RHEUMATOLOGY AND IMMUNOLOGY RESEARCH

Review • DOI: 10.2478/rir-2021-0020 • 2(3) • 2021 • 139–145

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Telerheumatology: A Narrative Review

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Received July 14, 2021 accepted August 18, 2021

Abstract

Telemedicine (TM), the delivery of health care using telecommunication technologies, has been in use in rheumatology practice for over two decades to maximize access and optimize care. As a direct consequence of the Coronavirus disease 2019 (COVID-19) pandemic in March 2020, rheumatology practice shifted from traditional in-person encounters to TM to ensure the safety of both healthcare professionals and patients. However, there is limited literature on the acceptance, feasibility, and effectiveness of TM in the management of rheumatic diseases. Additionally, there is limited guidance on the implementation of telerheumatology (TR) for both patient care and clinical trials. Here we reviewed the most recent publications related to the application of TR, in the management of Rheumatoid Arthritis (RA) and Systemic Lupus Erythematosus (SLE), assessed the perceptions of patients and physicians on TM in rheumatology, and identified several key barriers to TR.

Keywords

rheumatoid arthritis • rheumatology • systemic lupus erythematosus • telemedicine

Introduction

Telemedicine (TM) is defined by the American Telemedicine Association as a mode of healthcare delivery using telecommunication technologies. TM is classified as synchronous or asynchronous based on the synchronicity of the information exchange.[1] TM for rheumatology care, also referred to as telerheumatology (TR), was first reported by Chase *et al*. in 1995 when it was used to deliver rheumatology consultants to patients in the Texas State prison system. Since then TR has been applied in rheumatology practices for over two decades.[2] Synchronous TM enables real-time exchange of information between patients and physicians using radio and telephone-based methods or video telecommunication systems[3] and was introduced in rheumatology practices to maximize access to specialty care for populations in under-served areas and to optimize the efficacy of healthcare delivery in routine clinical practice.[4] A 2017, pre-COVID, systematic review of TR analyzed data on 1426 patients from 20 studies that evaluated the use of TM for diagnosis and/or management of rheumatic diseases; the review performed a descriptive analysis of 19 observational studies and one randomized clinical trial (RCT). The majority of the studies reviewed (n = 18) found TM to be effective. Six studies included a cost analysis component, and it was found that for 16% of patients TM was cost-effective. Five studies assessed the accuracy in diagnosis agreement. The authors concluded that there were insufficient outcomes of information data to draw strong conclusions about the effectiveness of TM in rheumatology.[3] A subsequent 2017 systematic review selected 23 methodologically appraised studies that reported outcomes for feasibility, effectiveness, and patient satisfaction. This review determined that the feasibility and patient satisfaction rates were high or very high across intervention types, and effectiveness was equal to or higher than the standard face-to-face (F2F) approach in controlled trials despite the small sample size and lack of blinding.[5]

Since the beginning of the COVID-19 pandemic in March 2020 the provision of medical services all over the world has shifted from F2F to TM. According to the Centers for Disease Control and Prevention (CDC), during the first quarter of

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2020, the number of TM visits increased by 50%, with a 154% increase in visits noted in March 2020, compared with the same period in 2019.[6] The rheumatology societies in the United States,[7] Europe,[8] and Asia[9] developed recommendations to optimize the use of TM to reduce exposure to Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Rheumatology practices began to offer TM encounters to the vast majority of patients with rheumatic diseases.[10] An American College of Rheumatology (ACR) expert panel guided the implementation of current Rheumatoid Arthritis (RA) disease activity measures but not for other rheumatic diseases including Systemic Lupus Erythematosus (SLE).

The goal of this article was to review the literature published in the last 2 years regarding the application of synchronous TM in rheumatology practice, with special attention to RA and SLE.

