CPD intervention (37).

Across the nine included studies, statistically or clinically significant changes in the learners as defined by the researchers were limited. Only four studies reported significant changes in their outcomes of interest (33, 34, 37, 38). Bellamy et al. noted clinically and statistically significant improvements in patient pain after their CPD intervention teaching arthrocentesis with viscosupplementation (37). Statistically significant improvements were noted in self-assessed knowledge (33), total best practice scores, satisfaction, and confidence (34), arthritis management, corticosteroid prescribing confidence, confidence in the musculoskeletal exam, prescribing of disease-modifying antirheumatic drugs (DMARDs), performing intra-articular injections (38). Two studies reported clinically significant changes after their CPD interventions (34, 38). Lineker et al. reported clinically important improvements in confidence of

corticosteroid prescribing, prescribing intra-articular injections and DMARDs, recommendation of assistive devices, weight management, analgesics, and non-steroidal anti-inflammatory drugs, along with a decrease in surgical consults (38). Lineker, Bell, and Badley reported clinically important improvements in education, occupational therapy/joint protection, psychosocial support, and referral to rheumatology (34). Both of the aforementioned studies (34, 38) defined clinically important changes as  $\geq 15\%$  improvement in knowledge scores compared to the learners' baseline.

The included articles consisted of two single-group post-test only studies (one mixed methods and one quantitative) and seven studies that were single-group pre-/post- intervention surveys. The MERSQI scores ranged from 9.5 (33) to 14 (21) with 18 being the highest possible score using this instrument (See table 3) (30). Studies have shown that MERSQI scores of 13.5 or greater are considered high quality, 9-13 are moderate, and scores of 8.5 or below are low quality (39). The average MERSQI score across the nine studies was 11.9. None of the included studies had a control or were randomized, which lowered the MERSQI score globally.

## **DISCUSSION**

We conducted this systematic review to synthesize the current literature on rheumatology-focused CPD offerings for PCCs to determine the quality of existing interventions. Overall, we found some evidence of effectiveness of the interventions in terms of knowledge acquisition, but evidence of patient outcomes was limited and based on a single study (37). In this

systematic review, we identified that the teaching involved both rural and urban providers, used predominantly in-person methods, and narrowly covered rheumatology topics. The quality of studies is moderate, with MERSQI scores ranging from 9.5-14 out of a maximum of 18 points (30) suggesting that readers should take caution when applying the study findings. In this discussion, we focus primarily on educational topic(s), geographical context, teaching modality, assessed outcomes, and efficacy.

The coverage of rheumatology topics is incomplete. The topics covered in the included studies were OA, RA, arthrocentesis, OP, SpA, MSK exam, serologies/labs, gout, and FMS. While this represents a wide range of topics and accounts for some of the most common rheumatologic and musculoskeletal disorders, it is by no means an all-inclusive list of topics important to PCCs. Further, important topics related to the ABIM maintenance of certification exam (28) such as systemic lupus erythematosus and vasculitis, are not addressed (see figure 2). Though systemic lupus erythematosus, vasculitis, idiopathic inflammatory myositis, and systemic sclerosis are rare, they can have life-threatening manifestations that warrant CPD for the PCC. Prompt diagnosis and treatment of many rheumatologic conditions can profoundly impact both morbidity and mortality, justifying the efforts in developing CPD (11-16).

Learners included rural and urban providers. The geographic context of the learners is important to highlight since the 2015 ACR Workforce Study noted that in certain geographic regions, the shortage of rheumatologists is more severe than in others (5, 6). As an example, in 2015, 21% of the rheumatologists in the US practiced in the northeast, while a mere 3.9% practiced in the southwest (5, 6). This highlights the need to ensure that CPD programs reach

PCCs in areas with fewer rheumatologists. In this systematic review, three of the included studies were affiliated with the Salt Lake City VA hospital in Utah and five studies involved PCCs from rural areas, which suggests a recognition of geo-specific rheumatology needs (21-23, 33-35, 38). While the geographic settings were broad, family medicine was the only specialty the included studies specifically mentioned. Several of the studies did not specify the learner's specialty type so those studies may have included various types of primary care clinicians. While the rationale for the specified inclusion of family medicine providers was not entirely clear, the fact that family medicine physicians provide 42% of healthcare in rural areas emphasizes the importance of their involvement in CPD initiatives (40).

Online learning may offer a way to ameliorate the geographic disparity in rheumatology-focused CPD access. For example, the use of online learning allowed Lineker et al. to give PCCs in very remote parts of Canada access to rheumatology-focused CPD (38) and aligns with initiatives by the Canadian government to improve access to CPD for rural providers (41). While none of the included studies were conducted during the pandemic, and only a single study used online learning (38), the use of virtual learning has drastically increased since the pandemic began with curricula from undergraduate medical education, graduate medical education, and CPD all making major shifts to online platforms. As such, the increasing acceptance of online learning might offer an alternative platform for CPD. Small group teaching was popular amongst the included studies with six studies using small groups for at least some part of their teaching strategy (21-23, 35-37).

