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Telerheumatology to improve first access outcomes in outpatients: a prospective monocentric pilot study

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Informed consent: all the participants signed an informed consent form.

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Availability of data and materials: the datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Abstract
Objective. The present pilot study aimed to assess the feasibility of a 'teletriagerheum' service before the first rheumatology visit and identify potential benefits and disadvantages by comparing a regular visit with a first face-to-face visit preceded by the ‘teletriagerheum' service.
Methods. A prospective monocentric pilot study was conducted from October to December 2021. Consecutive patients were contacted to investigate their willingness to receive a phone call ('teletriagerheum' service) from a physician of the Rheumatology Unit before the first rheumatology visit. The number of definite diagnoses at the first visit in the 'teletriagerheum' group was compared with patients receiving a regular first visit, as well as socio-demographic characteristics, the reason for the visit, face-to-face visit duration, and the number of additional exams.
Results. Overall, 75 patients performed the 'teletriagerheum' ('teletriagerheum' group), and 74 patients were included in the control group. In the 'teletriagerheum' group, a higher number of conclusive diagnoses was observed (72% *vs.* 58%, p=0.020) with a higher probability of receiving a conclusive diagnosis compared with the control group, both at univariate [odds ratio (OR) 2.28, p=0.021] and multivariate analyses adjusting for the only differences between the two groups (marital status and information and communication technologies skills; OR 2.95, p=0.007). At the first face-to-face visit, fewer additional tests were prescribed in the 'teletriagerheum' group; however, the overall number of tests (including those prescribed during teletriage) was higher.
Conclusions. A telephone-based telerheumatology service could be an effective triage tool for first visits of new outpatients, enabling more definitive diagnoses, thanks in part to the ability to perform the required investigations in a timely manner in most cases.

Introduction

The prevalence of rheumatic diseases in western countries has increased over the past 20 years (1). Consequently, the demand for adult rheumatologists is estimated to greatly exceed – by up to 102% – the full-time clinical practitioner workforce by 2030, which stresses the need for innovative strategies to improve and optimize access to healthcare, such as telemedicine (2).

Recently, the European League Against Rheumatism indicated that telehealth might be considered to improve the referral process to rheumatology, in addition to its use for diagnosis and follow-up visits, and help prioritization of patients with suspected rheumatic disease, as well as to assist in the pre-diagnostic processes (3). Indeed, telehealth may help establish and prescribe the correct blood and imaging tests necessary to make a diagnosis during the first face-to-face (FTF) visit. Moreover, these interventions could save unnecessary visits, time, and resources for patients and the healthcare system (4). However, clinical practice evidence supporting these hypotheses remains limited.

Given that assessing the drivers and barriers to telehealth is a prerequisite for successfully establishing remote care approaches in rheumatologic clinical practice, the purpose of the present pilot study was to investigate the feasibility of a phone-based 'teletriagerheum' service aimed at investigating the reason for the visit and prescribing additional examinations or specialistic consultations before the first FTF visit and to identify potential benefits and disadvantages of this service.

Materials and Methods

A prospective, monocentric pilot study was conducted among consecutive patients (>18 years old) scheduled for the first FTF rheumatology visit at the Rheumatology Unit – Niguarda Hospital (Milan, northern Italy) during the period from 1 October to 31 December 2021. Administrative staff contacted patients by phone 30 days before the scheduled appointment to verify their willingness to participate in the study. Patients who agreed to participate received a phone call ('teletriagerheum' service) from a rheumatologist of the Rheumatology Unit 20 days before the first FTF rheumatology visit. The 'teletriagerheum' service was intended to investigate the reason for the visit and to prescribe additional exams or specialistic consultations before the visit, to hasten the diagnosis process or bring forward the appointment in case of urgency. The telephone consultation did not follow a standardized or structured interview format. The discussion was instead tailored to each patient's reported symptoms and reason for referral, allowing the physician to determine the need for pre-visit laboratory or imaging tests based on clinical judgment. Age- and sex-matched control patients who did not participate in the 'teletriagerheum' service (not selected from those who refused the teletriagerheum) were consecutively enrolled during the period from 1 February to 31 March 2022. The study was conducted in compliance with current data protection regulations and the Declaration of Helsinki. All the study participants signed written informed consent. The study was approved by the local Ethics Committee (Code N. 118-04032021).

