Impact of a clinical pharmacist consultation on enhancing knowledge and safety skills in patients with chronic inflammatory arthritis treated with bDMARDs

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Abstract

Objective

Biologic-disease-modifying anti-rheumatic-drugs (bDMARDs) effectively manage chronic inflammatory arthritis (IA), but carry risks. To address patient knowledge gaps about treatment, pharmacist consultations have been implemented at our hospital. This study evaluated the impact of pharmacist consultations on knowledge and safety skills related to bDMARDs in patients with IA at three (M3), six (M6) and twelve months (M12) post- pharmacist intervention and identified patient factors associated with improved knowledge.

Methods

A self-administered questionnaire, BioSecure (score from 0 (worst) to 100 (optimal)), was utilised during consultations to address unlearned bDMARD knowledge with patients. The same questionnaire was administered at M3, M6 and M12. The primary outcome measured patient knowledge by comparing BioSecure mean scores from baseline to others time points. Secondary outcomes included the proportion of patients with good knowledge levels (BioSecure score >84), percentage of patients missing knowledge per topic and the patient factors associated with knowledge improvement at baseline.

Results

Among 99 patients, mean (SD) BioSecure score at baseline, M3, M6 and M12 were 70.7 (18.0), 80.9 (15.5), 83.1 (14.5) and 82.5 (14.4) respectively ($p<0.001$). Percentages of patients with good knowledge at baseline, M3, M6 and M12 were 23.8%, 57.1%, 59.5% and 57.1% respectively ($p<0.001$). Patient factors associated with improved knowledge included RAPID 3 <7.5, family status, information from community pharmacist, and low Charlson scores.

Conclusion

This study highlights the positive impact of pharmacist consultations on enhancing knowledge and safety skills in patients with IA and treated with bDMARDs. The lack of a control group limits interpretation of the finding.

Key words

clinical pharmacist, biologic disease-modifying anti-rheumatic drugs, knowledge

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Introduction

Chronic inflammatory arthritis (IA), including rheumatoid arthritis (RA) and spondyloarthrtitis (SpA), requires active patient involvement in management due to its chronic nature (1). Since the 2000s, biologic-disease-modifying-anti-rheumatic-drugs (bDMARDs) have revolutionised severe IA treatment (2). However, these therapies demand careful monitoring due to potential adverse events (particularly infections) and complex daily management (3, 4).

Patient knowledge and safety skills are crucial to optimising treatment outcomes (5). A lack of knowledge has been identified in various studies (6-9) and may affect adherence (10), which is pivotal in preventing disease progression (11-13). Non-optimal adherence rates are reported in IA, emphasising the need for patient education (14-17).

The primary sources of information for patients about their treatment with bDMARDs are the rheumatologist, the general practitioner, or personal research on the internet (18).

In order to enhance knowledge, safety skills and adherence, patient education plays a crucial role (19–25). Guidelines for this purpose have been established by the European Alliance of Associations for Rheumatology (EULAR) (2, 25). Therapeutic patient education programmes or educational interventions which can be done by a pharmacist are some examples (19-21, 24, 26, 27).

Multidisciplinary consultations, involving care coordinators, clinical pharmacists, and rheumatologists, have been established in our hospital to enhance patient management of bDMARDs. The pharmacist's role is to assess knowledge, safety skills, adherence, and optimise bDMARD management.

This study aimed to evaluate the impact of clinical pharmacist consultations on knowledge and safety skills related to bDMARDs in IA patients at three, six and twelve months after pharmacist consultation and to identify in the subgroup of patient with a baseline non optimal knowledge (*e.g.* BioSecure score <84) the baseline factors associated with the achievement of an acceptable knowledge (*e.g.* BioSecure >84) after the pharmacist consultation.

Methods

Study design

This study was a single-centre, non-randomised, open-label controlled and non-interventional trial conducted in a tertiary rheumatology department. The study was conducted between October 2019 and April 2021, registered under the NCT number NCT04499001.

Inclusion criteria

Patients with IA, including RA, SpA, or other forms of IA, who were undergoing treatment with subcutaneous bDMARDs and were receiving care in the rheumatology department were included. Fluency in French and age of 18 years or older were required for inclusion. Patients with major psychological disorders such as dementia, psychosis, confusion, and agitation were excluded.