METHODS

To identify articles related to TM and rheumatology, we performed database searches using Medline, Web of Science, and Scopus databases. Results were limited to articles published between January 2018 to June 2021 written in English, Chinese, Spanish, Italian, and French. The following search string was used to identify articles of interest (TM OR Telehealth OR TR) AND (SLE OR Lupus OR "Systemic Lupus Erythematosus" OR "Rheumatoid Arthritis" OR RA). The eligibility criteria were as follows: (1) included ≥20 patients with documented diagnosis of RA or SLE; or included ≥5 physicians engaged in the management of rheumatic diseases; (2) included TM interventions that are considered synchronous (e.g., video conference or telephone interview); (3) was published after January 1, 2018; (4) was original research. Two reviewers working independently (WT and ADA) evaluated the eligibility based on a review of the abstracts and titles. Disagreements regarding eligibility were resolved by consensus after discussion. The quality of each study was independently evaluated by 2 reviewers (WT and ADA). The quality of RCTs was measured using the Cochrane Collaboration's tool (CCT), a 7 domain tool for risk of bias assessment.[11] This tool rates each of the study characteristics as "high risk of bias," "low risk of bias," or "unclear." The risk of bias in observational studies was measured using the Risk Of Bias In Non-randomized Studies – of Interventions (ROBINS-I) tool.[12] It categorized the overall risk of bias into "low," "moderate,"

Table 1: Studies on patients' experience with TM

Reference/region	Study design	Scale (*n*)	Risk of Bias ROBINS-I	Findings	Conclusion
Devadula *et al.*[13]/ Australia	Online Survey	48	Moderate	88–100% of participants agreed or strongly agreed with affirmative statements relating to acceptability, quality of physician-patient interaction, and nurse involvement	Extremely high satisfaction with TR visits
Antony *et al.*[18]/US	Text Survey	550	Serious	98.4% considered the use of TM appropriate. 28.1% felt TM was only appropriate in times of strict infection control	TM was highly acceptable to patients during the COVID-19 pandemic
Opinc *et al.*[14]/ Poland	Online Survey	244	Moderate	82% preferred telephone consultations while only 303% declared interest in video consultations. 88.5% thought TM should be available even after the end of the COVID-19 pandemic	The majority agreed that TM should remain a choice even after the pandemic. Telephone was preferred over video as the method of delivering TM
Ziade *et al.*[15]/Arab countries	Online survey	2163	No information	98.8% would accept a teleconsultation, of which 50% through the Internet and 48.8% through a telephone contact	Extremely high acceptance of TM during COVID-19 pandemic and the preference for Internet or telephone is equivalent
Ferucci *et al.*[17]/US	Observational	TM (*n* = 56) Non-TM (*n* = 66)	Low	43% of TM group and 41% of non-TM group agreed or strongly agreed that they could always trust the equipment to work in a video visit. 61% of TM group expressed a preference for F2F visits compared to 74% in non-TM group	Individuals ever been seen by TM responded to 12- item TM perception survey more favorably than those who have never been seen by TM
So *et al.*[19]/China	Online survey	155	No Information	57.4% were willing to undergo TM follow-up. 40% of patients agreed or strongly agreed that they were confident in using TM as a mode of follow-up while only 14.9% disagreed or strongly disagreed, with the rest 45.1% showing a neutral response	Overall a high acceptance of TM as a mode of follow-up for lupus nephritis

F2F, face-to-face; ROBINS-I, Risk Of Bias In Non-randomized Studies- of Intervention; TM, Telemedicine; TR, telerheumatology; US, United States.

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Table 2: Studies on rheumatologists' experience with TM

