

# EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs: 2016 update

Josef S Smolen,<sup>1,2</sup> Robert Landewé,<sup>3,4</sup> Johannes Bijlsma,<sup>5</sup> Gerd Burmester,<sup>6</sup> Katerina Chatzidionysiou,<sup>7</sup> Maxime Dougados,<sup>8</sup> Jackie Nam,<sup>9</sup> Sofia Ramiro,<sup>10</sup> Marieke Voshaar,<sup>11</sup> Ronald van Vollenhoven,<sup>3,4</sup> Daniel Aletaha,<sup>1</sup> Martin Aringer,<sup>12</sup> Maarten Boers,<sup>13</sup> Chris D Buckley,<sup>14</sup> Frank Buttgerit,<sup>6</sup> Vivian Bykerk,<sup>15,16</sup> Mario Cardiel,<sup>17</sup> Bernard Combe,<sup>18</sup> Maurizio Cutolo,<sup>19</sup> Yvonne van Eijk-Hustings,<sup>20</sup> Paul Emery,<sup>10</sup> Axel Finckh,<sup>21</sup> Cem Gabay,<sup>21</sup> Juan Gomez-Reino,<sup>22</sup> Laure Gossec,<sup>23</sup> Jacques-Eric Gottenberg,<sup>24</sup> Johanna M W Hazes,<sup>25</sup> Tom Huizinga,<sup>11</sup> Meghna Jani,<sup>26</sup> Dmitry Karateev,<sup>27</sup> Marios Kouloumas,<sup>28,29</sup> Tore Kvien,<sup>30</sup> Zhanguo Li,<sup>31</sup> Xavier Mariette,<sup>32</sup> Iain McInnes,<sup>33</sup> Eduardo Mysler,<sup>34</sup> Peter Nash,<sup>35</sup> Karel Pavelka,<sup>36</sup> Gyula Poór,<sup>37</sup> Christophe Richez,<sup>38</sup> Piet van Riel,<sup>39</sup> Andrea Rubbert-Roth,<sup>40</sup> Kenneth Saag,<sup>41</sup> Jose da Silva,<sup>42</sup> Tanja Stamm,<sup>43</sup> Tsutomu Takeuchi,<sup>44</sup> René Westhovens,<sup>45,46</sup> Maarten de Wit,<sup>47</sup> Désirée van der Heijde<sup>10</sup>

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/annrheumdis-2016-210715>).

For numbered affiliations see end of article.

## Correspondence to

Professor Josef Smolen, Division of Rheumatology, Department of Medicine 3, Medical University of Vienna, Waehringer Guertel 18-20, Vienna A-1090, Austria; josef.smolen@wienkav.at, josef.smolen@meduniwien.ac.at

JSS and RL co-first authors. JSS and RL contributed equally.

Received 22 October 2016  
Revised 5 January 2017  
Accepted 9 February 2017

**To cite:** Smolen JS, Landewé R, Bijlsma J, et al. *Ann Rheum Dis* Published Online First: [please include Day Month Year] doi:10.1136/annrheumdis-2016-210715

