




Impact of teleconsultation on subsequent disease activity and flares in patients with systemic lupus erythematosus

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Abstract

Objectives. Despite the widespread adoption of teleconsultations amid the COVID-19 pandemic, their safety in SLE patients has not been evaluated. Here, we examined subsequent disease activity and flares among SLE patients who received teleconsultation vs in-person consultation. To discern differences in physicians' prescription behaviour during both forms of consultations, we compared corticosteroid dose adjustments.

Methods. We studied adult SLE patients who were seen between 1 February 2020 and 1 February 2021. At each patient-visit, rheumatologists utilized phone/video teleconsultation or physical consultation at their discretion. Disease activity was assessed with SLE Disease Activity Index 2000 (SLEDAI-2K) and flares were defined by the SELENA-SLEDAI Flare Index (SFI). We derived a propensity score for patients who were chosen for physical consultation. Multivariable generalized estimation equations were used to analyse SLEDAI-2K and flare at the next visit, adjusted for the propensity score.

Results. A total of 435 visits were recorded, of which 343 (78.9%) were physical visits and 92 (21.1%) were teleconsultations. The modality of consultation did not predict flare [OR for physical consultation (95% CI) 0.42 (0.04, 5.04), $P = 0.49$] or SLEDAI-2K at the next visit [estimate of coefficient for physical consultation (95% CI) -0.19 ($-0.80, 0.43$), $P = 0.55$]. Adjustments of prednisolone dosages were comparable between the two forms of visits [OR for physical consultation (95% CI) 1.34 (0.77, 2.34), $P = 0.30$].

Conclusion. SLE disease activity and flares at the subsequent visit were similar between teleconsultations and physical consultations. Medication prescription behaviour, determined using adjustment in corticosteroid dosages, was not different between the two forms of visits.

Key words: systemic lupus erythematosus, telemedicine, telehealth, teleconsultation, flares, disease activity, immunosuppression, COVID-19, health services, health care policy

Rheumatology key messages

- Subsequent SLE disease activity was similar between patients who received teleconsultation versus physical consultations.
- Medication prescription behaviour, measured using corticosteroid adjustments, was similar between teleconsultations and physical consultations.
- Telemedicine could be a safe and attractive tool for following patients with SLE.

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Introduction

SLE is an autoimmune disease with multisystem involvement causing diverse clinical features including hematological and serological abnormalities. Due to its complex and heterogeneous nature, a comprehensive clinical history and physical examination is key to accurately assess disease activity, uncover treatment adverse effects and facilitate clinical decision making [1]. Instruments to document and assess disease activity such as the SLE Disease Activity Index 2000 (SLEDAI-2K) and the British Isles Lupus Assessment Group (BILAG) index require physicians to assess multiple organ systems [2, 3]. Traditionally, physical in-person consultation with the patient had been the model of care in SLE, with the SLEDAI-2K and BILAG index designed for use during face-to-face assessment. However, telemedicine is now increasingly utilized during the COVID-19 pandemic, including in patients with SLE [4].

Telemedicine is the delivery of health care services using information and communication technologies for the exchange of information to diagnose, treat and prevent illness and injuries, and for the purposes of health research and health education [5]. Telemedicine encompasses a wide range of technologies and includes phone consultations, videoconferencing and even remote surgery [6]. Advantages of teleconsultation over in-person consultation include improved patient access to primary, secondary and tertiary care, increased convenience for patients and reduced healthcare costs [7]. However, the inability to perform physical examination has been a barrier to rheumatologists' acceptance of telemedicine prior to the COVID-19 pandemic, as evidenced by its slower adoption in rheumatology compared with other specialties [8, 9].