Reference/region	Study design	Scale (*n*)	Risk of Bias (ROBINS-I)	Findings	Conclusion
Muehlensiepen *et al.*[20]/DE	Online survey	485	Moderate	74.6% do not currently use TM 62.3% would like to use TM. 69.6% thought that TM can be used in rheumatology	Low use but high acceptance of the implementation of TR among physicians. Lack of a structural framework, including administrative efforts, adequate reimbursement, and training courses for physicians, was a barrier to the effective implementation of TR
Ziade *et al.*[21]/Arab countries	Online survey	858	Low	Clinicians used TM in 70% of cases. 12% of cases were reimbursed. 54% agreed to use telehealth, 24% would agree if fully reimbursed, 22% would not agree to use TM	Clinicians hesitated to use TM partly due to a lack of reimbursement. Better access to drugs and providing TM platforms are recommended to improve the practice
Singh *et al.*[22]/US	Online survey	103	Moderate	43% responders agreed or strongly agreed that they were able to provide health care efficiently; 68% were able to provide healthcare safely; >50% spent extra time providing care	A majority of the rheumatologists were somewhat or very comfortable with technology for providing health care to established patients during the COVID-19 pandemic, but not to new patients
Matsumoto *et al.*[23]/US	Online survey	45	Moderate	71% of respondents identified the inability to perform a physical exam as the greatest barrier to effective TR. 59% agreed that TR is vital to increasing access to care 40% agreed that TR is vital to the quality of care	Rheumatologists agreed that TM has the potential to improve access and quality of care despite the inability to perform a physical examination

CCT, Cochrane Collaboration's Tool; ROBINS-I, Risk Of Bias In Non-randomized Studies-of Intervention; TM, Telemedicine; TR, Telerheumatology; US, United States; DE, Germany.

Table 3: Studies on the effectiveness of TM in rheumatology practice

Reference/region	Study design	Scale (*n*)	Risk of Bias (ROBINS-I or CCT)	Primary outcome	Results*
de Thurah *et al.*[29]/DK	RCT	SC (*n* = 94) PRO-TR (*n* = 93) PRO-TN (*n* = 88)	Low	Change in DAS28 at week 52	No difference in DAS-28 between Control versus PRO-TR (RR = –0.10, CI [–0.30–0.13]), and PRO-TN versus control (RR = –0.19, CI [–0.41–0.02])
Taylor-Gjevre *et al.*[30]/CA	RCT	SC (*n* = 31) TM (*n* = 54)	Low	RA disease activity index (DAS-28-CRP, RADAI, mHAQ), quality of life (EQ-5D), and patient satisfaction (VSQ9) over 9 months	There were no significant between-group differences in DAS28-CRP (RR = 0.9, CI [–3.1 – 1.2]), RADAI (RR = –0.9, CI [–2.4–0.5]), mHAQ (RR = 0.2, CI [–0.5, 0.1]) or EQ-5D (RR = –0.1, CI [–0.1, 0.4]) scores at baseline or over the study period. Satisfaction rates were high in both groups.
Ferucci *et al.*[27]/US	Observational	SC (*n* = 59) TM (*n* = 63)	Low	Patient-reported diseases activity, functional status, and quality of care over a 12-month period	In short-term follow-up, there was no significant difference in most outcome and quality measures in patients with RA who incorporated TM versus in-person only.
Wood *et al.*[35]/US	Prospective pilot	SC (*n* = 60) TM (*n* = 25)	Low	RAPID-3, out-of-pocket visit costs and distances traveled, and patient satisfaction instruments	PROs for care delivered via TM were similar to usual care, with significant cost and distance savings.
Nguyen-Oghalai *et al.*[28]/US	Observational	TM & F2F (*n* = 38)	Moderate	Diagnoses made in TM and subsequent F2F visits	In TM visits, 23 were diagnosed as having an inflammatory or rheumatic condition; 15 were subsequently confirmed at the F2F visits. The overall correlation was 79% between the TM and F2F visits

*All the CI in the table refers to the 95% CI.
CCT, Cochrane Collaboration's Tool; CI, confidence interval; CRP, C-reactive protein; DAS-28, Disease Activity Score in 28 joints; EQ-5D, EuroQoL 5-dimension instrument; F2F, face-to-face; mHAQ, modified Health Assessment Questionnaire; PRO-TN, patient-reported outcome-based telehealth follow-up by a Nurse; PRO-TR, patient-reported outcome-based telehealth follow-up by a rheumatologist; RA, rheumatoid arthritis; RADAI, Rheumatoid Arthritis Disease Activity Index; RAPID-3, Routine Assessment of Patient Index Data 3.; RCT, Randomized clinical Trials; ROBINS-I, Risk Of Bias In Non-randomized Studies-of Intervention; RR, relative risk; SC, standard care; TM, telemedicine; TR, telerheumatology; US, United States DK, Denmark; CA, Canada; VSQ-9, Visit Specific Satisfaction Instrument.