## ABSTRACT

Recent insights in rheumatoid arthritis (RA) necessitated updating the European League Against Rheumatism (EULAR) RA management recommendations. A large international Task Force based decisions on evidence from 3 systematic literature reviews, developing 4 overarching principles and 12 recommendations (vs 3 and 14, respectively, in 2013). The recommendations address conventional synthetic (cs) disease-modifying antirheumatic drugs (DMARDs) (methotrexate (MTX), leflunomide, sulfasalazine); glucocorticoids (GC); biological (b) DMARDs (tumour necrosis factor (TNF)-inhibitors (adalimumab, certolizumab pegol, etanercept, golimumab, infliximab), abatacept, rituximab, tocilizumab, clazakizumab, sarilumab and sirukumab and biosimilar (bs) DMARDs) and targeted synthetic (ts) DMARDs (Janus kinase (Jak) inhibitors tofacitinib, baricitinib). Monotherapy, combination therapy, treatment strategies (treat-to-target) and the targets of sustained clinical remission (as defined by the American College of Rheumatology-(ACR)-EULAR Boolean or index criteria) or low disease activity are discussed. Cost aspects were taken into consideration. As first strategy, the Task Force recommends MTX (rapid escalation to 25 mg/week) plus short-term GC, aiming at >50% improvement within 3 and target attainment within 6 months. If this fails stratification is recommended. Without unfavourable prognostic markers, switching to—or adding—another csDMARDs (plus short-term GC) is suggested. In the presence of unfavourable prognostic markers (autoantibodies, high disease activity, early erosions, failure of 2 csDMARDs), any bDMARD (current practice) or Jak-inhibitor should be added to the csDMARD. If this fails, any other bDMARD or tsDMARD is recommended. If a patient is in sustained remission, bDMARDs can be tapered. For each recommendation, levels of evidence and Task Force agreement are provided, both mostly very high. These recommendations intend informing rheumatologists,

patients, national rheumatology societies, hospital officials, social security agencies and regulators about EULAR's most recent consensus on the management of RA, aimed at attaining best outcomes with current therapies.

The management of rheumatoid arthritis (RA) has changed dramatically over the past 30 years. Few therapeutic agents existed then, which were either minimally or not efficacious, because of toxicity and the fact that optimal dosing and onset of action had not yet been elucidated for some agents.<sup>1–4</sup> Available therapies were started late rather than early in the course of the disease.<sup>5–6</sup> Early arthritis clinics were emerging,<sup>7–9</sup> and their successes fuelled reappraisal of the classification criteria then available that focused primarily on long-standing disease.<sup>10</sup> A therapeutic target had not yet been defined, because relief of symptoms appeared to be the most important goal and the concept of aiming at disease states like remission or low disease activity was at best aspirational.<sup>11</sup>

To date, we have available numerous efficacious agents. Among the conventional synthetic (cs) disease-modifying antirheumatic drugs (DMARDs),<sup>12</sup> we adopted methotrexate (MTX), on its optimal use, as the anchor drug<sup>4</sup>; in addition, a number of biological (b) DMARDs have been approved, more recently followed (in many countries) by approval of the first targeted synthetic (ts) DMARD, with more in development.<sup>13</sup> Today, new classification criteria for RA promote the study of patients earlier in their disease course than before<sup>14</sup> and recommendations have been developed to treat patients with RA via strategic algorithms targeting an optimal outcome, irrespective of the types of available therapies.<sup>15–17</sup>

A limited number of measures to assess response in clinical trials and follow disease activity in

clinical practice are widely used<sup>18–21</sup> and the American College of Rheumatology (ACR) and the European League Against Rheumatism (EULAR) have jointly developed new definitions for remission which provide an optimal clinical outcome and can be achieved in a significant proportion of patients in trials and practice.<sup>22</sup> Attaining remission according to these criteria, index-based or Boolean, will prevent joint destruction or at least progression of joint damage irrespective of residual subclinical changes,<sup>23–24</sup> optimise physical function, improve quality of life and work capacity<sup>25–26</sup> and reduce comorbidity risks.<sup>27–28</sup>

With this recent evolution of evidence supporting stringent disease control to improve outcomes, interest in purely symptomatic drugs has significantly decreased today and disease modification has become the pivotal attribute of all modern drugs and treatment strategies. Nevertheless, symptomatic agents as well as physical measures, psychological support and surgery may and do have a place in the overall management of RA. However, disease modification is the mainstay of RA treatment and constitutes an amalgam of characteristics: relief of signs and symptoms; normalisation—or at least important improvement—of impairment in physical function, quality of life and social and work capacity; and—as the foremost distinguishing characteristic of DMARDs compared with symptomatic agents—inhibition of structural damage to cartilage and bone. Therefore, showing inhibition of damage progression by radiography is still a pivotal outcome for the classification of a drug as a DMARD, since radiographs can depict bony and cartilage damage and have proven sensitivity to change even over short-term intervals and at very low levels of overall progression in a population.<sup>29–30</sup> Rapid attainment of the targeted end point is now critical, and to achieve the treatment goal of remission or at least low disease activity within the time frame of 6 months, at least 50% clinical improvement within 3 months is desirable.<sup>31</sup>