Intervention

The BioSecure is a self-administered questionnaire to assess patient knowledge and skills related to subcutaneous bDMARDs (28). This questionnaire consisted of 55 questions, including nine multiple-choice questions and seven clinical scenarios with associated questions. The questionnaire measured knowledge and skills concerning safety issues for patients treated with bDMARDs, regardless of whether they were administered intravenously or subcutaneously. The questionnaire's final score ranged from 0 to 100, with higher scores indicating better skills. The score rating used was as follows: less than 64 indicated poor knowledge, scores between 64 and 84 indicated moderate knowledge, and scores above 84 indicated good knowledge (8).

During the consultation, a pharmacist discussed the BioSecure questionnaire with the patient, addressing any gaps in knowledge or skills related to b-DMARDs.

An advice card summarising the key points discussed during the consultation was provided to the patients.

Data collected

Patient knowledge regarding subcutaneous bDMARDs was assessed using the self-administered BioSecure questionnaire during the pharmaceutical consul-

Table I. Baseline characteristics of the patients with regard to their underlying chronic inflammatory arthritis.

	Total, n=99	Rheumatoid Arthritis n=29	Spondyloarthritis n=64	Other CIRD n=6
Female, n (%)	50 (50.5)	21 (72.4%)	27 (42.2%)	2 (33.3%)
Age, mean (SD), years	49.0 (14.6)	52.7 (16.6)	48.0 (13.9)	42.0 (7.6)
Disease duration, mean (SD), years	15.4 (11.0)	15.4 (8.5)	15.6 (11.9)	12.8 (13.5)
Disease activity (RAPID 3)	8.4 (5.7)	7.3 (6.5)	8.5 (5.1)	13.3 (4.1)
People who made the injection, n (%)				
Patient	84 (84.8%)	23 (79.3%)	55 (85.9%)	6 (100%)
Caregiver, nurse	15 (15.2%)	6 (20.7%)	9 (14.1%)	0 (0%)
Current treatment (bDMARD), n (%)				
Anti-TNF-α	88 (88.9%)	25 (86.2%)	59 (92.2%)	4 (66.7%)
Other	11 (11.1%)	4 (13.8%)	5 (7.8%)	2 (33.3%)
Duration of the current bDMARD, mean (SD), years	4.8 (4.2)	4.8 (3.5)	4.8 (4.4)	4.5 (5.4)
Associated treatment, n (%)				
Methotrexate	31 (31.3%)	16 (55.2%)	14 (21.9%)	1 (16.7%)
GCs	12 (12.1%)	9 (31.0%)	1 (1.6%)	2 (33.3%)
NSAIDs	13 (13.1%)	4 (13.8%)	9 (14.1%)	0 (0%)
Analgesics	19 (19.2%)	4 (13.8%)	13 (20.3%)	2 (33.3%)
Others cDMARDs	3 (3%)	1 (3.4)	0 (0%)	2 (33.3%)
At least 3 treatment lines, n (%)	58 (58.6%)	22 (75.9%)	32 (50.0%)	4 (66.7%)
History of previous bDMARDs	40 (40.4%)	15 (51.7%)	23 (35.9%)	2 (33.3%)
Charlson score, mean (SD)	0.1 (0.5)	0.1 (0.4)	0.1 (0.6)	0.0 (0.0)
Family status, n (%)				
Living alone or single	31 (31.3%)	6 (20.7%)	22 (34.4%)	3 (50.0%)
Living with family / in a couple or family relationship	68 (68.7%)	23 (79.3%)	42 (65.6%)	3 (50.0%)
Professional activity, n (%)				
Currently employed	64 (64.6%)	16 (55.2%)	44 (68.8%)	4 (66.7%)
Retired	20 (20.2%)	10 (34.5%)	10 (15.6%)	0 (0%)
Unemployed or student	15 (15.2%)	3 (10.3%)	10 (15.6%)	2 (33.3%)
Education level, n (%)				
High school or less	39 (39.4%)	15 (51.7%)	23 (35.9%)	1 (16.7%)
University	60 (60.6%)	14 (48.3%)	41 (64.1%)	5 (83.3%)
Socio-professional category: farmers, artisans, workers, intermediate professions, n (%)	27 (27.3%)	8 (27.6%)	18 (28.1%)	1 (16.7%)
History of multidisciplinary care, n (%)	40 (40.4%)	14 (48.3%)	23 (35.9%)	3 (50.0%)
Type of health professional who provided treatment information to the patient, n (%)				
Attending physician	21 (21.4%)	5 (17.2%)	15 (23.8%)	1 (16.7%)
Rheumatologist	94 (94.9%)	27 (93.1%)	62 (96.9%)	5 (83.3%)
Hospital pharmacist	29 (29.3%)	11 (37.9%)	16 (25.0%)	2 (33.3%)
Community pharmacist	30 (30.6%)	12 (41.4%)	16 (25.4%)	2 (33.3%)
Nurse	12 (12.2%)	5 (17.2%)	6 (9.5%)	1 (16.7%)
Mean number per patient (SD)	1.9 (1.1)	2.1 (1.1)	1.8 (0.9)	1.8 (1.7)
Type of information source used by patient about treatment, n (%)				
Website: rhumatismes.net	10 (10.1%)	4 (13.8%)	5 (7.8%)	1 (16.7%)
Mobile application: Hiboot +	8 (8.1%)	3 (10.3%)	4 (6.3%)	1 (16.7%)
Patient associations	12 (12.1%)	4 (13.8%)	6 (9.4%)	2 (33.3%)
Other sources on internet	58 (58.6%)	16 (55.2%)	37 (57.8%)	5 (83.3%)
Mean number per patient (SD)	0.9 (0.9)	0.9 (0.9)	0.8 (0.9)	1.5 (1.4)