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"serious," "critical," or "no information." The overall risk of bias for each publication was included in Tables 1–3.

Patient Experience

Patients in studies conducted before and during the COVID-19 pandemic indicated high acceptance and satisfaction with TM for the delivery of rheumatology care. Devadula *et al*. investigated 48 patients with a diverse range of rheumatic conditions from five Australian regional clinics regarding TR services; 88–100% of participants agreed or strongly agreed with affirmative statements relating to acceptability, physician-patient interaction, and nurse involvement. Most importantly, 88% of participants indicated a preference for TR appointments over F2F visits for future rheumatology appointments.[13] Similarly, a study conducted by Opinc *et al*. in Poland showed that the vast majority (88.5%) of 244 patients thought TM should be available even after the COVID-19 pandemic although 70.1% valued direct conversations with their doctor.[14] Another survey across 15 Arab countries involving 2163 patients with diverse rheumatic diseases revealed a 98.8% acceptance rate for TM during the COVID-19 pandemic; the preference for the Internet (50%) or telephone contact (48.8) was equivalent.[15] The survey of our own cohort from Columbia University Medical Center (CUMC) that consisted of 100 patients with a large proportion (60%) of SLE, reported a high satisfaction rate (84%) with TM and 77% responded positively when asked whether they would use TM in the future.[16]

Multiple studies attempted to identify factors related to the acceptance of TM by patients with rheumatic diseases. Ferucci *et al*. conducted a 12-item TM perception survey in 56 patients seen by TM (TM group) and 66 patients who were seen in-person (in-person only group). For most questions, the TM group responded more favorably than the in-person only group. However, 61% of the TM group still expressed a preference to be seen by the specialist in-person as compared to 74% of the in-person only group and only around 40% of both groups agreed or strongly agreed with the statement that "I can always trust the equipment to work in a video visit." Factors associated with the use of TM as reported from a univariate analysis by the study included a higher disease activity, a higher number of rheumatologist visits in the preceding year, a more positive perception of telehealth, and a visit with a physician who used telehealth more often.[17] This study included a large proportion of patients residing in rural Alaska with longer distances to travel to a rheumatologist than the average patients with rheumatic diseases, which made TM more attractive to those patients with higher patient-reported disease activity scores. Antony *et al*. surveyed a group of 550 patients with rheumatic musculoskeletal diseases (RMDs) and found 28.1% of participants thought TM was only appropriate in times of strict infection control despite a high overall acceptance of TM (98.4%). Participants also identified if their disease condition was well-controlled as the top factor regarding whether to accept TM or not.[18] So *et al*. reported good acceptance and confidence regarding the use of TM as a mode of follow-up for lupus nephritis in a survey of 203 patients. The accuracy of disease activity assessment (43.9%) and privacy (29.7%) were the main concerns for patients.[19]

Physician Experience

In a survey of 48 rheumatologists and 437 general practitioners from Germany, 74.6% of them answered that they did not use TM, 62.3% reported an interest in using TM. In addition, 69.6% of the surveyed physicians thought that TM could be used in rheumatology. Half of the participants chose TM as a specific approach to improve rheumatology care.[20] Ziade *et al*. surveyed 865 rheumatologists across several Arab countries and reported that clinicians used TM in 70% of encounters during the pandemic; however, only 12% of these TM encounters were reimbursed. As for their interest to use TM in the future, 54% fully agreed, 24% would agree if these encounters were reimbursed, and 22% disagreed.[21]