Program evaluation is an area for potential improvement in rheumatology-focused CPD. The Kirkpatrick Model is a framework focused on the levels of outcomes of the evaluated training(32) (see figure 1). In applying this model, only Bellamy et al. examined patient outcomes in relation to their CPD aimed at teaching arthrocentesis using viscosupplementation (37). However, it is important to point out that they looked only at a single arthrocentesis that was done as a part of the educational intervention rather than subsequent arthrocenteses done after their intervention (37). As such, it is difficult to determine if these skills were maintained after the intervention. The transition to electronic medical records has increased the opportunity for assessing physician behavior changes and patient outcomes after a CPD intervention. The majority of studies evaluated for knowledge change (Kirkpatrick level 2) as their highest-level outcome using testing or objective structured clinical examinations (OSCEs). Only one study had learner satisfaction response (Kirkpatrick level 1) as its highest level outcome (33), but it is important to note that physicians tend to be poor with self-assessments (42). The outcomes assessed portion of the MERSQI correlates with Kirkpatrick levels, so designing studies with higher-level outcomes would contribute to higher quality CPD studies as well (30). It would be helpful if future CPD studies were designed so that the outcomes affect physician practice (Kirkpatrick Level 3) or patient outcomes (Kirkpatrick Level 4). More CPD interventions that focus on patient outcomes (Kirkpatrick Level 4) may also lead to an improvement in patient comfort or even morbidity as they await an appointment with a rheumatologist.

It is important to acknowledge the limitations of our study. First, we may have inadvertently missed studies despite a robust search designed by a medical librarian that utilized multiple databases. Second, our study focuses only on the US and Canada, though important health professions education is being done around the world. Additionally, as a systematic review of the research studies, our inclusion criteria focused on published studies and excluded CPD conducted by professional associations and other entities (e.g., UpToDate, Medscape). Future researchers might more broadly explore a variety of available CPD materials to create an inventory of resources for clinicians. Lastly, while we report that the coverage of rheumatology topics is incomplete, we recognize that this might be partially due to how authors tend to focus on their areas of expertise related to a specific disease state or skill. Nevertheless, there is a need for broader coverage of rheumatology topics in CPD.

Our systematic review suggests possible implications for providing CPD in rheumatology to PCCs. Online learning may offer an effective way to improve access to CPD for rural PCCs and the COVID-19 pandemic has illustrated the utility of this learning modality. In developing CPD studies, leveraging electronic medical records to assess for Kirkpatrick level 3 or 4 outcomes such as changes in referral patterns, prescribing, and patient outcomes would permit a more thorough assessment of durable practice changes as a result of the CPD. Future endeavors in CPD should focus not only on the most commonly encountered rheumatologic conditions, but also those topics with high morbidity and mortality, which may lower patient morbidity while awaiting rheumatology appointments, prove beneficial on recertification exams, or may aid practice and referral patterns in light of numerous physician workforce shortages. Finally, it is

important to note that outcomes data on medical education programs initiated by professional societies such as ACR that target PCCs have not been published and are therefore inaccessible.