GCs: glucocorticoids; NSAIDs: non-steroidal anti-inflammatory drugs; cDMARDs: conventional disease-modifying anti-rheumatic drugs; bDMARDs: biological disease-modifying anti-rheumatic drugs.

tation at baseline. The same questionnaire was sent by letter again at 3 months (M3), 6 months (M6), and 12 months (M12) following the consultation.

Patient data were collected from electronic medical records and patient interviews. This included socio-demographic characteristics (age, sex, family status, professional activity, education level, socio-professional category), details about the underlying rheumatic disease (type of IA, disease duration, disease activity, start date of rheumatology follow-up in our hospital, comorbidities using Charlson Comorbidity Index), treatment information (administration of injections, current treatment, previous bDMARDs, duration of current bDMARD, concurrent use of methotrexate or corticosteroids, history of at least one multidisciplinary care initiative).

Two additional data points are gathered through patient self-reports to delve into the information received or actively sought by the patient regarding their treatment before the baseline assessment: health professionals who gave treatment information to the patient (rheumatologist, nurse, community pharmacist, hospital pharmacist, attending physician) and sources of information used by patient (website: rhumatis-

mes.net, mobile application: Hiboot+, patients associations, other website).

Outcomes

The primary outcome measure was patient knowledge and skills, evaluated by comparing the mean BioSecure questionnaire scores from baseline to M3, M6 and M12 after the pharmaceutical consultation.

Secondary outcomes included the proportion of patients with good knowledge and skills (score >84), percentage of patients missing knowledge per topic and the baseline factors associated with the achievement of an acceptable knowledge (*e.g.* BioSecure >84) after the pharmaceutical consultation in the subgroup of patients with a baseline non optimal knowledge (*e.g.* BioSecure score <84). The various sources of information used by patients have also been studied.

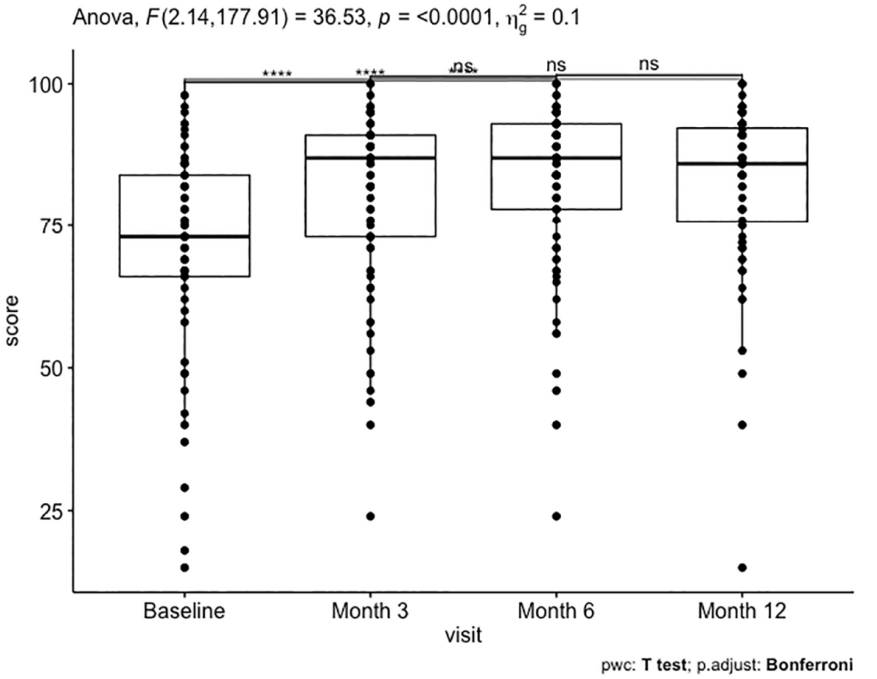

Fig. 1. Mean BioSecure score before and 3, 6 and 12 months after the pharmacist intervention.

