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ORIGINAL RESEARCH

Facilitators and barriers of vaccine uptake in patients with autoimmune inflammatory rheumatic disease: a scoping review

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ABSTRACT

Objectives Patients with autoimmune inflammatory rheumatic diseases (AIRD) often have lower vaccination coverage rates compared with the general population, despite being disproportionately affected by infectious complications. We aim to systematically review the literature regarding vaccination willingness and hesitancy in AIRD.

Methods A scoping review was conducted in PubMed, EMBASE and the Cochrane Library in June 2021. Study selection was performed by two independent reviewers and data were extracted using a standardised form. Risk of bias was assessed using instruments from McMaster University. Identified barriers were categorised into the WHO's measuring behavioural and social drivers (BeSD) of vaccination conceptual model.

Results The search yielded 1644 hits of which 30 publications were included (cross-sectional studies based on interviews (n=27) and intervention studies (n=3)). The majority of studies reported barriers to influenza and pneumococcal vaccination only (n=9) or in combination with another vaccination (n=8) from the patients' perspective. Only one study assessed the view of rheumatologists. Coverage of domains matched to the BeSD model suggests a lack of awareness of infection risk by both patients and physicians. Patients mainly mentioned behavioural and social factors that negatively influenced their willingness to be vaccinated while physicians mentioned organisational deficits as major barriers.

Conclusions The view on vaccination in patients with AIRD diverges between patients and rheumatologists. Our results show that in-depth counselling on vaccines is important for patients, whereas physicians need support in implementing specific immunisation recommendations. The themes identified provide a starting point for future interventions to improve vaccine rates in patients with AIRD.

WHAT IS ALREADY KNOWN ABOUT THIS SUBJECT?

⇒ Vaccination rates in patients with autoimmune inflammatory rheumatic diseases are low.
⇒ Barriers and facilitators are not well studied in this specific population at risk for an increased risk of infections.

WHAT DOES THIS STUDY ADD?

⇒ We provided data on barriers and facilitators towards vaccine uptakes from patients' and physicians' point of view

HOW MIGHT THIS IMPACT ON CLINICAL PRACTICE OR FUTURE DEVELOPMENTS?

⇒ Patients and physicians need different information to resolve vaccine hesitancy.
⇒ Particularly behavioural and social factors could be identified, which negatively influence patients' willingness to get vaccinated.
⇒ Physicians saw organisational deficits and lack of time as major barriers.
⇒ Both stakeholders suggest a lack of awareness of infection risk.

INTRODUCTION

Patients with autoimmune inflammatory rheumatic diseases (AIRD) have an increased risk of infections compared with the general population. This is due to two main reasons. First, the inflammatory burden of the rheumatic disease itself[1] and related comorbidities contribute to an increased risk of infections. Second, the vast majority of patients with AIRD receive therapies with glucocorticoids and disease-modifying antirheumatic drugs with increased risk of infection.[1 2]

The most effective strategy to prevent infections is vaccination.[3] Vaccinations were shown to provide a protective immune response even when patients with AIRD were treated with immunosuppressive agents concomitantly.[3] EULAR recommends vaccination for the vast majority of patients with AIRD and an

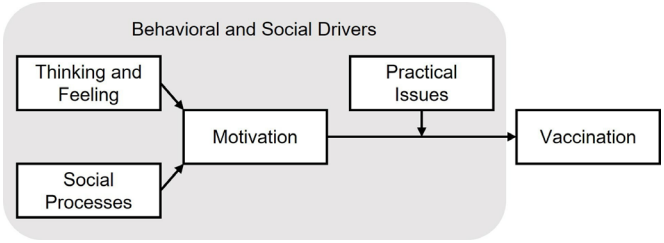

Figure 1 Behavioural and social drivers of vaccination conceptual model.[12]

annual check of their vaccination status.[4 5] Furthermore, EULAR strongly recommends consideration of influenza and pneumococcal vaccination for the majority of patients with AIRD. Although sufficiently powered safety assessment studies are lacking, most studies show post-vaccination a stable disease activity and only mild adverse events.[3]

Low vaccination rates have been consistently shown in many countries, for example, in an analysis of administrative claims data of outpatient care for the overall population in Germany.[6] A few studies have reported a low vaccination uptake in patients with AIRD.[7 8] Our own data have demonstrated a low vaccine uptake of 33.4% for influenza and 49.1% for pneumococci in 975 patients with AIRD in a tertiary centre.[9]

The overall low vaccination rates prompted WHO in 2019 to mark vaccination hesitancy as one of the 10 major threats to global health.[10] While low vaccination status has gained further significance with the advent of the current SARS-CoV-2 pandemic, the underlying reasons with respect to facilitators and barriers towards vaccine uptake are not well known. According to WHO, understanding how people think, feel and act is critical to developing strategies for better vaccination acceptance and uptake.[11] An expert group has developed a series of tools to measure behavioural and social drivers (BeSD) of vaccination. The BeSD conceptual model measures four domains (figure 1).[12] 'Thinking and feeling' covers confidence in benefits and safety of vaccines and perceived risks. 'Social processes' include external influences like some advice on vaccination by physician. These two domains then constitute the 'motivation', defined as the intention to get or willingness to recommend a vaccination, which only leads to successful vaccination if the vaccine is available and accessible ('practical issues').[12]

The aim of the present review was to systematically review the literature regarding vaccination willingness and hesitancy in patients with AIRD with focus on the perspective of patients and physicians and to close the knowledge gaps to identify facilitators and barriers towards vaccine uptake, and ultimately categorise the identified factors according to the BeSD conceptual model (figure 1).