With rising standards of care and outcomes, RA management has become increasingly complex over the last decade. Despite the availability of many efficacious agents, treatment strategies that have been developed, and outcomes assessments that allow effective follow-up, the high costs of novel therapies have limited the widespread use of these therapeutic options, creating a significant extent of inequity. Therefore, management recommendations on the approach to treating patients with RA have become increasingly useful in providing physicians, patients, payers, regulators and other healthcare suppliers with evidence-based guidance supported by the views of experts involved in many of these novel developments. Indeed, EULAR has recently updated the standardised operating procedures on the development of recommendations, which include cost aspects in addition to accounting for the assessment of evidence and expert opinion.<sup>32</sup>

EULAR developed a first set of recommendations for the management of RA with DMARDs in 2010 and updated them in 2013. They were originally based on the evidence provided by five (2010) and three (2013)<sup>33–35</sup> systematic literature reviews (SLRs). The EULAR recommendations have been widely used. They have been referred to by national rheumatology societies and regional leagues to inform the development of their own recommendations (such as Canadian, French, German, Mexican, Asia Pacific League of Associations for Rheumatology (APLAR), Pan American League of Associations for Rheumatology (PANLAR)), as well as by regulatory authorities.<sup>36–42</sup>

Consistent with our approach to providing recommendations based on the latest evidence, we have continued to evaluate the literature on clinical trials of new agents, new information on established drugs, new strategic studies, new perceptions on outcomes assessments and new insights related to the research

agenda<sup>16</sup> over the last 3 years. An abundance of new information motivated us to now further update the EULAR recommendations for the management of RA with DMARDs.

## METHODS

After approval by the EULAR Executive Committee, the Convenor (JSS) and methodologist (RL) invited a Steering Committee and a Task Force to work on this update of the EULAR recommendations for the management of RA. The 2010 recommendations and their 2013 update adhered to the original EULAR standardised operating procedures for the development of recommendations<sup>43</sup>; the 2016 update followed the recently amended version of these standards,<sup>32</sup> which also suggest adherence to the Appraisal of Guidelines for Research & Evaluation (AGREE) recommendations in its updated version (AGREE II).<sup>44</sup>

## Steering Committee

The Steering Committee included seven rheumatologists, one patient representative and three fellows. This group initially developed the research questions for the three SLRs. These SLRs focused on (i) efficacy of synthetic (s) DMARDs (as monotherapy or combination therapy, including both csDMARDs and ts DMARDs) and glucocorticoids (GC); (ii) efficacy of bDMARDs (as monotherapy or combined with csDMARDs) and (iii) safety aspects of sDMARDs and biological (b) DMARDs. To this end, the original SLRs obtained in 2013<sup>33–35</sup> served as a starting point and an update on the literature published between 2013 and 2016 was performed. New information on treatment strategies was also evaluated in the present SLRs. Formal economic analyses were not performed, but cost aspects were considered throughout the process in line with the current state of the art of developing recommendations,<sup>45–46</sup> EULAR's own previous SLR on cost aspects in the context of DMARD therapy<sup>47</sup> and the advent of biosimilars.<sup>48</sup> The three rheumatology fellows (KC, JN, SR) performed the SLRs (and checked each other's work) exploiting existing publication databases on randomised controlled trials for efficacy and registry data for safety, and also evaluating recent EULAR and ACR congress abstracts. Summary-of-findings (SoF) tables were generated and levels of evidence (LoE) were determined using the standards of the Oxford Centre for Evidence-Based Medicine.<sup>49</sup> The three SLRs informing the Task Force and a detailed description of their methods are published separately.<sup>50–52</sup>

The SoFs of the SLRs were presented to the Steering Committee that formulated a proposal for an update of the recommendations based on this information. The SLR data and the proposals of the Steering Committee were subsequently presented to the whole Task Force for further discussions and ultimately development of the updated recommendations.