In a US study of 103 Veteran Affairs (VA) rheumatologists to evaluate which rheumatic conditions were considered suitable for virtual visits, 35% considered the VA Video Connect based follow-up to be best suited for patients with stable lupus while for those in need of medication changes 41–53% selected an in-person follow-up visit as the best option. Interestingly, the study reported a high provider resilience score of 6.35 ± 1.260 on a validated 2-item Connor-Davidson Resilience Scale (CS-RISC 2), where the provider resilience (stress coping capability) was scored from 0 to 8 with higher scores corresponding to higher resilience.[22] Additionally, 68% agreed they could provide excellent care using TM and over 50% reported spending a lot more time per patient visit for TM. In another national survey involving 45 VA rheumatologists, 71% of respondents identified the inability to perform a physical exam as the greatest barrier to effective TR but agreed that TR is vital to increasing access to care (59%) and the quality of care (40%) in the VA.[23]

In our own survey of 17 rheumatology providers from CUMC, only 3 (18%) expressed satisfaction with TM while 14 (82%) felt the TM visit was inferior to conventional in-person clinical visits. Noticeably, technical difficulties, unsatisfactory communications, and insufficient physical examinations were reported by 12 (71%), 15 (88%), and 14 (82%) care providers as reasons for dissatisfaction with virtual care. However, 12 (71%) acknowledged the importance of TM and would recommend TM visits to other physicians.[16]

Barriers to TM

Several barriers to the widespread adoption of TM in rheumatology practice were identified. Limited access to TM technologies by either patients or physicians, lack of validation

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of the effectiveness of clinical outcomes, and an inability to perform physical examination have been suggested as the most concerning barriers.

Access to TM Technologies

Metha *et al*. conducted a worldwide survey involving 549 rheumatologists from 64 countries. They reported that 82% of the physicians had switched to TM video visits during the COVID-19 pandemic, 17% estimated that about a quarter of their patients did not have access to TM video, and that the majority of those lacking access were racial/ethnic minorities, low socioeconomic status (SES) patients. A total of 92% of survey participants believed that these vulnerable patients would have increased morbidity and mortality during the pandemic.[24]

In the United states, access to both secure internet and TM technology limits the ability of many patients to utilize TR. Roberts *et al*. reported that 41.4% of Medicare beneficiaries lacked access to a desktop or laptop computer with a high-speed Internet connection at home and 40.9% lacked a smartphone with a wireless data plan.[25] The disparities in digital access to TM might produce disastrous disruptions in medical care. Shenoy *et al*. surveyed 100 patients in a single Indian rheumatology clinic and found that 51% depended on others (family and friends) for the use of TM technology. Noticeably, 44% chose to stop seeking medical care and 30% acknowledged that they would have self-medicated if TM had not been available.[26] On the other hand, lack of access to TM technologies also exists in the community of rheumatologists. The survey by Muehlensiepen *et al*. of identified the purchase of the new technology equipment (62.3%), administrative burden (62%), and poor reimbursement (53.4%) as the top three barriers to the implementation of TM from the rheumatologists' point of view.[20]

Validation of Effectiveness

Before the COVID-19 pandemic, two RCTs and multiple observational studies[27, 28] have examined the effectiveness of TM in the management of RA (summarized in Table 3). De Thurah *et al*. proposed to use a telehealth follow-up strategy for tight control of disease activity in RA. A total of 294 patients were randomized in a 1:1:1 ratio to either a patient-reported outcome (PRO)-based telehealth follow-up by a rheumatologist (PRO-TR), PRO-based tele-health follow-up by a nurse (PRO-TN), or conventional outpatient follow up by physicians (control) for 1 year. The PRO-telehealth interventions achieved similar disease control compared to those in the conventional follow-up group. In addition, the telehealth intervention was equally effective for both rheumatologist and rheumatology nurse-led groups, and was associated with a high degree of patient satisfaction.[29] Similarly, Taylor-Gjevre *et al*. randomized 85 RA patients to either traditional in-person follow-up or video-conferenced follow-up over a 9-month period and found no significant differences in disease activity metrics, quality of life, and patient satisfaction between the two groups.[30] Unfortunately, no such studies assess the effectiveness of TM in the management of SLE.