Study measures

Socio-demographic characteristics, the reason for the visit, FTF visit duration, the number of additional tests prescribed, and the number of conclusive diagnoses at the first FTF visit were collected. The study's primary aim was to compare the number of conclusive diagnoses at the first FTF visit in the 'teletriagerheum' group with patients receiving regular first visits without 'teletriagerheum' service (controls). The type of diagnosis, the duration of the visit, and the need for additional examinations were considered secondary outcomes. Furthermore, all patients in the 'teletriagerheum' group, during the FTF visit, filled out a survey containing four questions to investigate their opinion on the quality of the service in terms of ease, care, satisfaction, and willingness to repeat the experience.

Statistical analysis

Patient characteristics were described using numbers and frequencies for categorical variables and mean and standard deviation (SD) for continuous variables. Pearson's chi-squared test and Student's

t-test were used as appropriate. The associations between participant characteristics of the primary outcome were explored by main fixed-effect logistic regression models; a multivariable model adjusted for unbalanced characteristics between the two study groups was performed. Point estimates of the odds ratio (OR) and their 95% confidence interval were calculated.

Results

During the study period, 284 people scheduled for the first rheumatology visit were contacted by the administrative staff: 42 did not answer the call three consecutive times; in four cases, the phone number was incorrect; 12 refused to participate; in 34 cases, it was not a first rheumatology visit; in 56 cases, a rheumatological diagnosis was already known; in 31 cases, the reason for the lack of telephone contact was not known; and nine patients were excluded for other reasons. Of the remaining 96 cases, 21 canceled their visit before the 'teletriagerheum' service was performed. As a result, 75 patients accepted and performed the 'teletriagerheum' ('teletriagerheum' group, 26.4% of patients) (*Supplementary Figure 1*). Patients in the 'teletriagerheum' group were mainly females (87%, n=65); the mean (SD) age was 59 (14) years (Table 1). Most patients reported a good/very good ability in self-assessment of information and communication technologies skills (66%, n=45) (Table 1). In most cases, the general practitioner prescribed the first rheumatology visit (72%, n=53) (Table 1). Patients did not differ in age or sex from the remaining 209 patients initially contacted who did not perform the 'teletriagerheum' (*Supplementary Table 1*). A total of 74 control patients were enrolled in the study period. Patients of the 'teletriagerheum' group and control patients were comparable in age, sex, ethnicity, education level, and offspring presence. In the 'teletriagerheum' group, a higher proportion of married/cohabiting patients was observed (60% *vs.* 51%; p=0.022), as well as a lower proportion of patients with no/little technological competence (p=0.017) (Table 1).

Conclusive diagnosis

In the 'teletriagerheum' group, a higher percentage of conclusive diagnoses at the time of the first FTF visit was observed, compared with the control group (72% *vs.* 58%, p=0.020) (*Supplementary Table 2*). A higher probability of receiving a conclusive diagnosis was observed in the 'teletriagerheum' group, both in the univariate analysis (OR 2.28, p=0.021) and after adjusting for the different factors between groups (marital status and technological skills, OR 2.95, p=0.007) (*Supplementary Table 3*).

Secondary outcomes

The distribution of diagnosis type was comparable between the two study groups (p=0.69; Table 2). As expected, the total duration of the visit ('teletriagerheum' when performed + FTF visit) was higher in the 'teletriagerheum' group [mean duration (SD): 39.3 (12.2) minutes *vs.* 26.9 (9.1) minutes, p<0.001], and no significant differences were found when comparing the duration of FTF visits between groups (Table 2).

At the time of the first FTF visit, fewer laboratory (25% *vs.* 47% p=0.009) and instrumental examinations (25% *vs.* 40% p=0.056) were required in the 'teletriagerheum' group; however, statistical significance was not achieved in the latter case (Table 2). In no case was it necessary to anticipate the visit for emergencies.

During the 'teletriagerheum', blood chemistry tests were required for 58 (77.0%) patients, instrumental examinations for 16 (21.0%), and specialist visits for two (2.7%). In most cases, it was possible to perform them before the first FTF visit (51/58, 87%, for blood chemistry tests and 14/16, 87%, for instrumental ones).