METHODS

This scoping review was conducted using recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews checklist.[13] No review protocol was published in advance.

Research questions are:

- What are inhibiting and facilitating factors regarding willingness of vaccination in adults with AIRD?
- What do physicians perceive as inhibiting and facilitating factors regarding the willingness to vaccinate and vaccination participation among adults with AIRD?
- How can the identified factors be classified into the BeSD conceptual model?

Search strategy

A systematic literature search of English and German language publications was carried out in PubMed, EMBASE and the Cochrane Library until 15 June 2021.

The strategy included a list of keywords pertaining three thematic blocks, namely (1) inflammatory rheumatic diseases, (2) vaccinations of interest for patients with AIRD and (3) attitudes of patients and physicians regarding vaccinations. In addition, corresponding Medical Subject Headings (Mesh; Medline and Cochrane Library) and Emtree (EMBASE) were used. Search strategies are described in online supplemental file 1.

Inclusion criteria

To be included, publications had to consider (1) adult patients with AIRD, (2) vaccination against tetanus, diphtheria, pertussis, poliomyelitis, hepatitis B, pneumococcus, human papillomavirus, influenza, SARS-CoV-2, herpes zoster, meningococcus, measles, mumps, rubella and chickenpox (varicella), (3) factors associated with vaccination willingness. Regarding physicians, the focus was on (1) attitudes and beliefs on the vaccination of patients with AIRD, (2) factors influencing these attitudes, (3) perceived barriers to vaccination. Regarding patients, this includes (1) vaccination willingness and hesitancy and (2) influencing factors.

Publications were excluded if they (1) did not meet the target population, (2) focused on travel vaccinations solely.

Study selection/extraction

After duplicates had been removed, all remaining articles were first scanned on a title and abstract basis according to the prespecified criteria. Also, reference lists from identified literature reviews were screened. At least two of three reviewers (CS, SS, PzN) screened the references independently. In case of disagreement, a third person was consulted.

The following information was extracted from each study: (1) article characteristics; (2) study characteristics; (3) participant information and (4) outcome measure.

Finally, facilitators and barriers regarding vaccination were extracted by two persons (CS, PzN) independently using a standardised form.

Quality assessment

For cross-sectional study designs, the risk of bias instrument for cross-sectional surveys of attitudes and practices from McMaster University was used.[14] For interventional studies, a tool to assess risk of bias in longitudinal research studies was used.[15] Two researchers conducted the quality assessment independently (SS, PzN). Studies were not excluded based on quality assessment.

Categorisation of factors into the BeSD conceptual model

Identified facilitators and barriers were synthesised by categorising them into BeSD conceptual model. Classification was conducted independently by two researchers (CS, PzN) by using an inductive coding approach based on the content analysis.[16] First, each identified factor was coded as facilitating or inhibiting. For example, if 'fear of adverse reactions' is associated with lower uptake or intention, it was coded as an inhibitor and assigned to the category 'fear'.

Allocation of factors depends on the circumstances given in the studies. The circumstances in which a factor is placed are important for interpreting it, for example, to determine whether people's opinions or their behaviour arise from personal reasons, or from the environment.

For classification, a document elaborated by WHO in which the framework had been applied for the case of SARS-CoV-2 vaccinations was used.[12] Identified factors were allocated into categories of the BeSD conceptual model irrespective of frequency of mentions.

RESULTS

The search process identified 1644 publications of which 30 met the inclusion criteria (cross-sectional studies (n=27) and intervention studies (n=3)) (figure 2).

Study characteristics

A total of 23 full-text publications[17–39] and 7 letters to the editor[40–46] were included (table 1). All studies were published between 2003 and 2021. Most were conducted in the UK (n=6),[36 37 40 41 43 44] Canada (n=3),[17 34 46] France (n=3)[18 30 31] and Ireland (n=3).[24 29 32] One study was carried out in a total of 56 countries.[21]

Table 2 presents study characteristics of the included publications using a cross-sectional design (n=27). In 19 studies questionnaire-based patient surveys,[17–20 22 24–26 28 30 31 33 34 36 37 40 42–44] and in 4 studies telephone surveys were used.[23 27 35 45] Two studies applied an online patient survey[21 39] and one an interview-based survey.[46] One study conducted a questionnaire-based physician survey.[29] A total of 13 studies were performed in a clinical setting[17 18 20 22 24–26 28 30 31 34 36 46] and used interviews/assessments for collecting data. Five publications did not specify the study setting.[33 40 42–44]

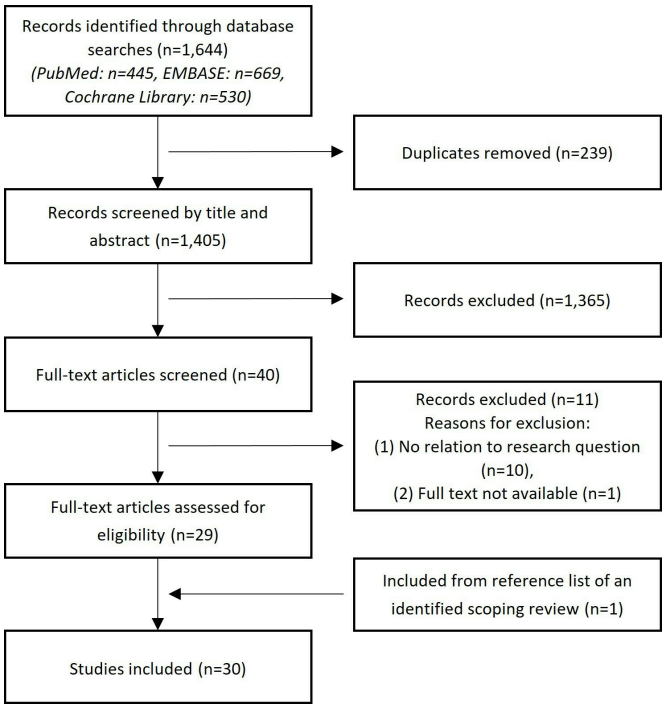

Figure 2 Study selection flow chart.