The reasons for increased uptake of telemedicine during the COVID-19 pandemic include: (i) minimizing the exposure of vulnerable patients to COVID-19; (ii) reducing the need for contact tracing; (iii) providing care and follow-up to patients who are unable to physically travel to healthcare facilities because of lockdowns or quarantine; and (iv) freeing up administrative and logistical resources required for in-person consultations [4]. However, despite the pressing need to adopt telemedicine as an alternative routine model of care, studies that have examined telemedicine outcomes in SLE are lacking. Given that disease activity measures such as SLEDAI-2K and BILAG index have not been validated for use in telemedicine, rheumatologists understandably worry if teleconsultation may jeopardize patient assessment and standard of care. In fact, while most SLE patients embrace telemedicine, concerns regarding the accuracy of disease activity assessment were the main reasons for patients not adopting telemedicine in a cohort of 155 SLE patients in Hong Kong (43.9% of respondents) [10]. Moreover, a survey of patients with rheumatic diseases during the pandemic revealed that patients who were most worried about COVID-19 were also more likely to alter or stop their medications, and it

is not clear if these medication compliance issues can be adequately addressed via teleconsultations [11]. Lastly, an earlier study has revealed altered medication prescription patterns among physicians during teleconsultations [12], a phenomenon that has not been explored in physicians treating SLE patients.

Therefore, we performed this prospective cohort study to evaluate subsequent disease activity and flares in SLE patients who received teleconsultation compared with in-person physical consultation. In addition, to discern any difference in prescription patterns, we compared adjustments in corticosteroid doses by rheumatologists during teleconsultations vs in-person consultations.

Methods

Patient recruitment and data collection

We studied adult patients who fulfilled the 1997 ACR [13] or the 2012 Systemic Lupus International Collaboration Clinic Classification (SLICC) criteria [14] from a tertiary hospital in Singapore, who were seen between 1 February 2020 and 1 February 2021. Patients were followed by a rheumatologist with intervals between visits determined by the treating physician. Demographic data including age, gender, marital status, education level, and alcohol and smoking history were collected. We defined disease duration as the time between the date of first SLE symptom onset and the date of first visit after 1 February 2020. At each visit, we collected clinical and laboratory variables from the hospital electronic record system. These variables comprise complete blood count, serum creatinine and albumin, serum complements 3 and 4, anti-dsDNA level, urine protein to creatinine ratio, erythrocyte sedimentation rate and treatment using immunosuppressive agents (defined as MTX, AZA, MMF, CYC, LEF, ciclosporin, tacrolimus, belimumab or rituximab). Written informed consent was obtained from all participants in accordance with the Declaration of Helsinki. Ethics approval was obtained from the Singapore National Healthcare Group Domain Specific Review Board.

Implementation of telemedicine and physical consultations

In response to the COVID-19 pandemic in 2020, synchronous telemedicine using either over-the-phone voice consultation or videoconferencing was introduced as an alternative modality of care so as to reduce travelling to hospital, physician-patient contact and contact-tracing. Rheumatologists triaged, based on their discretion, suitable patients for teleconsultation one to four weeks before the scheduled appointment and decided on the modality of teleconsultation. Use of teleconsultation was highly encouraged but not compulsory, and a minimum or maximum requirement not stipulated. The decision for teleconsultation vs physical consultation was individualized for each patient at each visit and depended on the physicians' clinical judgement. Patients who consulted a rheumatologist for

the first time had to be seen physically and were excluded from the analysis. From 1 February 2020, we recorded the nature of all study visits (whether over-the-phone, video-conferencing or in-person consultation).

All patients were instructed to visit the hospital in-person a few days before their teleconsultation or physical consultation for blood and urine tests. Between one and seven days prior to the scheduled appointment date, patients selected for teleconsultation were informed by phone of the intention to carry out the consultation remotely and reminded of the time and date of the session. Patients who declined teleconsultation were asked to attend the appointment in person.

For phone consultations, the physician called the patient at the prearranged appointment date and time. For video-conferencing, the consultation was performed on a secure hospital device via Zoom (Zoom Video Communications, Inc. San Jose, California, United States). Patients selected for videoconferencing were provided with the session code and password prior to the conference. On the scheduled telemedicine appointment, the physician entered the teleconferencing room specific to the link sent to the patient and subsequently admitted the patient.