Ethics and informed consent

The study was conducted in accordance with French regulations and to good clinical practices for biomedical studies. The study protocol and informed consent information were approved by an ethics committee (no. ID RCB: 2020-A01380-39 – CPP Ile de France X). All patients received an information letter, and non-opposition was obtained from each patient.

Statistical analysis

The mean score of BioSecure questionnaire across visits were compared using one-way ANOVA test. In case of one time-point missing, last observation carried forward (LOCF) technique has been used. *Post-hoc* pairwise comparison of BioSecure scores between visits were conducted using the Bonferroni correction.

The percentages of patients with good level of knowledge across visits were compared using Generalized Estimating Equation (GEE) for binary outcomes and the percentages of patients missing knowledge per topic at baseline and after consultation were compared using the exact Mc Nemar test for paired data.

To identity the patients' characteristics associated with an intervention success, we performed an analysis focused on the subgroup of patients with a non-optimal baseline knowledge (*e.g.* Bisosecure score <84) and defining the success intervention by a BioSecure score of at least 84 after the pharmacist intervention (*e.g.* either at M3, M6 or M12). The baseline parameters associated with improved knowledge were evaluated using univariate logistic regressions. Variables with *p*-values <0.15 in univariate analysis were included in a multivariate logistic regression model and the final model was obtained using backward stepwise procedure.

A simple descriptive analysis has also been performed to assess the following a) the number of health professionals providing treatment information to the patient b) the number of information source used by patient about treatment (self-report by the patient).

All contrasts were bilateral and considered significant with a *p*-value <0.05. Data were analysed using RStudio 1.4.1106.

Results

Patients

A total of 99 patients were included, with 29.3% having RA, 64.6% having SpA and 6.1% having another form of IA. Baseline characteristics of patients are summarised in Table I.

All patients (100%) responded to the BioSecure questionnaire at baseline. The percentage of patients who completed all time-point was 45.5% and those completed at least one time-point was 84.8%.

For the analysis of patient knowledge and skills, as well as the assessment of their knowledge and skills level, 15 patients were excluded due to incomplete questionnaire responses at M3, M6, and M12, resulting in a total of 84 patients included.

Patient knowledge and skills

The mean (SD) BioSecure score at baseline, M3, M6 and M12 were 70.7 (18.0), 80.9 (15.5), 83.1 (14.5), and 82.5 (14.4) respectively (Fig. 1). Significant differences were observed between time points ($p<0.001$), particularly between baseline and each subsequent time point ($p<0.001$). No significant differences were found between M3 and M6 ($p=0.241$), M3 and M12 ($p=1.000$), and M6 and M12 ($p=0.924$).

At baseline and after the consultation, the topics with the highest percentage of patients missing knowledge were signs of infection (77.1% *vs.* 46.6%), management of infection (76.1% *vs.*

34.2%), surgical procedure (68.5% *vs*. 41.1%), vaccination (46.7% *vs*. 20.5%), wound care (43.5% *vs*. 12.3%) and travel-related concerns (39.1% *vs*. 17.8%) (Table II).

Patient's level of knowledge and skills

The percentage of patients with a good level of knowledge and skills (BioSecure >84) at baseline, M3, M6 and M12 was 23.8%, 57.1%, 59.5%, and 57.1% respectively (Fig. 2). Significant differences were observed between baseline and M3, M6, and M12 (p<0.001).

Baseline patient's characteristics associated with intervention success (patients reaching a BioSecure score >84 after the pharmacist intervention)

Among the 61 patients with BioSecure scores <84 at baseline, multivariate analysis identified several factors associated with the achievement of an optimal bDMARD knowledge: family status (living with family, in a couple or family relationship; OR 8.13 [CI 95% 1.71–61.3]), information provided by the community pharmacist (OR 33.4 [CI 95% 4.17–834.3]), RAPID 3 <7.5 (*odds ratio* [OR] 0.15 [confidence interval 95% (CI 95%) [0.02–0.70]) and low Charlson score (OR 0.02 [CI 95% 0.00–0.27]) (Table III).

Information received or actively sought by the patient regarding their treatment before the baseline assessment

The mean number of healthcare professionals providing treatment information to the patient was 1.9 (1.1), as illustrated in Figure 3a-b. The primary source of information for the majority of patients (94.9%) was their rheumatologist, while approximately one-third from a pharmacist, 21% from their attending physician, and 12% from a nurse.