Faced with the rapid increase in telehealth visits during the COVID-19 pandemic, the ACR convened an expert panel to guide the implementation of RA disease activity and functional status measures for TM. The expert panel recommended that the measures requiring formal joint counts, including Clinical Disease Activity Index (CDAI), 28-joint Disease Activity Score (DAS28-ESR/CRP), and Simplified Disease Activity Index (SDAI) can be calculated using patient-reported swollen and tender joint counts.[31] The validity of these modifications was not assessed. Additionally, no guidance has been provided on the implementation of SLE disease activity indices in TM.

Challenge of Performing Physical Examinations

Physical examination is a critical component in the evaluation of patients with rheumatic diseases. Musculoskeletal and mucocutaneous manifestations are the most common symptoms of SLE[32] and are regularly evaluated in clinical care and research to accurately monitor disease activity.[33, 34] However, the inability to perform physical examination was considered by both physicians and patients as a major barrier to TM in rheumatology.[23, 27, 35] Approaches to the assessment of the musculoskeletal system in TM settings have been reported, including virtual physical examinations of shoulder, hips, knees, spine, elbows, ankles, and feet.[36–38] In general, validated musculoskeletal examination maneuvers frequently performed in F2F visits have been modified to facilitate self-evaluations by patients. Despite this, the ability of current technology to allow for accurate evaluations by the remote visit is not fully understood. Additionally, there is a lack of guidance on the virtual dermatological examination and current teledermatology practice still faces the challenges of low-resolution photographs and videos that impairs the accurate evaluation of cutaneous lesions.[39]

Discussion

The COVID-19 pandemic, since the beginning of March 2020, has accelerated the utilization of TR and shifted TM from the periphery to the very center of rheumatology practice. This change pressed attention to the literature evaluating the acceptance, feasibility, and effectiveness of TM in the management of rheumatic diseases. The current publication provides a critical evaluation of the observational studies and a small number of clinical trials published between 2018 and 2021. Despite their small size and relatively high risks of bias, all of these data consistently reveal high satisfaction with an

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excellent feasibility for TR among both patients and physicians despite several significant barriers.

The majority of the literature on TR focuses on RA, as RA is the most common rheumatic disease with well-defined treatment guidelines and outcome measures.[4] Unfortunately, other rheumatic and musculoskeletal disorders have a paucity of data on the use of TM in all aspects of rheumatology practice.

SLE TM data is limited. SLE outcome measures are both complex and complicated[40, 41] and as such pose additional challenges to the use of TM. During the COVID-19 pandemic, almost all SLE clinical trials paused enrollment and most enrolled subjects were seen remotely.[42] Data from these remote clinical trial visits are problematic as SLE disease activity assessments, such as the SLE Disease Activity Index (SLEDAI),[33] the British Isles Lupus Assessment Group (BILAG) Index,[34] and Physician Global Assessment (PGA),[43] have not been validated in TM. There is a critical need for the evaluation of SLE virtual outcome measures that can be used by busy clinicians and clinical trialists when in-person visits are not feasible. Virtual outcome measures could provide meaningful targets for optimizing treatment and improving immediate and long-term outcomes in lupus when F2F visits are not possible.

The high acceptance of TR among patients and physicians during the pandemic suggests that TR will continue to be an integral part of rheumatology and a significant addition to conventional in-person care. The place of TR will evolve over the next several years but we envision a combination of in-person and virtual care that will be tailored to the needs of each patient as such extensive efforts to standardize the TM encounters and outcome measures are needed.

Conflict of Interest

There is no conflict of interest to disclose for any of the authors.

Ethical Statement

This article is a review of previously conducted studies and does not contain any studies with human participants or animals performed by any of the authors.

Funding

There is no funding or financial support for this work.

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