Figure 1: Kirkpatrick levels translated into medical outcomes

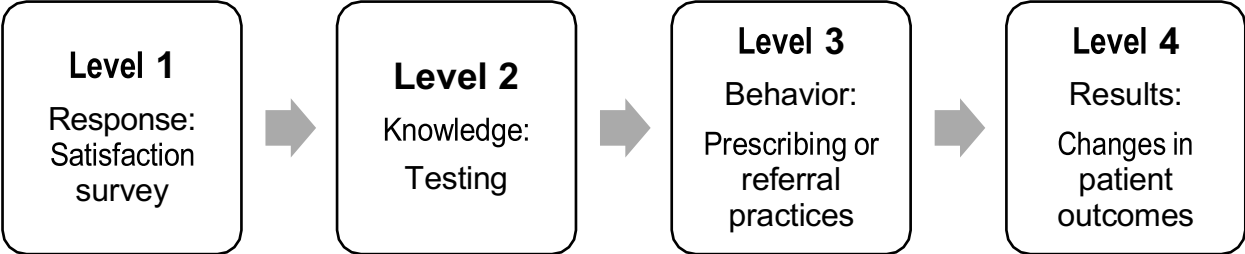


Figure 2: PRISMA Flow Chart

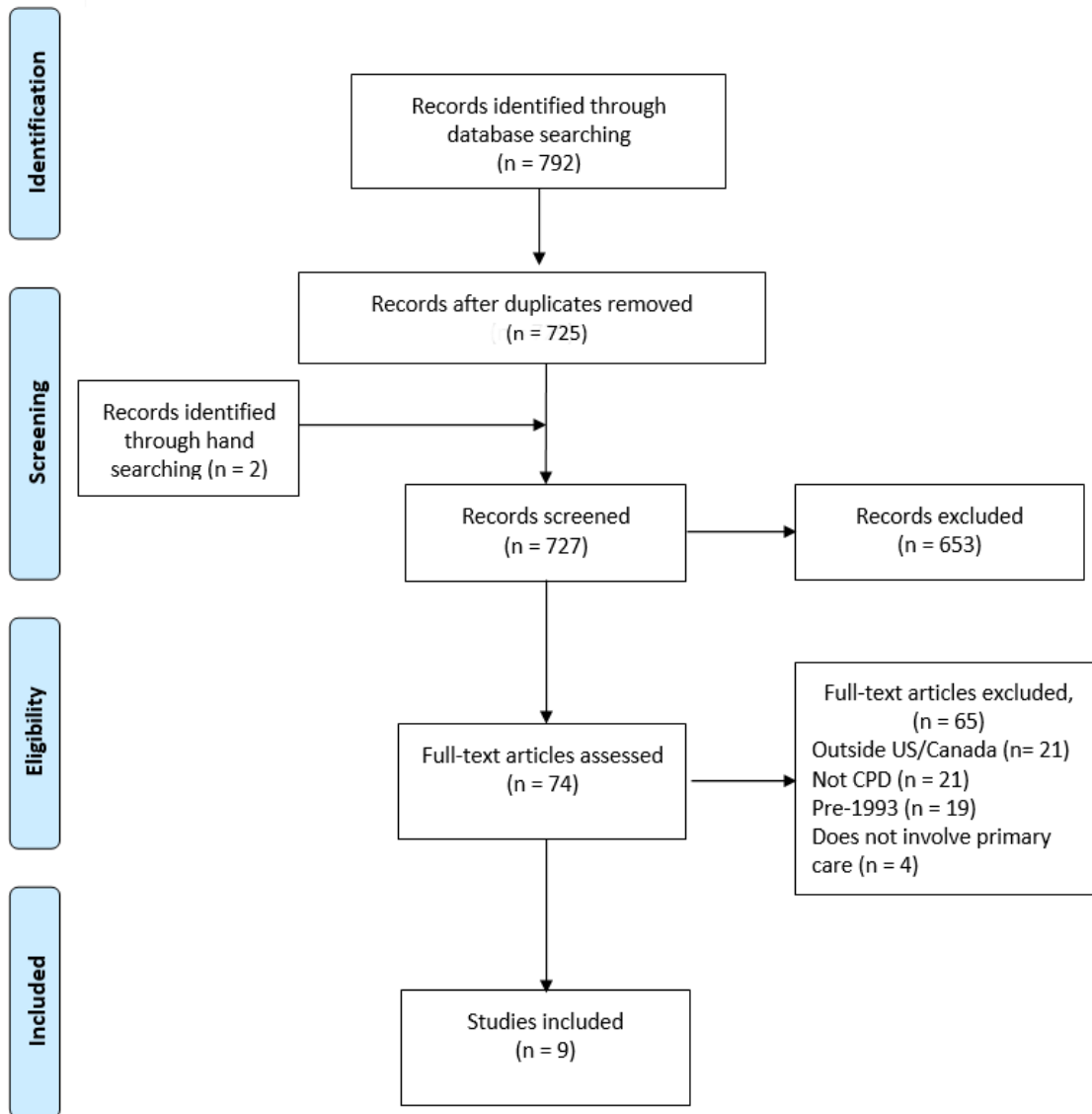


Table 1: Participant and Educator Characteristics found in studies of rheumatology-focused continuing professional development offered to primary care clinicians

<b>Author, year (ref.)</b>	<b>Number of participants who completed study</b>	<b>Learner Practice Level</b>	<b>Learner Specialty</b>	<b>Educators</b>
Barker et al., 2020 (10)	24	Physician, NP, PA	Primary care NOS, specialty care	Not specified
Battistone et al., 2016 (11)	227	Physicians, PAs, NPs, Nurses	Primary care NOS	Generalist and Rheumatologist or other MSK specialist
Battistone et al., 2016 (12)	19	Physician, NP, PA	Primary care NOS	Not specified
Bellamy et al., 2000 (21)	445	Physicians	FP	“Specialist or FPs who have particular skills in injection techniques, primarily in the knee”

Davis & Suarez-Almazor, 1995 (19)	20 Physicians	FP	Rheumatologist, a gastroenterologist, and a geriatrician
Davis et al. 1999 (20)	40 Physicians	FP	“Content experts on issues surrounding OP and previously trained [PCC]s”
Lineker et al., 2011 (18)	275 Physician, NP, OT/PT, Nurses, other healthcare providers, non-medical staff, students	Primary care NOS	“Arthritis specialists:” rheumatologists, dietitians, PT/OTs, SWs, pharmacists
Lineker et al. 2019 (22)	35 completed OA module and 31 completed early RA module	Physicians, OT/PT, Nurses, “others”	FP and “others”
Petrella & Davis, 2007 (17)	659 Physicians	FP	Not specified, but ask the expert feature, where the expert is a physician
			Trained facilitator family physician, assisted by an expert (rheum, ortho, gastro, nephro, endo)

Abbreviations: OA-osteoarthritis, RA-rheumatoid arthritis, MD/DO-physician, PA-physician's assistant, NP-nurse practitioner, OT/PT-occupational/physical therapist, MSK-musculoskeletal, SW-social worker, NOS-not otherwise specified, FP-family practice, rheum-rheumatology, ortho-orthopedics, gastro-gastroenterology, nephro-nephrology, endo-endocrinology.