Satisfaction survey

A total of 52 patients of the 'teletriagerheum' group completed the satisfaction questionnaire. The majority of patients rated the televisit experience positively. In total, 63% of patients reported a very good/high feeling of comfort during the service; 57% reported a very good/high quality of the service;

50% reported a very good/high global satisfaction; and 64% reported a very good/high willingness to repeat the experience in the future. Response rates to individual questions are shown in *Supplementary Table 4* and *Supplementary Figure 2*.
Adjusted analysis of the association between socio-demographic factors and service satisfaction level showed an association between higher education level and willingness to repeat the experience in the future (p=0.033) (*Supplementary Table 4*).

Discussion and Conclusions

Results of our pilot study showed that a telephone-based telerheumatology service could be an effective triage tool for first visits of new outpatients. Indeed, the 'teletriagerheum' service helped ensure that appropriate laboratory and/or imaging tests were performed before the first FTF visit, enabling more definitive diagnoses than in patients who did not perform the 'teletriagerheum' (72% *vs*. 58%, p=0.020). In addition, fewer laboratory examinations (25% *vs*. 47%, p=0.009) were required at the time of the first FTF visit in the 'teletriagerheum' group. In no case was it necessary to anticipate the visit for emergencies. The 'teletriagerheum' service was rated as a positive experience by most patients, who expressed willingness to repeat the experience in the future in 64% of cases. The willingness to repeat the experience in the future was significantly associated with a higher level of education (p=0.033). For instance, the pandemic context may have influenced patients' willingness to participate and the healthcare system's acceptance of telehealth solutions.
Our study is among the first to explore the utility of telerheumatology as a referral tool to improve the diagnosis of new patients. Indeed, most of the available studies have explored the effectiveness of telemedicine in making a diagnosis by comparing it with the standard FTF visit or performing scheduled follow-up visits (5,6), with some data revealing some limitations for initial rheumatological diagnoses (7). However, to avoid the risk of reduced quality of care and patient satisfaction, a possible way forward is to complement traditional FTF visits with information obtained through telemedicine in order to optimize the number of referrals and render these consultations more efficient, rather than replacing personal contact with technology (8).
In 2018, Nugyen-Oghadai *et al.* explored the use of telerheumatology for new patients referred to a Veterans Affairs rheumatology clinic. The referrals were triaged by a nurse practitioner, with a rheumatologist participating in the meeting via a tele-link (9). They found that all patients with inflammatory and rheumatic conditions were identified at the telerheumatology visits and that this service may be appropriate for screening and prioritizing patients for in-person rheumatology clinics. However, the telerheumatology service, performed by a physician supported by administrative staff, was resource-intensive regarding working time for both medical and administrative staff (9). More recently, the quality of referrals to a rheumatology service before and after implementing a telemedicine-supported triage system was evaluated in a tertiary care center in a southern Brazilian capital (10). The authors reported a marked improvement in referrals submitted to the new triage system compared with patients not screened by telemedicine (p>0.001). They concluded that the quality of rheumatology referrals improved, particularly among patients from sites subjected to referral protocols and teleconsultation support (2).
Our patients' high level of satisfaction aligns with historically reported high patient satisfaction with telerheumatology (11). In addition, another previous study reported a higher educational level to be associated with preferences for video televisit over FTF visits (12). A more recent study by Danila et al. investigated factors associated with patients' preference for telemedicine over FTF as the type of follow-up visit during the pandemic period. They found that patient diagnosis, place of residence, age, or sex were not associated with a preference for telemedicine (13). Accordingly, it may be suggested that further exploring and understanding patient preferences will help identify and improve the role of telemedicine in the health care of patients with rheumatic diseases.
Despite its strengths, this study presents some limitations. First, as a pilot study, the small sample size did not allow us to perform an analysis for diagnosis. Second, a cost-effectiveness analysis was not

performed, although the “teletriagerheum” service modality suggests the need to devote extra time to medical and administrative staff, which must be evaluated in terms of costs. Indeed, the overall time increased, and no time-saving was observed during the FTF visit, which may affect feasibility. Third, the lack of a longer observation period did not allow us to explore the utility of teletriage in the follow-up of the new patients by analyzing other factors, such as the need for additional follow-up visits. Follow-up data or assessing changes in diagnosis over time will be the objective for future studies, as well as the inclusion of a broader and more representative spectrum of rheumatologic conditions and the evaluation of the appropriateness of referrals for in-person visits.