The mean number of information sources used by patients regarding their treatment was 0.9 (0.9), as depicted in Figure 4. About 10.1% of patients sought information on the website: rhumatismes.net, 8.1% through the mobile application Hiboot+, 12.1% from patient associations and 58.6% from other online sources. Notably, 38.4% of patients did not perform internet searches.

Table II. Percentage of patients missing knowledge per topic.

Topic	Baseline (%)	After consultation (%)	p-value
Knowledge of infectious risk	30.1	17.8	0.063
Signs of infection	76.7	46.6	<0.001
Management of infections	65.8	34.2	<0.001
Travel-related concerns	38.4	16.4	<0.001
Dental care	31.5	12.3	0.001
Surgical management	68.5	39.7	<0.001
Vaccination	43.8	20.5	0.002
Wound care	42.5	12.3	<0.001

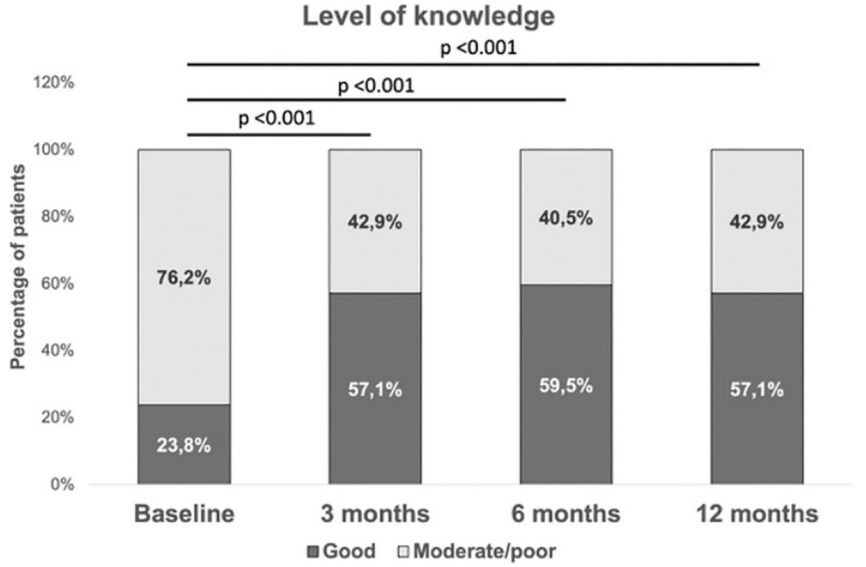

Fig. 2. Percentage of patients with a good level of knowledge and skills before and 3, 6 and 12 months after the pharmacist intervention.

Discussion

This study highly suggests the positive impact of clinical pharmacist consultations on the improving of knowledge and safety skills related to subcutaneous bDMARDs in patients with IA. The improvement of knowledge was sustained for at least 12 months.

The baseline mean score was consistent to others studies, with particular a quite low percentage of patients with an optimal knowledge (*e.g*. 70.7% in our study) indicating a need for patient education (8, 9, 19, 21, 29). In fact, in our study more than two-thirds of patients lacked the necessary skills regarding signs of infection, infection management, and surgical procedures. A significant increase in BioSecure scores and the proportion of patients with good knowledge and skills was observed at 3 months, which was maintained at 6 and 12 months.

The consultation contributed to enhancing the patient's ability to make informed decisions about their treatment, particularly in situations such as surgery, infections and wound management, as evidence by the significant reductions in the percentage of patients missing critical information. Indeed, this knowledge improvement is observed across the key topics covered in the questionnaire.

These findings collectively underscore the critical role of targeted pharmacist-led education in empowering patients with the knowledge and skills necessary for the safe and effective management of their treatment.

Although our study could not compare the impact of clinical pharmacists against other healthcare providers, the specialised training of pharmacists in medication management and patient education may be a key factor contributing to the intervention's success. Educational interventions have been effective in improving knowledge and other outcomes in IA patients. The

Table III. Patient's factors at baseline associated with improved knowledge.