The conduct of telemedicine consults adhered to the Singapore National Telemedicine Guidelines [15]. At the start of each teleconsultation, the identity of the patient was verified using the patient's national registration number. For teleconsultation using videoconferencing, an additional check using the photograph on the patient's NRIC and the patient was performed. For all teleconsultations, the exact location of the patient was also ascertained. A comprehensive history-taking, assessment of symptoms and shared decision making on subsequent treatment plans were performed at each teleconsultation. Medications prescribed by the rheumatologist were either sent to the patient's home or collected by the patients at the hospital's pharmacy.

Should the rheumatologist assess the teleconsultation to be medically inappropriate during the session, the teleconsultation would be terminated and the patient would be instructed to attend an in-person consultation in the hospital within a week. In the case of an emergency, the patients were directed to the hospital's Accident and Emergency Department. All patients, regardless of modality of consultation, were provided with the rheumatology clinic contact number or email.

By comparison, physical consultations occurred as per routine care, with the patients performing the requisite blood and urine tests before appointment. Patients registered in the clinic on the appointed date and time and were reviewed by a rheumatologist in person. The rheumatologist performed history taking, physical examination, evaluated investigation results, prescribed medications and scheduled the next appointment.

Therefore, while patients who received teleconsultations may still need to attend hospital once for routine laboratory investigations prior to the consultation, they have one reduced hospital visit as compared with patients who were seen physically. For patients, this

reduced potential exposure to COVID-19. For clinicians, teleconsultations reduced crowding in clinics, thereby allowing safe distancing to be implemented within the limited clinic space.

Assessment of SLE disease activity and flares

At baseline and every visit (including teleconsultations), the patients' disease activity was scored using the SLEDAI-2K [2]. SLEDAI-2K was recorded for each teleconsultation visit based on patient-reported symptoms, systems review by the rheumatologist, and laboratory blood and urine test results. The rheumatologist provided a score between 0 and 3 on the physician's global-assessment visual-analogue scale after each teleconsultation. Disease flares were defined by SELENA-SLEDAI Flare Index (SFI) [3]. For patients who had only one visit between 1 February 2020 and 1 February 2021, the disease activity at that visit was compared with the disease activity at last visit before 1 Feb 2020. We compared physician prescribing attitudes during physical and teleconsultations by examining prednisolone dose changes, defined as the amount of increase or decrease in prednisolone dose compared with the preceding visit.

Statistical analysis

Baseline demographic and clinical data of patients were analysed descriptively. Mean values with their s.d. were calculated for variables with normal distribution. Otherwise, median values with interquartile range (IQR) were reported. The frequency (*n*) and percentage were reported for categorical variables. We performed univariable comparisons of disease variables including SLEDAI-2k, SDI, disease duration of SLE, prednisolone use, immunosuppression use using χ^2 test for categorical variables and Mann-Whitney *U* test for continuous variables.

As data were collected over time with repeated measures, a generalized linear model was used to analyse variables associated with use of physical consultation over teleconsultation. To account for selection bias, we derived a propensity score for patients to be chosen for physical consultation using age, disease duration of SLE; as well as disease variables at the last visit, which included prednisolone use (yes/no), flare (yes/no), immunosuppressive therapy use (yes/no) and SLEDAI-2k. Multivariable generalized estimation equations were used to analyse the outcome of SLE flare and SLEDAI at the next visit, adjusted for the propensity score as a covariate. Missing data were not imputed. Statistical analyses were performed using SPSS (SPSS version 25, Chicago, IL, USA).

Results

In total, 245 patients were reviewed at least once between 1 February 2020 and 1 February 2021. Among these, 74 received at least one teleconsultation and 171 received only physical consultations (between one and

five visits). A total of 435 visits occurred, of which 343 (78.9%) were physical visits and 92 (21.1%) were teleconsultations. None of the teleconsultations were deemed medically inappropriate during the session and converted to physical consults. The mean (s.d.) age of the 245 patients was 45.4 (13.4) years, and 218 (89%) were female. The median (IQR) disease duration of SLE was 12 (5.4–25.3) years. The median (IQR) SLEDAI-2k at the first visit from 1 February 2020 was 2 (0–4). A large proportion ($n = 166$, 67.6%) of patients was on immunosuppressive therapy. Leukopenia ($n = 150$, 61.2%) and arthritis ($n = 145$, 59.2%) were the most prevalent baseline manifestations. **Table 1** represents the demographic and disease variables of the cohort.