Nine studies reported survey response rates, which were around 55% in two studies,[29 35] between 90% and 99% in five studies[19 20 23 26 33] and 100% in two studies.[18 24] In total, 26 studies focused on patients[17–28 30 31 33–37 39 40 42–46] and 1 rheumatologist practising in Ireland.[29] The study population ranged from 44 to 1258 participants. Age of participants is reported very heterogeneous. One study reported an age range of 50–88 years.[17] Five studies reported a median between 50 and 62 years.[20–23 33] In all studies, the proportion of women was >60%. Overall, four publications displayed no demographic information[29 42–44] and one gave information about the participants' age but no gender-specific information.[22]

Most studies focused on influenza and pneumococcal vaccine coverage only (n=9),[18 24 27 28 30 33 36 37 43] and eight on influenza, pneumococcal and 'other' vaccine coverage, including herpes zoster (n=5),[17 26 29 34 35] tetanus (n=1),[19] diphtheria (n=1),[19] meningococcus (n=2)[19 29] or hepatitis B virus (n=2).[29 34] One study also considered vaccination against COVID-19.[21] Eight focused on influenza only,[22 23 25 31 40 42 44 46] two on COVID-19 vaccines[39 45] and one on pneumococcus only.[20]

In 24 studies the objectives were to assess vaccination uptake, coverage rate and/or influencing factors.[17–20 22–28 30 31 33–37 40 42–46] Two studies analysed patterns of behaviours regarding COVID-19 vaccines, as a proxy to vaccination willingness and to identify actions to increase vaccine coverage in this risk population.[21 39] One study investigated the effect of a quality improvement intervention to increase pneumococcal and influenza vaccination rates in rheumatology care.[29]

Table 3 presents study characteristics of included interventional studies. Both full publications used a prepost

Table 1 Included publications

Study	Country	Funding source
Full publication		
Aberumand *et al*[17]	Canada	None declared
Brocq *et al*[18]	France, Monaco	None declared
Chehab *et al*[19]	Germany	None declared
Constantinou *et al*[20]	Greece	None declared
Felten *et al*[21]	Worldwide (56 countries)	None declared
Figueroa-Parra *et al*[22]	Mexico	None declared
Fragoulis *et al*[23]	Greece*	None declared
Haroon *et al*[24]	Ireland	None declared
Harrison *et al*[25]	Austria	None declared
Jiang *et al*[26]	China	Health management platform of spondyloarthritis and hyperuricemia (A2968), Distinguished Young Scholar Candidates Programme for The Third Affiliated Hospital of Sun Yat-Sen University, Pearl River Nova Programme of Guangzhou (Grant No. 201610010005)
Lawson *et al*[27]	USA	None declared
Lee *et al*[28]	Australia	None declared
McCarthy *et al*[29]	Ireland	None declared
Morel *et al*[30]	France	None declared
Mouthon *et al*[31]	France	None declared
Murray *et al*[32]	Ireland	None declared
Nguyen *et al*[33]	Denmark	None declared
Qendro *et al*[34]	Canada	None declared
Sandler *et al*[35]	USA	Pfizer award #8392087 and National Institutes of Health rant P60AR064464.
Sowden and Mitchell[36]	UK	None declared
Subesinghe *et al*[37]	UK	None declared
Valerio *et al*[38]	Canada	Canadian Initiative for Outcomes in Rheumatology cAre (CIORA), the McGi II, Interdisciplinary Initiative in Infection and Immunity (MI4) and the McGill University Health Centre Foundation
Yurttas *et al*[39]	Turkey	None declared
Letters to the editor		
Bridges *et al*[40]	UK*	n/a
Doe *et al*[41]	UK*	n/a
Michel *et al*[42]	France	n/a
Pradeep *et al*[43]	UK*	n/a
Saravana[44]	UK*	n/a
Smerilli *et al*[45]	Italy	None declared
Vieira de Rezende *et al*[46]	Brazil	None declared

*Data were inferred from further information (eg, authors' institution, ethics votes).
n/a, not available.

interventional design with two survey time points.[32 38] Data were collected in 2017 and 2018[32] and in 2015 and 2019,[38] respectively. In the study by Doe *et al*, data were assessed after an intervention in 2004.[41]

All intervention studies examined vaccination coverage rates. Murray *et al* aimed to assess vaccination coverage rate before and after implementation of a quality intervention and factors influencing it.[32] In the study by Valerio *et al*, differences in vaccination coverage before and after implementation of a multimodal intervention were investigated.[38] Doe *et al* focused on the uptake of influenza and pneumococcal vaccination after an intervention.[41] None of the intervention studies reported response rates. The number of included patients ranged from 169 to 425. Murray *et al* mentioned that 45.6% of the study population were over 60 years of age.[32] In the study by Doe *et al*, 48% of participants were over 65 years of age.[41] Valerio *et al* reported a mean age around 50.8 years (SD=19,4).[38] Murray *et al* and Valerio *et al* surveyed more women than men at both survey time points, with the proportion of women being >70%.[32 38] With a proportion of 48%, Doe *et al* is the only study with a lower rate of women than men.[41]

Risk of bias assessment

The risk of bias assessment was limited by the poor reporting quality of most of the included publications. For more details, see online supplemental file 1.