Table 2: Education Interventions found in studies of rheumatology-focused continuing professional development offered to primary care clinicians

<b>Author, year (ref.)</b>	<b>Learning Environment</b>	<b>Needs Assessment</b>	<b>Teaching Modality</b>	<b>Topic</b>
Barker et al., 2020 (10)	F2F	pre-course self-assessment on knee and shoulder physical exam	multi-modality: Lecture, Hands-On Skills (PE and Arthrocentesis Task Trainers), Simulated Patients, OSCE, OSTE	MSK pain and exam, arthrocentesis
Battistone et al., 2016 (11)	F2F	not done	multi-modality: lecture, small group, cases, exam practice, OSCE	MSK exam, rheum cases (not specified), rheum serologies, arthrocentesis, OP
Battistone et al., 2016 (12)	F2F	not done	multi-modality: lecture, simulations, and hands-on peer learning	MSK Exam, OP, OA, RA, gout, SpA, arthrocentesis
Bellamy et al., 2000 (21)	F2F in learners' own practice	Survey	multi-modality: interactive small group learning, live patient	OA, arthrocentesis

			injection demonstration and practice	
Davis & Suarez-Almazor, 1995 (19)	F2F	Open-ended questionnaire relating to the diagnosis and management of OA	case-based small group learning	OA
Davis et al. 1999 (20)	F2F	advisory committee reviewed literature and locally generated data on OP to establish needs of PC Cs	case-based small group learning	OP
Lineker et al., 2011 (18)	F2F	not done	multi-modality: single day workshop with didactics and hands-on learning (not described), reinforcement activities in the 6 months following	OA, RA

Lineker et al. 2019 (22)	online	survey of providers and patients	case-based learning	OA, RA
Petrella & Davis, 2007 (17)	F2F	survey conducted at Annual Scientific Congress of College of Family Physicians and FGs with FP physicians	case-based learning	OA, RA, FMS, MSK pain

Abbreviations: F2F- face to face, PCCs- primary care clinicians, FP-family practice, FGs-focus groups, PE-physical exam, OA-osteoarthritis, OP-osteoporosis, RA-rheumatoid arthritis, MSK-musculoskeletal, FMS-fibromyalgia, rheum-rheumatology, SpA-spondyloarthritis.

Table 3: MERSQI, Outcome Levels, and Efficacy of studies on rheumatology-focused continuing professional development offered to primary care clinicians

Author, year (ref.)	MERSQI Kirkpatrick Level	Description of Reported Efficacy
Barker et al., 2020 (10)	14	2 <ul style="list-style-type: none"> <li>● Significant change in self-assessments of shoulder and knee exam from pre- to post- CPD</li> <li>● Change in OSCE scores based on years of experience, practice level (PA/NP), or physician specialty were not statistically different,</li> <li>● Specialty physicians trended towards better scores</li> <li>● Learners with &lt;3 years' experience trended towards lower scores</li> </ul>
Battistone et al., 2016 (11)	11.5	2 <ul style="list-style-type: none"> <li>● Post-course higher than pre-course self-assessments in all tested domains</li> <li>● 79% of participants scored in 81–100 deciles on shoulder OSCE (mean score 90%)</li> <li>● 65 % of participants scored in 81-100 deciles on knee OSCE (mean score 86%)</li> </ul>

Battistone et al., 2016 (12)	13	3	<ul style="list-style-type: none"> <li>● 100% survey completion with course rated very highly</li> <li>● 100% (of 14) interviewed had increased comfort with full shoulder &amp; knee exam, and increased comfort with procedures after intervention</li> <li>● 8 weeks post-course, 2 participants initiated musculoskeletal clinics</li> <li>● Increase in mean monthly injections in interviewed learners</li> </ul>
Bellamy et al., 2000 (21)	12	4	<ul style="list-style-type: none"> <li>● &gt;94% of FPs agreed or strongly agreed the CPD was effective and they felt comfortable in performing viscosupplementation via arthrocentesis</li> <li>● Clinically and statistically significant improvements in patient pain</li> </ul>
Davis & Suarez-Almazor, 1995 (19)	11.5	3	<ul style="list-style-type: none"> <li>● Increased use of analgesics and decreased use of NSAIDs, but changes in other therapy choices were not statistically significant</li> <li>● PT and intraarticular steroids considered earlier therapeutic options but weren't statistically significant</li> <li>● No changes in referrals</li> <li>● Improved awareness of complications of treatment choices, but indeterminate significance</li> </ul>

Davis et al. 1999 (20)	11	2	<ul style="list-style-type: none"> <li>● High CPD satisfaction with average score of 3.35 out of 4</li> <li>● 98% of learners improved their scores from pre- to post-test; mean pre-test score of 52.7 (range 35.6-64.8) to post-test 63.2 (range 44.6-75.3) out of a max possible of 81</li> <li>● Improvements in OSCE scores ranged from 1 to 29, but one person decreased their score by 15 points</li> </ul>
Lineker et al., 2011 (18)	13	2	<ul style="list-style-type: none"> <li>● Significant increases in total best practice scores 6 months post-CPD</li> <li>● Significant (<math>p &lt; 0.05</math>) and clinically important (<math>&gt;15\%</math>) improvements in best practices for early RA</li> <li>● Significant improvements in satisfaction and confidence (<math>p \leq 0.05</math>) 6 months post-CPD</li> <li>● Significant decrease in perceived barriers to arthritis services (<math>p &lt; 0.01</math>)</li> <li>● No significant change in physicians' recommendations for best practices</li> </ul>
Lineker et al. 2019 (22)	12	2	<ul style="list-style-type: none"> <li>● Significant improvement in learner satisfaction with the ability to manage OA and early RA</li> <li>● Significant and clinically important (<math>&gt;15\%</math>) improvements corticosteroid prescribing</li> </ul>