On univariable analysis, patients who selected for teleconsultation were younger [mean (s.d.) age 40.0 (12.1) vs 46.2 (13.9), $P = 0.01$] and had lower disease activity

[mean (s.d.) 2.0 (1.9) vs 2.8 (2.7), $P = 0.04$], were less likely to be on prednisolone at last visit (55.4% vs 73.8%, $P < 0.01$) and were less likely to be in a flare at last visit (4.3% vs 13.1%, $P = 0.02$). **Table 2** shows the univariable comparison of demographic and disease characteristics of patients who received physical vs teleconsultation.

On multivariable generalized linear modelling, patients who were not using corticosteroids were less likely to be scheduled for physical consultation [OR (95% CI) 0.35 (0.17, 0.72), $P < 0.01$], whereas age was associated with increased odds of physical consultation [OR (95% CI) 1.04 (1.01, 1.07), $P = 0.01$]. However, SLEDAI-2k at last visit, flare at last visit, disease duration and SDI did not predict use of teleconsultation. **Table 3** shows the multivariable generalized linear model for selecting physical consultation.

TABLE 1 Demographic and disease variables of 245 patients who had at least one physical or teleconsultation visit between 1 February 2020 to 1 February 2021

Demographics	
Current age in 2020, mean (s.d.)	45.4 (13.4)
Female, n (%)	218 (89)
Ethnicity, n (%)	
Chinese	172 (70.2)
Malay	46 (18.8)
Indian	16 (6.5)
Others	11 (4.5)
Education level, n (%)	
Primary	40 (16.3)
Secondary (pre-university or vocational)	77 (31.4)
Tertiary (graduate or post-graduate)	125 (51)
Unknown or others	3 (1.2)
Disease characteristics at first visit after 1 February 2020	
Disease duration in years, median (IQR)	12 (5.4–25.3)
SLEDAI-2K, median (IQR)	2 (0–4)
SDI, median (IQR)	0 (0–1)
Immunosuppressive therapy ^a , n (%)	166 (67.8)
Prednisolone, n (%)	156 (63.7)
SLICC classification criteria at disease presentation, n (%)	
Acute cutaneous lupus	126 (51.4)
Chronic cutaneous lupus	39 (15.9)
Oral ulcers	51 (20.8)
Non-scarring alopecia	99 (40.4)
Arthritis	145 (59.2)
Serositis	47 (19.2)
Renal involvement	118 (48.2)
Neurologic involvement	24 (9.8)
Haemolytic anaemia	45 (18.4)
Leukopenia ^b	150 (61.2)
Thrombocytopenia ^c	61 (24.9)
Anti-nuclear antibody positive	223 (91.0)
Anti-dsDNA positive ^d	211 (86.1)
Low complements ^e	203 (82.9)
Antiphospholipid antibody	104 (42.4)

IQR: interquartile range; SLEDAI-2k: Systemic Lupus Erythematosus Disease Activity Index – 2K; SDI: Systemic Lupus Erythematosus Collaborating Clinics Damage Index. ^aIncludes AZA, MMF, rituximab, CYC, belimumab, ciclosporin, tacrolimus, MTX and LEF. ^bDefined as peripheral blood total white cell count $< 3.84 \times 10^9/l$. ^cDefined as peripheral blood platelet count $< 100 \times 10^9/l$. ^dDefined as above laboratory reference cut-off of 100IU/l. ^eDefined as serum complement 3 < 85 mg/dl or serum complement 4 < 10 mg/dl.