Factor	Improvement n=40	No improvement n=21	Univariate analysis		Multivariate analysis	
			OR (95%CI)	*p*-value	OR (95%CI)	*p*-value
Sex female	17 (42.5%)	9 (42.8%)	0.99 (0.34-2.92)	0.979		
Age <50 years	21 (52.5%)	15 (71.4%)	0.44 (0.13-1.33)	0.158		
Rheumatoid arthritis	12 (30.0%)	6 (28.6%)	1.07 (0.34-3.60)	0.908		
Spondyloarthritis	25 (62.5%)	14 (66.7%)	0.83 (0.26-2.49)	0.748		
At least 13 years since the diagnosis	26 (65.0%)	10 (47.6%)	2.04 (0.70-6.10)	0.193		
RAPID3 ≥7.5	13/39 (33.3%)	14 (66.7%)	0.25 (0.08-0.75)	**0.016**	0.15 (0.02-0.70)	**0.027**
People who made the injection (patient *vs*. caregiver or nurse)	37 (92.5%)	17 (81.0%)	2.90 (0.58-16.1)	0.193		
Family status (living with family, in a couple or family relationship *vs*. alone or single)	27 (67.5%)	10 (47.6%)	2.28 (0.78-6.89)	0.135	8.13 (1.71-61.3)	**0.017**
Professional activity						
Currently employed (ref)	31 (77.5%)	8 (38.1%)	Reference			
Retired	7 (17.5%)	8 (38.1%)	0.23 (0.06-0.80)	**0.022**		
Unemployed or student	2 (5.0%)	5 (23.8%)	0.10 (0.01-0.57)	**0.014**		
Education level (University *vs*. other)	25 (62.5%)	9 (42.9%)	2.22 (0.77-6.69)	0.146		
Socio-professional category (farmers, artisans, workers, intermediate professions *vs*. other)	13 (32.5%)	5 (23.8%)	1.54 (0.48-5.53)	0.481		
History of multidisciplinary care	14 (35.0%)	8 (38.1%)	0.88 (0.29-2.68)	0.811		
Type of health professional who provided treatment information to the patient						
Attending physician *vs*. others	11 (27.5%)	2 (9.5%)	3.60 (0.84-25.0)	0.120		
Rheumatologist *vs*. others	39 (97.5%)	18 (85.7%)	6.50 (0.77-136.5)	0.116		
Hospital pharmacist *vs*. others	10 (25.0%)	5 (23.8%)	1.07 (0.32-3.91)	0.918		
Community pharmacist *vs*. other	18 (45.0%)	2 (9.5%)	7.77 (1.91-52.9)	**0.011**	33.4 (4.17-834.3)	**0.006**
Nurse *vs*. others	5 (12.5%)	1 (4.7%)	2.86 (0.42-56.8)	0.353		
≥2 information sources per patient	28 (70.0%)	7 (33.3%)	4.67 (1.55-15.22)	**0.008**		
Type of information source used by patient about treatment						
Website: Rhumatisme.net (at least once) vs. others	3 (7.5%)	3 (14.3%)	0.49 (0.08-2.85)	0.405		
Mobile application: Hiboot+ (at least once) *vs*. others	2 (0.5%)	0 (0%)	-	0.993		
Patient associations (at least once) *vs*. others	3 (7.5%)	1 (4.8%)	1.62 (0.19-34.0)	0.684		
Web (at least once) *vs*. other	23 (57.5%)	9 (42.9%)	1.80 (0.62-5.37)	0.279		
≥1 information sources per patient	24 (60.0%)	11 (52.4%)	1.36 (0.47-3.99)	0.568		
At least 3 years since treatment start	27 (67.5%)	10 (47.6%)	2.28 (0.78-6.89)	0.135		
Current treatment (anti-TNF-α *vs*. other bDMARDs)	37 (92.5%)	17 (81.0%)	2.90 (0.58-16.1)	0.193		
At least 3 treatment lines *vs*. <3 line	13 (61.9%)	23 (57.5%)	0.83 (0.27-2.43)	0.740		
Associated treatment						
Methotrexate *vs*. other	15 (37.5%)	7 (33.3%)	1.20 (0.40-3.78)	0.748		
GCs *vs*. other	4 (10.0%)	4 (19.0%)	0.47 (0.10-2.21)	0.327		
NSAIDs *vs*. other	5 (12.5%)	1 (4.8%)	2.86 (0.42-56.8)	0.353		
Analgesics *vs*. other	8 (20.0%)	4 (19.0%)	1.06 (0.29-4.45)	0.929		
Other cDMARDs *vs*. other	2 (0.5%)	0 (0%)	-	0.993		
Treatment with previous bDMARDs	15 (37.5%)	9 (42.9%)	0.80 (0.27-2.38)	0.684		
Charlson score ≥1	1 (2.5%)	5 (23.8%)	0.08 (0.00-0.56)	**0.028**	0.02 (0.00-0.27)	**0.012**

GCs: glucocorticoids; NSAIDs: non-steroidal anti-inflammatory drugs; cDMARDs: conventional disease-modifying anti-rheumatic drugs; bDMARDs: biological disease-modifying anti-rheumatic drugs; TNF: tumour necrosis factor.

pharmacist's role in patient education has been shown to positively influence knowledge, quality of life, and patient satisfaction (19, 21, 27, 29-31). Thus, our findings highlight the importance of integrating clinical pharmacists into healthcare teams.