		<ul style="list-style-type: none"> <li>● Significant improvements in confidence of performing MSK exam, ordering serologies</li> <li>● Clinically important improvements in recommending knee arthrocentesis or NSAIDs for OA</li> <li>● Statistically significant and clinically important improvements in DMARD management and arthrocentesis for RA, though confidence still rather low</li> <li>● 35.7% improvement in best practice scores for OA</li> <li>● Clinically significant reduction in recommended surgical referrals</li> <li>● Total best practice scores for the RA module improved by 17.9%</li> </ul>
<p>Petrella &amp; Davis, 2007 (17)</p>	<p>9.5</p>	<p>1 ● Statistically significant improvement in self-assessed knowledge on distinguishing inflammatory &amp; non-inflammatory arthritis, distinguishing mechanical &amp; inflammatory pain, choosing labs for diagnosis and management of arthritis, choosing appropriate medication for MSK pain, recognizing patients at high risk for NSAID complications, identifying shoulder anatomy and etiology of shoulder pain, shoulder exam, availability of community resources for patients</p>

- Overall high level of satisfaction with the intervention

Abbreviations: OA-osteoarthritis, OP-osteoporosis, RA-rheumatoid arthritis, MSK-musculoskeletal, rheum-rheumatology, GI-gastroenterology, MERSQI-Medical Education Research Study Quality Instrument.

Table 4: Rheumatology topics identified in the systematic review of the literature on continuing professional development for Primary Care Clinicians

<b>ABIM Rheumatology Topics</b>	
<b>Included in CPD Literature</b>	<b>Not Included in CPD Literature</b>
Crystal-induced arthropathy	Systemic Lupus Erythematosus
Localized joint syndromes	Systemic Sclerosis
Rheumatoid Arthritis	Charcot-Marie-Tooth Disease
Osteoarthritis	Vasculitis
Metabolic and Other Bone Disorders	Infectious Arthritis
Orthopedic Disorders	Bursitis
Spondyloarthropathies	Undifferentiated Rheumatology
	Other Primary Rheumatic Disorders

Abbreviations: ABIM-American Board of Internal Medicine

**Supplement A:** Medline via Ovid search strategy for rheumatology-focused continuing professional development offered to primary care clinicians

Database Searches August 14, 2020

PubMed

August 14, 2020

Search	Query	Results
#1	"Education, Continuing"[Mesh] OR "Health Personnel/education"[Mesh] OR "Continuing education"[tiab] OR "continuing medical education"[tiab] OR "continuing professional development"[tiab] OR "professional development"[tiab] OR "lifelong learning"[tiab]	125470
#2	"Physicians, Primary Care"[Mesh] OR "Primary care provider"[tiab] OR "primary care providers"[tiab] OR "primary care physician"[tiab] OR "primary care physicians"[tiab] OR "physician"[tiab] OR "nurse practitioner"[tiab] OR "physician assistant"[tiab]	219471
#3	"Rheumatology"[Mesh] OR "Rheumatic Diseases"[Mesh] OR "Rheumatology"[tiab] OR "Rheumatic Diseases"[tiab] OR "Rheumatic and Musculoskeletal Diseases"[tiab] OR "Musculoskeletal and Rheumatic Diseases"[tiab]	241163
#4	#1 AND #2 AND #3 AND (english[Filter])	64

Embase

August 14, 2020

Search	Query	Results
#1	'Continuing Education'/exp/mj OR 'Health Personnel'/exp/mj OR 'Continuing education':ab,ti OR 'continuing medical education':ab,ti OR 'continuing professional development':ab,ti OR 'professional development':ab,ti OR 'lifelong learning':ab,ti	560459

#2	'Primary Care Physicians'/exp/mj OR 'Primary care provider':ab,ti OR 'primary care providers':ab,ti OR 'primary care physician':ab,ti OR 'primary care physicians':ab,ti OR 'physician':ab,ti OR 'nurse practitioner':ab,ti OR 'physician assistant':ab,ti	326693
#3	'Rheumatology'/exp/mj OR 'Rheumatic Diseases'/exp/mj OR 'Rheumatology':ab,ti OR 'Rheumatic Diseases':ab,ti OR 'Rheumatic and Musculoskeletal Diseases':ab,ti OR 'Musculoskeletal and Rheumatic Diseases':ab,ti	240125
#4	#1 AND #2 AND #3 NOT ([conference abstract]/lim OR [conference paper]/lim OR [conference review]/lim) AND [english]/lim	183