Most frequent facilitators and barriers

In 22 studies, patients' responses were quantified and provide insight into which factor was most frequently cited.[17–27 30–33 35 38–42 44]

Fear of adverse reactions were stated as most frequent reason in seven publications. In one study, 21.8% of respondents self-reported developing a flare post-vaccination as most important adverse reaction.[19] In another study, adverse reactions induced by COVID-19 vaccine were stated by 95.3%.[21] Also 27% of participants mentioned previous adverse reactions of vaccines given in the past.[41] The rate of patients being afraid of any vaccination ranged from 16% to 48%.[25 30 39 42] Sandler *et al* showed that up to 70% of patients did not trust vaccinations.[35] Not feeling safe was stated by 39% of respondents in the study by Figuerra-Parra *et al*.[22] The belief in good health was stated as most frequent reason in three studies (rates 8.9%–36.9%).[32 33 41]

Table 2 Study characteristics of publications using cross-sectional designs

Study	Method	Recruitment setting	Performing setting	Focused vaccine(s)	Study objective(s)	Response rate	Study population	No. of paticipants	Demographic information
Aberumand *et al*[17]	Patient survey (questionnaire based)	Hospital (academic rheumatology)	Hospital, UK	Influenza, pneumococcus, herpes zoster	Uptake of herpes zoster, influenza and pneumococcal vaccination	n/a	Patients with RA	98	Age range: 50–88 years Female: 70.4%
Brocq *et al*[18]	Patient survey (questionnaire based)	Hospital	Several hospitals, France and Monacco	Influenza, pneumococcus	Evaluate influenza (in winter 2012/13 and previous winters) and pneumococcal (last 5 years) vaccine coverage	100%	Patients	584	Age: 58.3±14 Female: 68.15%
Chehab *et al*[19]	Patient survey (questionnaire based)	Participants were recruited on individual invitation by their caring rheumatologist or association	Nationwide, Germany	Influenza, pneumococcus, tetanus, diphtheria, meningococcus	Coverage rates of selected vaccinations in a representative sample of patients with SLE and to identify predictors for non-vaccination, clinical parameters and health-related quality of life	92%	Patients with SLE	579	Age: 52.3±13.4 Female: 94%
Constantinou *et al*[20]	Patient survey (questionnaire based)	Hospital (academic rheumatology, outpatient), Greece	Hospital, Greece	Pneumococcus	Vaccination coverage rate, factors for non-vaccination	98,75%	Patients	395	Median age: 58 years Female: 78.99%
Felten *et al*[21]	Patient survey (web-based questionnaire)	Dissemination through social media and mailings via patient associations and various medical societies	Internet	Influenza, pneumococcus and intention to vaccinate against COVID-19	Analyse patterns of behaviours regarding SARS-CoV-2 vaccination in patients with AIRD, as a mean to identify pragmatic actions to increase vaccine coverage in this population	n/a	Patients	1258	Median age: 50 years Female: 90.5%
Figueroa-Parra *et al*[22]	Patient survey (questionnaire based)	Community speech for patients and academic rheumatology	Performed during an educational community speech for patients and in a rheumatology hospital, USA	Influenza	Uptake of influenza vaccination and factors influencing it	n/a	Patients	223	Median age: 51 years Female: n/a
Fragoulis *et al*[23]	Patient survey (telephone-based)	Hospital (two outpatient hospitals)	Via telephone, Greece	Influenza	Uptake of influenza vaccination and factors influencing it	97%	Patients	1015	Median age: 58 years Female: 74.7%

Continued

Table 2 Continued

Study	Method	Recruitment setting	Performing setting	Focused vaccine(s)	Study objective(s)	Response rate	Study population	No. of paticipants	Demographic information
Haroon *et al*[24]	Patient survey (questionnaire based)	Hospital (academic rheumatology, outpatient)	Hospital, Ireland	Influenza, pneumococcus	Influenza and pneumococcal vaccination coverage rate among rheumatology outpatients who are immunosuppressed, identification of factors influencing immunisation uptake among patients	100%	Patients	110	Age: 55±13.49 Female: 63%
Harrison *et al*[25]	Patient survey (questionnaire based)	Hospital (academic rheumatology, outpatient)	Hospital, Austria	Influenza	Vaccination coverage rate and predictors for influenza vaccination willingness	n/a	Patients	490	Age: 55.3±14.3 Female: 66.5%
Jiang *et al*[26]	Patient survey (questionnaire based)	Hospital (academic rheumatology, inpatient)	Hospital, China	Influenza, pneumococcus, herpes zoster	Vaccination coverage rate and factors influencing it. Knowledge, attitude and practice towards certain vaccinations	97%	Patients	235	Age: 39.7±15.86 Female: 66.4%
Lawson *et al*[27]	Patient survey (longitudinal telephone study)	Existing cohort (UCSF Lupus Genetics Project (various clinics, rheumatologists, other sources (eg, support groups, conferences, newsletters and websites))	Via telephone, USA	Influenza, pneumococcus	Vaccination coverage rate and factors influencing it	n/a	Patients	485	Mean age: 50 years Female: 93%
Lee *et al*[28]	Patient survey (questionnaire based)	Hospital (academic rheumatology)	Hospital, Australia	Influenza, pneumococcus	Vaccination coverage rate and factors influencing it, infection rate in non-vaccinated persons. Observation of Biologic Therapy (RABBIT) risk score	n/a	Patients	193	Mean age: 60 years Female: 73%
McCarthy *et al*[30]	Physician survey (questionnaire based)	Practising rheumatologists identified from the Irish Society for Rheumatology register and from data provided by the national specialty training scheme)	Dissemination via postal, Ireland	Influenza, pneumococcus, herpes zoster, hepatitis B, meningococcus	Knowledge, attitudes and clinical practice of rheumatologists with respect to vaccination	55%	Rheumatologists practising in Ireland in 2009	44	n/a