TABLE 2 Univariable comparison of demographic and disease characteristics of patients who received physical vs teleconsultation

	Physical consultation visits (n = 343)	Teleconsultation visits (n = 92)	P
Age, mean (s.d.)	46.2 (13.9)	40.0 (12.1)	0.01
Current disease duration in years, median (IQR)	10.3 (3.8–16.8)	12.3 (6.4–18.2)	0.14
Current SLEDAI-2K, mean (s.d.)	2.8 (2.7)	2.0 (1.9)	0.04
SLEADI-2k at last visit, mean (s.d.)	2.7 (2.6)	2.4 (2.3)	0.44
SDI, median (IQR)	0 (0–2)	0 (0–1)	0.39
Current prednisolone, n (%)	246 (71.7)	49 (53.3)	<0.01
Prednisolone at last visit, n (%)	253 (73.8)	51 (55.4)	<0.01
Flare at current visit, n (%)	33 (9.6)	2 (2.2)	0.02
Flare at last visit, n (%)	45 (13.1)	4 (4.3)	0.02
Immunosuppression at this visit ^a , n (%)	256 (74.6)	65 (70.7)	0.50

IQR: interquartile range; SLEDAI-2k: Systemic Lupus Erythematosus Disease Activity Index -2K; SDI: Systemic Lupus Erythematosus Collaborating Clinics Damage Index. ^aIncludes AZA, MMF, rituximab, CYC, belimumab, ciclosporin, tacrolimus, MTX and LEF.

TABLE 3 Multivariable generalized linear model for the outcome of selecting physical consultation at current visit

	OR (95% CI)	P
Not in a flare at last visit	0.41 (0.10, 1.63)	0.21
Not on corticosteroids at last visit	0.35 (0.17, 0.72)	<0.01
Age	1.04 (1.01, 1.07)	0.01
Disease duration	1.00 (0.997, 1.003)	0.95
SLEDAI-2k at last visit	0.92 (0.80, 1.05)	0.22
SDI	0.93 (0.69, 1.23)	0.59

OR: odds ratio; SLEDAI-2k: Systemic Lupus Erythematosus Disease Activity Index -2K; SDI: Systemic Lupus Erythematosus Collaborating Clinics Damage Index.

Patients seen at physical consultations were more likely to be in a flare compared with teleconsultations [OR (95% CI) 4.18 (1.06, 16.50), $P = 0.04$], despite adjusting for age, use of immunosuppression, prednisolone use, SLEDAI-2k at last visit, flare at last visit, baseline renal and neurological involvement and the propensity score for selecting physical consultation.

Table 4 demonstrates the multivariable generalized linear model for the outcome of flares at the current visit.

In a multivariable model including use of immunosuppression, flare at current visit, age and current SLEDAI-2k, the choice of teleconsultation vs physical consultation did not predict flare at the next visit [OR (95% CI) 0.42 (0.04, 5.04), $P = 0.49$]. Only prednisolone use and SLEDAI-2k at this visit predicted SLEDAI-2k at the next visit [estimate of coefficient (95% CI) -1.13 (-2.06 , -0.21), $P = 0.02$ and 0.54 (0.42, 0.66), $P < 0.01$, respectively]. The use of physical consultation vs teleconsultation did not significantly predict SLEDAI-2k at next visit [estimate of coefficient (95% CI) -0.19 (-0.80 , 0.43), $P = 0.55$]. **Table 5** demonstrates the multivariable generalized linear model for SLEDAI-2k at the subsequent visit.

Patients not on immunosuppressive agents and older patients were less likely to receive adjustments in prednisolone dosages [OR (95% CI) 0.45 (0.25, 0.81), $P = 0.01$ and OR (95% CI) 0.91 (0.88, 0.93), $P < 0.01$, respectively]. There was no difference in adjustments of prednisolone dosages between the two forms of consultations [OR (95% CI) 1.34 (0.77, 2.34), $P = 0.30$].