## Task Force

The Task Force consisted of 50 individuals, including the Steering Committee members. Among the Task Force members were three patients, two health professionals and two delegates of the EULAR young rheumatologists' network Emerging Eular NETwork (EMEUNET). The rheumatologists were all experienced in the treatment of RA and most had frequently participated in clinical trials; moreover, several of them had experience in patient registries of their countries or in various aspects of outcomes research. The patients and health professionals all had experience in consensus finding activities, as well as most of the rheumatologists. Since we also wished the Task Force's work to be informed by rheumatologists from other

regions of the world, aside from a broad representation from 14 European countries, 2 colleagues from Asia, 1 from Australia, 2 from Latin America and 2 from North America were invited to participate. Several of them had actively participated in developing documents of their regional leagues and/or national societies. All Task Force members declared their potential conflicts of interest before the start of the process.

The Task Force agreed on a few principal considerations upfront. First, all recommendations needed to be discussed in the context of new evidence; where no new evidence was available, the former evidence base was followed. Second, any of the previous recommendations (4 overarching principles and 14 recommendations) could be maintained as they had been presented in the 2013 version, amended, shifted in sequence or deleted. Third, drugs that were not (yet) approved in Europe but used elsewhere in the world, or drugs that had not yet undergone regulatory assessment but for which evidence from clinical trials was available, could be considered in recommendations to allow for some anticipation of a potential uptake in clinical practice, with all respective caveats. Finally, there was agreement that all recommendations of 2013, which were either further supported by new evidence or lacked novel information, should be incorporated as previously worded, unless certain components were now considered inappropriate.

After the presentation of the SLR results and the Steering Committee's proposals for the amendment of the recommendations, the Task Force was split into four breakout groups. One group reviewed bDMARDs, the second group csDMARDs, the third tsDMARDs and the fourth GC; all groups proposed draft language for respective recommendations to the whole Task Force. Safety aspects were addressed in each of these breakout groups.

### Consensus finding

Representatives of each breakout group reported the results of the respective deliberations and presented proposals for the wording of individual recommendations to the whole Task Force. Thereafter, the voting process took place.

For an overarching principle or recommendation to be accepted for the final document without further change, a majority of 75% of the votes was required in the first ballot. If this result was not achieved, the respective text was amended and subjected to a second ballot, for which a 67% majority was required. If this ballot was not successful, further textual changes were proposed until a  $\geq 50\%$  majority was attained. The recommendations are presented as finally voted on. The results of the respective last ballot are presented as percentage of voting members. Notes captured the contents of the discussions and the reasoning behind each decision to be presented in the comments accompanying the individual items. For various reasons, not every Task Force member was present in the room throughout the whole meeting and, therefore, there were slight variations in the numbers of votes. However, at every point in time  $>90\%$  of the members participated in the ballots.

After the face-to-face meeting, the recommendations, as agreed by the Task Force, were subjected to an anonymous vote (by email) on the levels of agreement (LoA). Each recommendation received an adjudication on a scale of 0–10, 0 meaning no agreement whatsoever and 10 absolute agreement. During this process, several weeks after the meeting, one individual withdrew from the Task Force, because the inclusion of csDMARD combination therapy in the recommendations had not found a majority during the preceding voting process. This colleague had been present and voted throughout the face-to-face meeting and the respective votes regarding all recommendations are

accounted for accordingly, but ultimately the person declined authorship and no vote was cast on the LoA.