Continued

Table 2 Continued

Study	Method	Recruitment setting	Performing setting	Focused vaccine(s)	Study objective(s)	Response rate	Study population	No. of paticipants	Demographic information
Morel *et al*[30]	Patient survey (questionnaire based)	Hospitals (academic rheumatology, questionnaires were randomly delivered to patients)	Two hospitals, France	Influenza, pneumococcus	Vaccination coverage rate, factors for non-vaccination in patients with Sjögren's syndrome	n/a	Patients	111	Age: 57±15 Female: 94%
Mouthon *et al*[31]	Patient survey (questionnaire based)	Patient association of systemic sclerosis or during hospitalisation in an academic rheumatology centre	Meetings of the French association of patients with systemic sclerosis and during hospitalisation, France	Influenza	Vaccination coverage rate and factors influencing it	n/a	Patients	177	Age: 58.7±12.6 Female 79.7%
Nguyen *et al*[33]	Patient survey (questionnaire based)	Hospitals (academic rheumatology, outpatient or the outpatient clinic of regional rheumatology centre)	n/a	Influenza, pneumococcus	Influenza and pneumococcus vaccination coverage rate, differences depending on the type of RA therapy in the vaccination coverage	95%	Patients	192	Median age: 62 years Female: 70%
Qendro *et al*[34]	Patient survey (questionnaire based)	Hospital (academic rheumatology)	Hospital, Canada	Influenza, pneumococcus, hepatitis B	Vaccination coverage rate and factors influencing it	n/a	Patients	352	Age of patients with: ► RA: 55.0±17.0 ► SARD: 48.6±16.6 ► SpA: 44.8±14.1 ► OD: 56.7±15.4 Sex female: 74.4%
Sandler *et al*[35]	Patient survey (telephone based)	Hospital (academic rheumatology hospital—structured query language was used to identify all eligible patients from EHR data)	Via telephone, USA	Influenza, pneumococcus (PNVX), herpes zoster	Vaccination coverage rate and factors influencing it, physician recommendations on vaccines	55.40%	Patients	102	Age: 57.8±14.5 Female: 85.3%
Sowden *et al*[36]	Patient survey (questionnaire based)	Hospital (rheumatology outpatient hospital at our district general hospital)	Outpatient hospital, UK	Influenza, pneumococcus	Vaccination coverage rate	n/a	Patients	101	Mean age: 60.6 years Female: 69.3%
Subesinghe *et al*[37]	Patient survey (questionnaire based)	Hospitals (King's College Hospital, London and Fife Rheumatic Diseases Unit, Scotland)	Dissemination via postal and telephone, UK	Influenza, pneumococcus	Vaccination coverage rate and factors influencing it, infection rate	n/a	Patients	929	Mean age: 63.1 years Female: 74.9%

Continued

Table 2 Continued

Study	Method	Recruitment setting	Performing setting	Focused vaccine(s)	Study objective(s)	Response rate	Study population	No. of paticipants	Demographic information
Yurttas *et al*[39]	Patient survey (web-based)	Patients: examined in an outpatient hospital (recruited via telephone) Healthcare workers: questionnaire was sent to the staff of university hospital	Internet	SARS-CoV-2	Vaccination willingness	n/a	Patients	732	Age patients: 42.8±11.6 Female 64.6%
Bridges *et al*[40]	Patient survey (questionnaire based)	Hospital	n/a	Influenza	Document the rate of uptake of influenza vaccine in patients with RA; assess the degree of conformity to the BSR guidelines; explore the factors that influence vaccine uptake	n/a	Patients	129	Mean age: 59.4 years Female: 69%
Michel *et al*[42]	Patient survey (questionnaire based)	Hospital	n/a	Influenza	Vaccination coverage rate and factors influencing it	n/a	Patients	161	n/a
Pradeep *et al*[43]	Patient survey (questionnaire based)	Hospital	n/a	Influenza, pneumococcus	Vaccination coverage rate and factors influencing it	n/a	Patients	155	n/a
Saravana[44]	Patient survey (questionnaire based)	Hospital	n/a	Influenza	Vaccination coverage rate and factors influencing it	n/a	Patients	100	n/a
Smerilli *et al*[45]	Telephone survey	Hospital (patients followed up at the Rheumatology Unit of Carlo Urbani Hospital in Jesi (Ancona, Italy), Polytechnic University of Marche)	Via telephone	SARS-CoV-2	Vaccination coverage rate and factors influencing it	n/a	Patients	301	Age: 56±13 Female: 61.5%
Vieira de Rezende *et al*[46]	Interview-based patient survey	Hospital (SLE outpatient hospital at the hospital of the State University of Rio de Janeiro, Brazil)	Outpatient hospital, Brazil	Influenza	Influenza vaccinacion uptake and factors influencing it	n/a	Patients	173	Age: >18 years Female: 89.9%