TABLE 4 Multivariable generalized linear model for the outcome of flares at the current visit

	OR (95% CI)	P
Physical consultation at this visit (vs teleconsultation)	4.18 (1.06, 16.50)	0.04
Prednisolone (no vs yes)	0.231 (0.04, 1.22)	0.09
Immunosuppressive agents ^a (no vs yes)	1.76 (0.72, 4.33)	0.22
Flare at last visit (no vs yes)	0.41 (0.13, 1.34)	0.14
Age	0.98 (0.95, 1.02)	0.35
SLEDAI-2k at last visit	1.07 (0.94, 1.22)	0.33
Renal involvement at baseline (no vs yes)	1.06 (0.50, 2.25)	0.87
Neurologic involvement at baseline (no vs yes)	1.20 (0.37, 3.92)	0.76

Adjusted for propensity score for selecting physical consultation. OR: odds ratio; SLEDAI-2k: Systemic Lupus Erythematosus Disease Activity Index -2K. ^aIncludes AZA, MMF, rituximab, CYC, belimumab, ciclosporin, tacrolimus, MTX and LEF.

TABLE 5 Multivariable generalized linear model for SLEDAI-2k at next visit (adjusted for propensity for selecting physical consultation at current visit)

	Estimate of coefficient (95% CI)	S.E.	P
Physical consultation at this visit (vs teleconsultation)	-0.19 (-0.80, 0.43)	0.31	0.55
Prednisolone use at this visit (no vs yes)	-1.13 (-2.06, -0.21)	0.47	0.02
Immunosuppressive agents ^a (no vs yes)	-0.29 (-1.08, 0.50)	0.40	0.46
Age	0.02 (-0.01, 0.05)	0.01	0.21
SLEDAI-2k at this visit	0.54 (0.42, 0.66)	0.06	<0.01
Renal involvement at baseline (no vs yes)	-0.03 (-0.63, 0.57)	0.30	0.93
Neurologic involvement at baseline (no vs yes)	0.01 (-1.05, 1.07)	0.53	0.99

OR: odds ratio; SLEDAI-2k: Systemic Lupus Erythematosus Disease Activity Index - 2K. ^aIncludes AZA, MMF, rituximab, CYC, belimumab, ciclosporin, tacrolimus, MTX and LEF.

TABLE 6 Multivariable generalized linear model for changes in prednisolone doses (adjusted for propensity for selecting physical consultation)

	OR (95% CI)	P
Physical consultation at this visit (vs teleconsultation)	1.34 (0.77, 2.34)	0.30
Immunosuppressive agents ^a (no vs yes)	0.45 (0.25, 0.81)	0.01
Renal involvement ever	0.76 (0.44, 1.31)	0.32
Neurologic involvement ever	0.51 (0.23, 1.13)	0.10
Age	0.91 (0.88, 0.93)	<0.01
SLEDAI-2k	1.09 (0.99, 1.20)	0.10

OR: odds ratio; SLEDAI-2k: Systemic Lupus Erythematosus Disease Activity Index -2K. ^aIncludes AZA, MMF, rituximab, CYC, belimumab, ciclosporin, tacrolimus, MTX and LEF.

Table 6 represents the multivariable generalized linear model for changes in prednisolone dosages.

Discussion

The barrier to physical examination and poor acceptance by physicians and patients have encumbered the uptake of telemedicine, particularly in rheumatology [7, 8]. Despite the accelerated use of telemedicine globally as a result of the COVID-19 pandemic, the adoption of tele-rheumatology appears to be purely borne out of practical necessity rather than supporting evidence of its safety and effectiveness. Patients' concerns about the accuracy of SLE disease activity assessment over teleconsultation has been unaddressed [10]. Unfortunately, there had been no previous studies in rheumatology that had examined the safety of teleconsultation as a modality of care in SLE- a disease with a notoriously undulating course.

Here, we show that disease activity and flares at the subsequent visit was similar between SLE patients who

had been reviewed via teleconsultation and physical consultation. More flares were observed among patients who had been selected for physical consultation, even after adjusting for previous visit's disease activity and flares. In addition, rheumatologists' prescription behaviour, measured using change in corticosteroid doses, was not discernably different between teleconsultations and physical consultations. These findings provide early evidence on the safety and effectiveness of telemedicine as a model of care in SLE patients, though larger observational studies or clinical trials are needed.