Web of Science

August 14, 2020

Search	Query	Results
#1	TS=("Health Personnel education" OR "Continuing education" OR "continuing medical education" OR "continuing professional development" OR "professional development" OR "lifelong learning")	28452
#2	TS=("Primary care provider" OR "primary care providers" OR "primary care physician" OR "primary care physicians" OR "physician" OR "nurse practitioner" OR "physician assistant")	153854
#3	TS=("Rheumatology" OR "Rheumatic Diseases" OR "Rheumatology" OR "Rheumatic Diseases" OR "Rheumatic and Musculoskeletal Diseases" OR "Musculoskeletal and Rheumatic Diseases")	32861
#4	#1 AND #2 AND #3 <i>Refined by: LANGUAGES: ( ENGLISH )</i>	16

CINAHL

August 14, 2020

Search	Query	Results
#1	(MJ "Continuing Education") OR (MJ "Health Personnel") OR TX ("Continuing education" OR "continuing medical education" OR	177477

	“continuing professional development” OR “professional development” OR “lifelong learning”)	
#2	(MJ “Primary Care Physicians”) OR TX (“Primary care provider” OR “primary care providers” OR “primary care physician” OR “primary care physicians” OR “physician” OR “nurse practitioner” OR “physician assistant”)	346267
#3	(MJ "Rheumatology") OR (MJ "Rheumatic Diseases") OR TX (“Rheumatology” OR “Rheumatic Diseases” OR “Rheumatic and Musculoskeletal Diseases” OR “Musculoskeletal and Rheumatic Diseases”)	63869
#4	#1 AND #2 AND #3 <i>Limiters</i> - Peer Reviewed, English Language	472

ERIC

August 14, 2020

Search	Query	Results
#1	(“Continuing education” OR “continuing medical education” OR “continuing professional development” OR “professional development” OR “lifelong learning”) <b>AND</b> (“Primary care provider” OR “primary care providers” OR “primary care physician” OR “primary care physicians” OR “physician” OR “nurse practitioner” OR “physician assistant”) <b>AND</b> (“Rheumatology”)	2

PsycINFO

August 14, 2020

Search	Query	Results
#1	Health Personnel Education OR Continuing education OR continuing medical education OR continuing professional development OR professional development OR lifelong learning	35995
#2	Primary care provider OR primary care providers OR primary care physician OR primary care physicians OR physician OR nurse practitioner OR physician assistant	38872
#3	Rheumatology	761

#4	#1 AND #2 AND #3 <i>Limit to English</i>	2
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Search Results Table

August 14, 2020

Database	Results
PubMed	64
Embase	183
Web of Science	16
CINAHL	472
ERIC	2
PsycINFO	2
TOTAL with duplicates	791
TOTAL after duplicates	725

Supplement B: Extraction Form
Article Number
Title
Authors
Journal
Publication Date
Country (US=1, Canada=2)
Number of participants enrolled
Number of participants who were trained/educated
Number of participants who completed study
Notes re: number of participants
Specialty (Primary care NOS=1, IM=2, FP=3, Geriatrics=4, other=5 and please specify)
Educational background of learner (MD/DO=1, NP=2, PA=3, OT/PT=4, nurse=5, other=6 and please specify)
Practice context of learners (private practice=1, university hospital=2, govt=3, community hospital=4, other=5 please specify)
Geographic context of learner (rural=1, urban=2, not specified=3, other=4 please specify)
Notes on geographic context of learners
who are the educators
Learning environment (classroom=1, online=2, simulation lab=3, conference=4, other=5 and please specify, 6=not specified)
Notes on learning environment
in person=1, virtual=2, combination=3
Was a needs assessment done? (Y=1, N=2)
How was the needs assessment done?
Teaching modality: is there active learning? Lecture? Workshop? Simulated patient? Patient interaction? Case studies?
Any notes about the teaching/learning
Educational Topic: RA, SLE, gout, FMS, SSc, OA, musculoskeletal pain, Osteoporosis/bone health, MSK physical exam

Educational Objectives (Y=1, N=2)
Duration of intervention
single class, multi-day conference, longitudinal, workshop (meaning multiple classes in a single day)
Is there repetition or option for repetition (Y=1, N=2)
Quantitative=1, qualitative=2, mixed=3
Study design (RCT, pre-post survey, cohort, etc)
How were learners assessed? (satisfaction survey, knowledge test, OSCE, patient outcomes, practice changes, etc). If no assessment, enter None
Kirkpatrick level (reaction-did they just assess reponse=1, learning-did they test the learners somehow=2, behavior-did they follow up to see that a behavior changed=3, results-did they look at patient outcomes=4)
Study outcomes
Efficacy of outcomes
Was CME credit given (Y=1, N=2, not specified=3)
Did learners specifically evaluate the educational experience (Y=1, N=2, not specified=3)
Did the learners evaluate the educators (Y=1, N=2, not specified=3)
Did the educators evaluate the experience (Y=1, N=2, not specified=3)
What are the stated limitations?
What are described future directions
Should the study still be included (Y=1, N=2)
Final Thoughts

## CHAPTER 3: DISCUSSION

This systematic review was conducted to synthesize and determine the quality of the current literature on rheumatology-focused CPD interventions. While there is evidence of effectiveness in terms of knowledge acquisition amongst participants, there is limited evidence for patient outcomes (37), which contributes to the moderate quality of the body of literature based on MERSQI scores (30). In this systematic review, we identified that the teaching involved both rural and urban providers, used predominantly in-person methods, and narrowly covered rheumatology topics. In this discussion, the aforementioned findings are addressed, as well as the societal, scientific, and military relevance.