OD, that is, osteoarthritis, fibromyalgia, crystal arthropathies.
AIRD, autoimmune inflammatory rheumatic diseases; BSR, British Society of Rheumatology; EHR, electronic health records; n/a, not available; OD, other diseases; RA, rheumatoid arthritis; RABBIT, Rheumatoide Arthritis: Beobachtung der Biologika Therapie; SARD, systemic autoimmune rheumatic diseases; SLE, systemic lupus erythematosus; SpA, spondyloarthropathies.

Table 3 Study characteristics of publications using interventional designs

Study	Design	Data collection	Method	Intervention	Recruting setting	Performing setting	Focused vaccine(s)	Study objective(s)	Response rate	Study population	No. of participants	Demographic information
Murray *et al*[32]	Prepost design	t0: 2017 (pre-intervention) t1: 2018 (post-intervention)	Patient survey (questionnaire-based)	Quality improvement intervention with training event for all employees of the rheumatology department	Clinic (inflammatory arthritis hospital)	Clinic, Ireland	Influenza, pneumococcus (PPSV23)	Vaccination coverage rate between pre-implementation and post-implementation and factors influencing it Primary end point: increase in vaccination rate	n/a	Outpatients	t0: 163 t1: 262	Age: 45.6% ≥60 years Female t0: 74.8% Female t1: 73.4%
Valerio *et al*[38]	Prepost design	t0: 2015 (pre-intervention) t1: 2019 (post-intervention)	Patient survey (questionnaire-based)	Multimodal implementation strategy in the outpatient hospitals of the Department of Rheumatology at the Montreal General Hospital, McGill University. 254 letters mailed to patients (vaccination information), physician reminders (16 posters for waiting rooms, etc to encourage vaccination), and vaccination nurse during a 7-week period who offered free influenza vaccinations to patients and family members	Hospital (outpatient hospitals)	Dissemination via postal (information letter), information posters in examining rooms, waiting areas and reception areas, Ireland, Canada	Influenza	Vaccination coverage rate between pre-implementation and post-implementation	n/a	Patients	t0: 136 t1: 107	Age: 50.8±19.4 Female t0: 80.9% Female t1: 75.2%
Doe *et al*[41]	Postdesign	2004 (post-intervention)	Patient survey (questionnaire-based)	1. Discuss vaccination status during new patient education 2. Provision of the DoH publication 'Fighting with influenza' 3. A list of patients taking DMARDs was distributed to each primary care practice prior to the annual immunisation campaign	Hospital (rheumatology hospital)	Hospital	Influenza, pneumococcus	Uptake of influenza and pneumococcal vaccination after intervention	n/a	Patients	169	Age: 48% >65 years Female: 48%

DMARDs, disease-modifying antirheumatic drugs; DoH, Department of Health; n/a, not available.

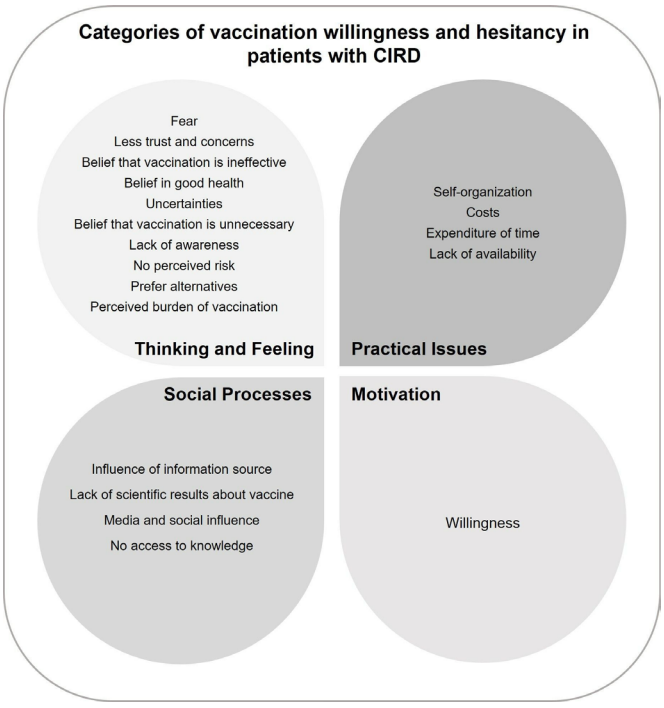

Figure 3 Allocation of identified categories to the domains of behavioural and social drivers of vaccination concept model.

In one study, lack of awareness was the most common reason for non-vaccination before intervention for both influenza (36.7%) and pneumococcal (PPSV23) (82.1%). After the intervention, these were 34.2% and 76.4%, respectively.[32]

Unwillingness of patients to receive any vaccination was mentioned in three studies with a rate between 55.0% and 56.5%.[17 38 44] Two studies reported that 63% and 72% of patients forgot to get vaccinated.[18 23] A lack of recommendation or no offer of vaccination by providers was mentioned by 36%–87% of patients in five studies.[20 24 27 31 40]

Classification of facilitators and barriers of vaccination willingness

Altogether, 19 categories were identified. Within the domains 'thinking and feeling', 'social processes', 'motivation' and 'practical issues', a total of 10, 4, 1 and 4 categories were identified (figure 3).