A key novelty of this study is the identification of factors associated with improved knowledge in patients who initially had low levels of knowledge. These factors included a RAPID 3 score <7.5, living with family, receiving treatment information from a community pharmacist, and having a low Charlson score. This knowledge can help tailor patient education interventions to achieve better treatment outcomes.

To our knowledge, few studies have delved into the factors associated with knowledge within this particular population and none study on the factors associated with improvement in knowledge in patients with initially low level of knowledge. Rat *et al*. demonstrated that living alone was correlated with lower knowledge scores (8). They also identified a lack of professional activity as a factor linked to a lower level of knowledge. While our analysis did not pick-up a significant association with the lack of professional activity, there was a noticeable trend ($p>0.05$), suggesting that this factor was linked to a lack of knowledge improvement in the univariate analysis.

Various studies have established a connection between educational level and knowledge level (8, 32). However, we did not discern any such differences, possibly due to the high educational attainment within our patient population.

Fig. 3a. Type of health professional who provided treatment information to the patient, n (%)

Attending physician	21 (21.4%)
Rheumatologist	94 (94.9%)
Hospital pharmacist	29 (29.3%)
Community pharmacist	30 (30.6%)
Nurse	12 (12.2%)
Mean number per patient (SD)	1.9 <(1.1)

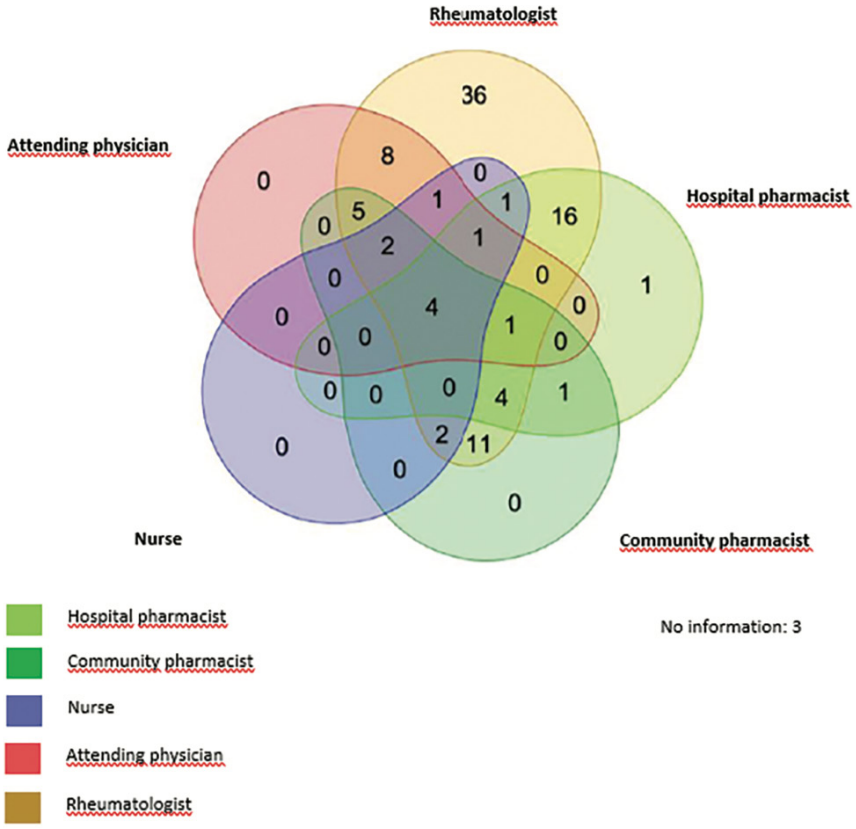

Fig. 3b. Venn diagram showing the number of health professionals who provided treatment information to the patient.