The coverage of rheumatology topics is incomplete with covered topics including OA, RA, arthrocentesis, OP, SpA, MSK exam, serologies/labs, gout, and FMS. While this represents a wide range of topics and accounts for some of the most common rheumatologic and musculoskeletal disorders, it is by no means an all-inclusive list of topics important to PCCs either clinically or with respect to MOC (see figure 2) (28). Though many RMDs are rare, they can have life-threatening or life-altering manifestations that warrant CPD for the PCC particularly since prompt diagnosis and treatment can profoundly impact both morbidity and mortality, justifying the efforts in developing CPD (11-16).

The background specialty of the learners was narrowly focused. Family medicine was the only specialty the included studies specifically mentioned. The rationale for the specified inclusion of family medicine providers was not entirely clear, though family medicine physicians provide

42% of healthcare in rural areas, which emphasizes the importance of their involvement in CPD initiatives (40) and may suggest an additional recognition of the need for rheumatology in rural areas. The broader inclusion of other primary care providers, such as internal medicine, geriatrics, or perhaps emergency medicine clinicians, could be a fruitful approach in future studies.

The geographic context of the learners is important to highlight. In 2015, the ACR Workforce Study reported that in certain geographic regions the shortage of rheumatologists is more severe than in others (5, 6) and underscores the need to ensure that CPD programs reach PCCs in areas with fewer rheumatologists. In this systematic review, three of the included studies were affiliated with the Salt Lake City VA hospital in Utah and five studies involved PCCs from rural areas, which suggests a recognition of geo-specific rheumatology needs (21-23, 33-35, 38). While there is a dearth of rheumatologists in the American southwest, there are other areas of need within both the United States and Canada that would benefit from targeted interventions.

Online learning may help ameliorate the geographic disparity in rheumatology-focused CPD access. For example, the use of online learning allowed Lineker et al. to give PCCs in very remote parts of Canada access to rheumatology-focused CPD (38) and aligns with initiatives by the Canadian government to improve access to CPD for rural providers (41). The use of virtual learning has drastically increased since the COVID-19 pandemic began with curricula from undergraduate medical education, GME, and CPD all making major shifts to online platforms. As such, the increasing acceptance of online learning might offer an alternative platform for CPD.

Small group teaching was popular amongst the included studies with six studies using small groups for at least some part of their teaching strategy (21-23, 35-37). Three of the four most recent studies used simulation in addition to small groups, which reflects a shift in teaching to a multi-modal approach and the use of more active teaching methods, which is commensurate with the evolution in medical education more broadly (43). However, as small group and simulation training can be resource intensive (i.e., manpower needs, monetary costs), it will be important for future studies to consider the return on investment for such approaches.

Program evaluation is an area for potential improvement in rheumatology-focused CPD. Only Bellamy et al. examined patient outcomes in relation to their CPD. However, their methods lacked follow up leaving the strength of that outcome questionable (37). Looking to the future, the mandated transition to electronic medical records, may provide the valuable opportunity for assessing physician behavior changes and patient outcomes after a CPD intervention with minimal disruption to the provider and patient. The majority of included studies evaluated for knowledge change (Kirkpatrick level 2) as their highest-level outcome using testing or objective structured clinical examinations (OSCEs). Only one study had learner satisfaction response (Kirkpatrick level 1) as its highest level outcome (33), but it is important to note that physicians tend to be poor self-assessors (42). The outcomes assessed portion of the MERSQI correlates with Kirkpatrick levels, so designing studies with higher-level outcomes would contribute to higher quality CPD studies as well (30). It would be ideal for future CPD studies to be designed with outcomes that affect physician practice (Kirkpatrick Level 3) or patient outcomes

(Kirkpatrick Level 4). Further, Cervero & Gaines reported that more interactive teaching improves learner outcomes in CPD, and thus may aid in a shift towards higher Kirkpatrick level outcomes (see figure 1) (20).

Cost was only minimally addressed in the included studies. The group from the Salt Lake City VA Hospital, performed an in-depth cost analysis for teaching arthrocentesis prior to starting their mini-residency program for musculoskeletal CPD, and found that it was cost-effective to teach rural providers to perform arthrocentesis (24). In recognition of the significant cost burden that in-person CPD programs can have, Lineker et al. adapted the Canadian “Getting a Grip on Arthritis” program to an online version. While Lineker et al. acknowledged that online learning is more cost effective, they did not specifically discuss the costs of creating the program (38). Though considering the cost of creation of the CPD intervention is critical, it is also important to consider what teaching method will be used. For instance, a review of CPD in general by Bloom showed that the use of ineffective methods for CPD may increase the costs of CPD long term (44).