The results almost exclusively show the patients' perspective (n=29) (table 4). One study (table 5) examines perceptions of physicians, which is limited to the rheumatologists' opinions and their attitude towards patient education. Whether rheumatologists know the reasons for their patients' willingness to be vaccinated could not be answered.

Identified categories

Regarding behavioural factors the first identified category 'fear' is reported in 20 publications and is mentioned as a reason for vaccination hesitancy. The most stated reason in this category is fear of adverse reactions.[18–20 23 25 28 30–33 39 40 42 43] In other publications, fear is specifically directed at the development of allergic reactions,[17 27 31 36] at experience of flares or relapses of the rheumatic disease,[19 25 41] at inefficacy[31] and at fear in general.[24] Additionally, the category 'less trust and concerns' points out that patients mentioned a lack of trust and concerns regarding their vaccines in 11 publications. This lack referred to safety,[20 22 23 26–28 35 37 42] to efficacy of the vaccine[27 31 42] or to healthcare professionals.[21]

The category 'belief that vaccine is ineffective/does not protect' includes patients who believe that vaccination does not protect,[18 19 39 40] who do not perceive any benefit[23] and who believe that vaccinations weaken the immune system or that vaccination results in an increased vulnerability to other illnesses.[19 22 25]

The category 'belief in good health' in this domain includes respondents believe in their good health and therefore refuse vaccination.[24 26 32 33 38 41 44] Also, the category 'uncertainties' illustrates uncertainties based on prior experience. Stated reasons for this are previous 'sickness with the vaccination' or 'negative experience in the past'.[17 25 41]

Other publications mention that patients believe vaccination is unnecessary,[24 26] or that vaccination is only necessary from the age of 65 years onwards.[17] Also, the category 'lack of awareness' shows that some patients are not aware of the need of vaccination.[32 38 44] Lack of perception of personal risk of illness is mentioned as barrier for vaccination uptake in the category 'no perceived risk'. Patients did not perceive an influenza infection as a serious disease[25] or did not assess the risk of infection.[30] Moreover, the category 'prefer alternatives' demonstrate that some patients preferred alternatives like herbal medicines, traditional medicine or certain foods.[22 39]

In one study, efforts were mentioned to be too troublesome for patients.[26] This factor was assigned to the category 'perceived burden of getting vaccine'.

Factors that can be assigned to the domain of social processes are assigned to four categories. The first category 'influence of information source' shows that the lack of a recommendation, and the failure to offer vaccinations by the rheumatologist or primary care physician[20 23–27 30 31 33 35 37 40 43 46] are mentioned reasons in 13 publications for vaccination hesitancy. The willingness to get vaccinated is also negatively influenced if the physician never discussed the importance of vaccination or never mentioned it,[20 23–27 30 31 33 35 37 40 43 46] or when patients considered vaccines to be contraindicated,[30 36] in one study even after consultation with their physician.[30] Additionally, the category 'missing of scientific results about vaccine' points out that patients' vaccination hesitancy results from not knowing the scientific results regarding vaccinations[26] or concerns about a technology that has never been used before (eg, RNA vaccine).[21] The factor 'media and social influence' shows that a negative reputation of the vaccine,[45] news of a particular vaccine[39] or bad reports[41] are negatively influencing factors. Finally,

Table 4 Patients' point of view

Thinking and feeling	
Fear	► Fear of/experience with adverse reactions[18–20 23 25 28 30–33 39 40 42 43] ► Fear of allergy[17 27 31 36] ► Fear of/experience with flares/relapse of disease[19 20 25 41] ► Fear of inefficacy[31] ► General fear[24]
Lack of trust and concerns	► No confidence in vaccination/general safety concerns/it takes huge risks[20 22 23 26–28 35 37 42] ► Belief that vaccinations weaken the immune system/vulnerable to other illnesses[19 22 25] ► No trust in healthcare professionals[21]
Belief that vaccine is ineffective/does not protect	► Belief that vaccination does not protect[19 39] ► Belief that vaccine is ineffective[18 40] ► No perceived benefit[23]
Belief in good health	Not that old/perception of good health[24 26 33 41]
Uncertainties	Previous sickness with the vaccination/uncertain because of negative experience[17 25 41]
Belief that vaccination is unnecessary	► Belief that vaccination is unnecessary[24 26] ► Belief that vaccine is only useful/necessary above the age of 65 years[17]
Lack of awareness	Lack of awareness of the need of vaccination[32 38 44]
No perceived risk	► Influenza is not seen as a serious disease[25] ► No perceived risk of infection/influenza[30]
Prefer alternatives	Herbal medicines, traditional medicine or certain foods[22 39]
Perceived burden of getting vaccine	Troublesome to take vaccine[26]
Social processes	
Influence of information source	► Lack of a recommendation/not offered by rheumatologist or primary care physician[20 23–27 30 31 33 35 37 40 43 46] ► Physician (rheumatologist or primary care physician) never discussed the importance of vaccination or mention it[17 27] ► Considered vaccine contraindicated after consultation with physician[30 36], even once after consultation with their physician[30]
Scientific results	► Do not know the scientific results[26] ► Concerns about a technology that has never been used before (eg, RNA vaccine)[21]
Media and social influence	► Negative reputation of the vaccine[45] ► Rejection of a particular vaccine influenced by media[39] ► Heard bad reports[41]
No access to knowledge	No access to get knowledge about vaccination[26]
Motivation	
Willing	*Willing to take vaccine under doctor's recommendation*[26]
Practical issues	
Costs	► Costs in general[27 38] ► Too expensive[26]
Expenditure of time	Feeling that vaccinations are very time consuming[27 38]
Self-organisation	Vaccination was forgotten/failure to remember[18 23 38]
Lack of availability	Lack of availability[27]

*Facilitators are shown in italics, barriers in standard font.