Nevertheless, our findings pave the way for further studies to validate and improve the use of telemedicine tools in the preassessment of new patients and to promote the wider and proper use of telemedicine in routine clinical practice.

In conclusion, the telerheumatology service seems to be an effective tool and a positive experience before the first rheumatology visit, enabling more definitive diagnoses. However, a cost-effectiveness analysis should be performed to assess the balance between the increased use of medical and administrative human resources and the savings due to improved patient outcomes.

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Online supplementary material

Table 1. Characteristics of the subject enrolled in the study.

Characteristics	Total (n=149), n (%)	'Teletriagerheum' group (n=75), n (%)	Controls (n=74), n (%)	p-value
Gender (female)	127 (85.8)	65 (86.7)	62 (84.9)	0.762
Age (years), mean (SD)	58.9 (16.2)	59.6 (14.1)	58.3 (16.2)	0.613
Ethnicity (Caucasian)	128 (96.2)	60 (98.4)	68 (94.4)	0.237
Education				0.519
Primary and/or lower secondary school	39 (28.1)	19 (28.8)	20 (27.4)	
High school	78 (56.1)	39 (59.1)	39 (53.4)	
University and/or higher degree	22 (15.8)	8 (12.1)	14 (19.2)	
Married or living with a common-law partner	85 (59.9)	48 (69.6)	37 (50.7)	0.022
Offspring (yes)	108 (72.5)	54 (72.0)	54 (73.0)	0.894
Work (employed)	67 (48.5)	37 (55.2)	30 (42.2)	0.128
Self-assessment of information and communication technologies (ICT) skills:				0.017
None	8 (5.7)	2 (2.9)	6 (8.2)	
Poor	22 (15.6)	5 (7.3)	17 23.3)	
Sufficient	32 (22.7)	16 (23.5)	16 21.9)	
Good	40 (28.4)	26 (38.2)	14 (19.2)	
Very good	39 (27.7)	19 (27.9)	20 (27.4)	
Prescription by				0.261
General practitioner	108 (75.5)	53 (71.6)	55 (79.7)	
Medical specialist	35 (24.5)	21 (28.4)	14 (20.3)	

SD, standard deviation.

Table 2. Comparisons of the primary and secondary outcomes between the subject who performed the televisit (cases) and who did not (controls).

	Cases	Controls	p-value
Primary endpoint			
Diagnosis	n=75	n=74	
Conclusive diagnosis at first in-person visit, n (%)	57 (76.0)	43 (58.1)	0.020
Secondary endpoints			
Diagnosis			
Type of diagnosis, n (%)			
Osteoporosis	16 (28.1)	18 (41.9)	0.692
Osteoarthritis	12 (21.0)	9 (20.9)	
Fibromyalgia	8 (14.0)	2 (4.7)	
Inflammatory arthritis	7 (12.3)	4 (9.3)	
Connective tissue disease	2 (3.5)	1 (2.3)	
Other*	12 (21.0)	9 (20.9)	
Duration of the visit			
In-presence visit time	n=62	n=65	
Mean (SD), minutes	27.4 (9.3)	26.9 (9.1)	0.790
>30 minutes, n (%)	27 (43.5)	28 (43.1)	0.957
Televisit time, mean (SD)	11.7 (5.4)	-	
Total visit time	n=59	n=65	
Mean (SD), minutes	39.3 (12.2)	26.9 (9.1)	<0.001
Need for prescriptions			
At least one prescription during televisit, n (%)			
Laboratory tests, yes	58/74 (78.4)	-	-
Instrumental tests, yes	16/74 (21.6)	-	-
Consultations, yes	3/72 (4.2)	-	-
At least one prescription during in-presence visit, n (%)			
Laboratory tests, yes	16/63 (25.4)	33/70 (47.1)	0.009
Instrumental tests, yes	16/63 (25.4)	28/70 (40.0)	0.074
Consultations, yes	3/63 (4.8)	4/70 (5.7)	0.816
At least one prescription (in-presence and/or televisit), n (%)			
Laboratory tests, yes	62/74 (83.8)	33/70 (47.1)	<0.001
Instrumental tests, yes	28/74 (37.8)	28/70 (40.0)	0.787
Consultations, yes	4/74 (5.4)	4/70 (5.7)	0.937

SD, standard deviation. *Including isolated laboratory abnormalities or non-specific arthralgia without evidence of underlying rheumatic disease.