The implementation of teleconsultation in our study had several key characteristics; including; (i) rheumatologists' decided at each patient-visit whether to conduct teleconsultation or physical consultation; (ii) routine blood and urine tests were ordered for all patients at each visit, regardless of modality of consultation; (iii) patients planned for teleconsultation but who preferred a face-to-face consult would nonetheless be reviewed physically; and (iv) all patients could access the clinic by email or phone. These measures ensured that patients who were seen at teleconsultations still had access to routine

laboratory monitoring and that both the physician and patient agree with the decision for teleconsultation. The use of routine laboratory monitoring also enabled key domains of SELINA-SLEDAI to be assessed. These features could be implemented due to the nature of the lockdown in Singapore in April to May 2020, where residents were allowed to leave the house for essential activities; for example, to buy food, exercise and seek medical care. Moreover, by 1 June 2020, these lockdown measures were further relaxed to allow residents to visit public areas as long as they have registered for contact tracing. As such, the teleconsultation model described in this study cannot be extrapolated to health-care systems where remote consultation is the only option, and does not apply to patients who cannot visit tertiary centres due to intercity lockdowns [9].

In addition, we note that patient acceptance and the implementation of telemedicine widely differs in various cultural settings. In an Italian study, 78% of patients accepted telemedicine [9], whereas only 57.4% of Hong Kong SLE patients were open to telemedicine follow-up [10]. Therefore, our findings at a single site may limit its extrapolation to other centres with different forms of telemedicine implementation and a different nature of lockdown. Moreover, while SLEDAI-2k and SFI have been validated only for use at physical consults, we have used these tools to measure disease activity during physical and teleconsultations as we are not aware of any SLE disease activity tool that had been robustly validated for telemedicine. Other important limitations are noted in our study. While we have performed multivariable statistical analysis by adjusting for the propensity to select for teleconsultation, we could not completely remove selection bias due to unknown confounders. For example, the proportion of patients who were offered teleconsultation but declined and attended the visit in-person was not known and not included in the analysis. Interval between visits was also not included in the multivariable model. In addition, even though we did not observe any difference in disease activity or flares between the two forms of visits, we have recorded only 342 physical visits and 92 teleconsultations, raising the possibility of type II error due to limited power.

Our study is among the first to contribute to the scant literature on the safety and efficacy of telemedicine in SLE patients. This could provide preliminary assurance to rheumatologists on this modality of care that has become ubiquitous during the COVID-19 pandemic. In addition, we have provided the best available evidence short of a randomized controlled trial, by employing a prospective design with analysis using generalized estimating equations to account for repeated measures. We have also adjusted for the propensity for selecting patients for physical consultations to account for the patient and disease imbalances between the two groups. Nonetheless, given the important limitations outlined in this observational study, further evidence is needed to evaluate the long-term effectiveness and safety of telemedicine in SLE, particularly in other communities.

While telemedicine may be safe, economically advantageous, convenient and increasingly accepted in rheumatology [16, 17], concerns remain as to whether telemedicine may undermine patient rapport due to depersonalization and inability to perform the entire consultation [8]. In addition, regulatory concerns on data storage and patient privacy continues to be unanswered [7].

Therefore, we need a concerted and multifaceted approach to answer the questions that abound in rheumatology, including: (i) validating existing or deriving new disease activity assessment tools for use in teleconsultation; (ii) performing randomized controlled trials that examine disease outcomes; (iii) using qualitative studies to explore patients' perspectives in-depth; and (iv) performing health services research to improve telemedicine service delivery.

Conclusion

In a healthcare model where rheumatologists triaged patients to be seen via teleconsultation vs physical consultation at each patient-visit, teleconsultation was favoured in younger patients who were no longer on corticosteroids. Subsequent SLE disease activity and flares did not differ among patients seen via teleconsultation or physical visits, especially among patients with relatively low disease activity that received mandatory laboratory monitoring and good access to care. Medication prescription behaviour, determined using adjustment in corticosteroid dosages, was also not different in the two forms of visits.

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Data availability statement

Participants of this study did not agree for their data to be publicly shared, so supporting data is not available.

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