#### Societal & Scientific Relevance

US Centers for Disease Control (CDC) data from 2013-2015 revealed that 22.7% of adults (roughly 54.4 million US residents) had a form of arthritis or a similar condition (e.g., fibromyalgia) (45). By the year 2040, the CDC estimates that approximately 25.9% of adults (roughly 78.4 million people) will have arthritis or another similar condition (45). With an ever-increasing shortage of rheumatologists in the US, PCCs will increasingly be called upon to

manage basic rheumatologic disorders or take the initial steps to diagnose and manage more complicated disease until the patient can be seen by a rheumatologist. As a result, it is imperative that rheumatology-focused CPD for PCC be leveraged to its full potential.

This research provides important information on the landscape of rheumatology-focused CPD and an answer to the question of what is the quality of current rheumatology CPD for PCCs. In answering this question, it was determined that the quality of rheumatology CPD for primary care providers is unfortunately only moderate. The research also illustrates that CPD offerings to target PCCs in rural areas and areas where the number of rheumatologists is low could be improved. This work also highlights that the body of topics covered by the rheumatology CPD is incomplete and leaves out rheumatologic topics that not only might be covered in maintenance of certification exams but also rheumatologic diseases that might carry a high morbidity and mortality thus suggesting an area for improvement.

This research supports the need to create and distribute high quality rheumatology CPD that targets geographic areas where the density of rheumatologists is low. Creators should be deliberate in thinking about their teaching methods as well, with a focus on interactive methods that have been shown to improve outcomes. In trying to create higher quality rheumatology CPD, there should be a focus on evaluation and outcomes, particularly with respect to how CPD affects physician behaviors and patient outcomes.

## Military Relevance

Rheumatic disease often develops earlier in adulthood, frequently coinciding with when a person might be actively serving in the military. Early recognition and treatment of rheumatic disease is crucial to reduce morbidity among service members and preserve the fighting force.

The military is no exception to the shortage of rheumatologists seen throughout the US, with 28 active duty rheumatologists (13 Air Force rheumatologists with 2 in non-rheumatology billets; 4 Navy rheumatologists with all in non-rheumatology billets; 11 Army rheumatologists 3 in non-rheumatology billets) in the Department of Defense by the end of 2022. Further, many military bases are without rheumatologists, thus forcing PCCs to take initial steps in diagnosis and treatment on their own or referring patients to other military bases that may require multi-day trips, or referral to an already over-extended civilian rheumatologist in the patient's geographic area. This research can subsequently inform future DOD/VA CPD initiatives to better equip PCCs with the knowledge needed to treat patients with RMDs while they await an initial appointment with a rheumatologist. By creating CPD that looks at physician behaviors and patient outcomes, there may also be a subsequent improvement in morbidity resulting in improved preservation of the fighting force.

## **Limitations**

It is important to acknowledge the study's limitations. First, we may have inadvertently missed studies despite robust search strategies run by a medical librarian that utilized multiple databases. Second, our study focuses on the US and Canada, though important health professions education is being conducted worldwide. Future studies, should examine CPD interventions being done throughout the world, particularly as the medical world shrinks in size with the increased use of online learning and virtual meetings. Additionally, as a systematic review of the research studies, our inclusion criteria focused on published studies and excluded CPD conducted by professional associations and other entities used to obtain CPD credit for MOC (e.g., UpToDate, Medscape). While we report that the coverage of rheumatology topics is incomplete, we recognize that this might be partially due to how authors tend to focus on their areas of expertise related to a specific disease state or skill. Nevertheless, there is a need for broader coverage of rheumatology topics in CPD.

## **Conclusions and Future Directions**

Our systematic review suggests possible implications for providing CPD in rheumatology to PCCs. In developing CPD studies, leveraging electronic medical records to assess for Kirkpatrick level 3 or 4 outcomes such as changes in referral patterns, prescribing, and patient outcomes would permit a more thorough assessment of durable practice changes as a result of the CPD. CPD designers should also keep cost in mind, during the design process itself and should consider performing a cost analysis similar to that done by Nelson, et al prior to initiating a CPD

intervention (24). Evaluation should be a critical part of the design stage of CPD to make sure that the efforts in creation of CPD will have impact on patient and physician outcomes, which could, in turn, impact cost effectiveness of the CPD (44). Online learning may offer an effective way to improve access to CPD for rural PCCs and the COVID-19 pandemic has illustrated the utility of this learning modality. Though with online learning becoming popular in recent years, researchers should evaluate online learning CPD modules through the same critical lens as in-person modalities, to include evaluating levels of outcomes. Future endeavors in CPD should focus not only on the most commonly encountered rheumatologic conditions, but also those topics with high morbidity and mortality, which may lower patient morbidity while awaiting rheumatology appointments, prove beneficial on recertification exams, or may aid practice and referral patterns in light of numerous physician workforce shortages.

Based on the information gleaned from this research, next steps, specific to the DOD, should involve performing a needs assessment of military (and possibly VA) PCCs to begin creation of a rheumatology-focused CPD program for this audience. The CPD should be focused on improving outcomes that relate to physician behaviors (Kirkpatrick Level 3) and, through the implementation of a unified electronic medical record (MHS Genesis) throughout VA and DOD medical facilities, there may be the opportunity to evaluate patient outcomes (Kirkpatrick Level 4).

## CHAPTER 4: REFERENCES

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