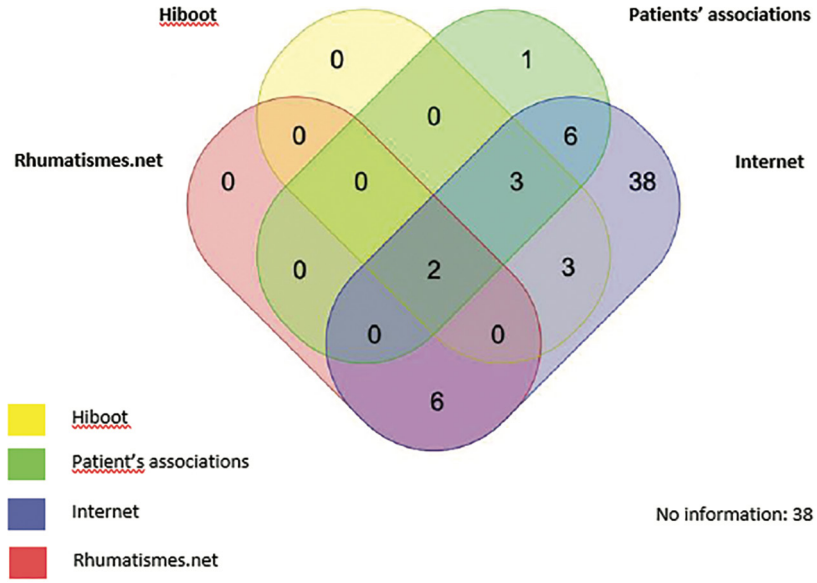

Fig. 4. Venn diagram about information source used by patient about treatment.

In fact, a striking 90% of our patients possessed at least a secondary education, with 60% having tertiary education.

Furthermore, Hennell *et al*. did not discover any associations with age, disease duration, or educational level following an educational intervention (32).

To reinforce the information provided during consultations, written materials were supplied to patients at the conclusion of their appointments. Some studies suggest that this approach leads to improved knowledge (33, 34).

The primary source of information for our patients was their rheumatologist. The number of patients receiving information from pharmacists exceeded that reported in another study (18). This can be attributed to the practice in our hospital, where pharmacists are sometimes involved in educating patients about treatment initiation. Additionally, patient education initiatives are being expanded in community pharmacies.

Among the 61.6% of patients sought information on internet, 21.2% relied on a site recommended by our hospital, while 38.4% explored information from other online sources. The number of patients reaching out to a patient association mirrored that in another study, but those conducted internet searches was higher in our study (61.6% *vs*. 29%) (18). This can be attributed to the evolution of the internet in recent years.

The strengths of the study include the use of a validated questionnaire, patients acting their own controls and pharmacist training in patient education. To the best of our knowledge, our study is the first to assess factors associated with improved knowledge and safety skills in patients with IA treated with bDMARDs.

However, this study has several important methodological limitations. First, the absence of a control group represents a major methodological limitation. Without a control group, it is difficult to attribute the observed outcomes solely to the pharmacist consultation, as external factors could also influence patients' knowledge over time. This absence of a control group limits the generalisability of the findings and reduces the ability to confirm if the effects are directly related to the intervention.

Another significant limitation concerns patient selection. The inclusion of a heteregenous cohort, involving patients with various types of IA, could introduce bias.

The limitations of the study include its monocentric nature, potential recruitment bias due to language requirement, potential bias stemming from the questionnaire format in patients with low literacy where the BioSecure score did not necessarily reflect the actual knowledge of the patient and with the method of imputing values where the actual patient score was not available.

Moreover, the potential effect of repeated exposure to the BioSecure questionnaire at M3, M6, and M12 evaluations presents a methodological limitation. Repeated use of the same evaluation tool may lead to biased results, reflecting greater familiarity with the questionnaire rather than actual knowledge improvement. Although few studies have examined this effect, prior research on other questionnaires suggests that such learning effects can indeed influence results (35).

It would have been better to choose as primary endpoint a comparison of severe infection rates among our patients and those documented in the literature. Alternative endpoints could have included evaluating patients' ability to manage treatment while travelling or undergoing surgery, or a higher rate of vaccination against influenza, pneumococcus, and tetanus within our patient population. This would have provided a better reflection of patients' practical application of acquired knowledge in real-life situations. Having a good level of knowledge did not necessarily guarantee that patients would apply the concepts from the questionnaire to make informed decisions.

In conclusion, this study showed a beneficial effect of a clinical pharmacist consultation on knowledge and safety skills to bDMARDs in patients with IA and underscore the critical role of pharmacist-led patient education in enhancing patient autonomy and treatment safety.

A multicentre controlled study and investigations into the pharmacist's role in managing patients on bDMARDs for IA could further validate these findings. Future research could explore broader endpoints such as severe infection rates, patient decision-making in real-life scenarios, and patient management of treatment during travel, surgery, and vaccinations.

Take home messages

- A clinical pharmacist consultation enhances patients' knowledge about bDMARDs.
- The improvement of knowledge is sustained for at least 12 months.
- Different factors are associated with improved knowledge.

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