Table 5 Rheumatologists' point of view

Practical issues	
Lack of time	Insufficient time with patients.[29]
Not the task of special rheumatologist hospitals	There are more important issues to be discussed in a specialty hospital.[29]
Responsibility placed in primary care	Responsibility for vaccination uptake and update was within the domain of the patient's general practitioner.[29]

the last category in this domain 'no access to knowledge' shows that patients sometimes have no access to knowledge about vaccination.[26]

In the domain 'motivation', the only identified category is 'willingness'. One publication mentioned that patients would seek influenza or pneumococcal vaccination based on a physician's recommendation.[26] This is the only factor identified as a facilitator in this review.

Regarding the domain 'practical issues', the identified category 'self-organisation' shows that patients sometimes forgot about vaccinations.[18 23 38] The categories 'costs', 'expenditure of time' and 'lack of availability' points out

that there are barriers related to costs,[26 38] time[27 38] and availability of vaccinations.[27]

In the study which surveyed rheumatologists, three categories could be identified. Respondents in this study mainly stated practical issues, including lack of time with patients as barrier in the category 'lack of time' for education about vaccinations.[29] In addition, they believe that there are more important issues to be discussed in a specialty hospital[29] and that the responsibility to educate is placed in primary care.[29] These two factors are assigned to the categories 'not the task of special rheumatologist clinics' and 'responsibility placed in primary care' (table 5).

DISCUSSION

We identified a variety of barriers that prevent patients with AIRD from getting vaccinated. The fear of adverse reactions was the most frequently reported reason for vaccination hesitancy in seven publications.[19 21 25 30 39 41 42] Furthermore, five studies have shown that 36%–87% of patients reported that vaccination was not recommended/not offered by the physician.[20 24 27 31 40] In this scoping review only one facilitator was identified, namely the willingness to take vaccines once recommended by the treating physician.

Our scoping review showed clearly that barriers for patients can rather be assigned mainly in behavioural and social areas, less in practical issues. A total of 18[17–20 23–25 27 28 30–33 36 39 40 42 43] and 16[17 20 23–27 30 31 33 35–37 40 43 46] publications mentioned factors that can be assigned to the categories 'fear' and 'influence of information source', respectively. A scoping review published in 2020[47] also searched for vaccine uptake or hesitancy. Also social and contextual factors as well as provider factors as main themes were identified.[47] In contrast, by using the BeSD conceptual model, we gained a different insight into understanding vaccination hesitancy among patients.

One publication mentioned that the opposition of some physicians to provide or to suggest vaccinations could have prevented the immunisation.[24]

We conclude that the physician's active recommendation for a specific vaccination is strongly influencing the patients' decision to get vaccinated. This fact is also underlined by the only facilitator showing that the willingness of patients to be vaccinated increases after a recommendation by the physician.[26]

Although the scoping review identified almost exclusively the patients' view, our results indicate that the view about vaccination in patients with AIRD diverges between patients and physicians. Interestingly, only one publication[29] notes that the rheumatologist's perspective allocated barriers mostly to practical issues. None of the included studies indicate to what extent physicians have knowledge about the specific recommendations for vaccines in immunocompromised patients. Moreover, insights of rheumatologists or other physicians into vaccine hesitancy of their patients could be helpful to close the immunisation gap, including COVID-19 vaccines, as shown in the study by Tedeschi *et al*.[48] Therefore, in-depth counselling on vaccines is important for patients with AIRD, whereas physicians need support in implementing specific vaccine recommendations. Consequently, the EULAR recommendation for vaccination assigned the responsibility for assessment, education and implementation of the individualised vaccination programme to the treating rheumatologist to improve the uptake of vaccination.[4]

Finally, recent studies[39 45] have also revealed concerns about COVID-19 vaccine. It can be seen that factors such as 'bad reputation of vaccine' and 'type of vaccine' are mentioned for the first time in connection with COVID-19 vaccinations. Recently published literature on COVID-19 shows misinformation as another factor, the relevance of which will certainly have to be considered in more detail in the future.[49] In this regard, the impact of the pandemic on vaccination preparedness is not yet foreseeable.

It cannot be ruled out that the categorisation of factors is subjective. We tried to minimise this risk by carrying out the classification by two persons independently and by using WHO guidance.[11] Moreover, systematic search revealed mainly cross-sectional studies with low reporting quality, which is reflected by the results of the risk of bias assessments.

In conclusion, our scoping review provides insights into different barriers to vaccination that prevent patients with AIRD to have a complete vaccine coverage. Interventions to increase vaccine rates should focus on benefit/risk assessments, risk perception and disease-specific vaccine recommendations. Future research should aim to gather more evidence in relation to physicians' perceptions. In particular, research should focus on capturing what physicians know about their patients in relation to their vaccination coverage.

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