The draft of the manuscript was sent to all Task Force members for their comments. After incorporation of these comments, it was submitted to the EULAR Executive Committee for review and approval; at this time, it was again sent to the Task Force members. Final remarks were obtained from members of the Task Force and the Executive Committee and addressed in the manuscript, which was then submitted with approval by the EULAR Executive Committee.

## RESULTS

### General aspects

As before, the 2016 update of the EULAR RA management recommendations reflects the balance of clinical, functional and structural efficacy, safety, costs and patients' perceptions as perceived by the Task Force. Aspect of drug toxicity were considered in the overall wording of the recommendations, but data are presented only in the Safety SLR<sup>50</sup> because it is assumed that prescribers are aware of the safety information provided in the manufacturers' package inserts of the various agents. Also, EULAR has developed a series of documents dealing with safety aspects of RA drugs,<sup>53–58</sup> and various other publications have addressed these aspects.<sup>59–62</sup> In particular, as also suggested by the safety SLR,<sup>50</sup> the major risk of bDMARDs (and also tsDMARDs) is related to infections, and recommendations for vaccination<sup>56</sup> as well as a score allowing to calculate the risk of infection in patients exposed to bDMARDs have been recently developed.<sup>63 64</sup> For all medications discussed in this paper, the summary of product characteristics document provides valuable information on risks, side effects and need for monitoring. The recommendations given here should in no way be construed so as to detract from that information. In any case, when toxicity constitutes a major issue, a specific warning is provided within the respective recommendation or the accompanying comments. Of note, the three SLRs as well as the text accompanying each item should be regarded as part and parcel of the recommendation. The individual bullet points represent abbreviated conclusions from the discussions and, as such, do not capture all aspects related to a particular theme; rather, such aspects are elucidated in more detail in the respective explanatory part of the Results section.

When classifying DMARDs, the Task Force adhered to the previously used nomenclature<sup>12 16</sup> as shown in table 1. Table 1 also provides a glossary for terms employed in the recommendations. The Task Force did not distinguish between early and established RA regarding the recommendation of the types of drugs, but rather discerned phases of the treatment process by differentiating between patients who are naïve to any DMARD therapy, patients who had an insufficient response (IR) to initial course(s) of csDMARDs and those who had an IR to bDMARDs. There is currently no evidence for differential responses solely based on disease duration, when leaving differences in baseline damage due to delayed treatment initiation aside. Indeed, trials on MTX-naïve patients with RA used different disease durations for inclusion, which ranged from a few months to several years, without appreciable differences in outcomes on indirect comparison.<sup>65–68</sup> However, the Task Force distinguished between early and established RA in terms of the targeted outcome (see recommendation 2). The Task Force also took prognostic factors (table 1) into account, which have similar predictive power irrespective of disease duration.<sup>69</sup> Of note, recommendations for the management of early arthritis, including undifferentiated arthritis, have been recently

## Recommendation

**Table 1** Glossary and definitions

Term	Definition
Poor prognostic factors	<ul style="list-style-type: none"> <li>▶ Moderate (after csDMARD therapy) to high disease activity according to composite measures<sup>71</sup></li> <li>▶ High acute phase reactant levels<sup>72, 73</sup></li> <li>▶ High swollen joint counts<sup>72–74</sup></li> <li>▶ Presence of RF and/or ACPA, especially at high levels<sup>72, 75</sup></li> <li>▶ Combinations of the above<sup>69, 76</sup></li> <li>▶ Presence of early erosions<sup>72</sup></li> <li>▶ Failure of two or more csDMARDs<sup>77</sup></li> </ul>
Low-dose glucocorticoid	▶ ≤7.5 mg/day (prednisone equivalent) <sup>57, 78</sup>
<i>Meanings of treatment reduction</i>	
Tapering	<ul style="list-style-type: none"> <li>▶ Usually reduction of drug dose or increase of application interval ('spacing')</li> <li>▶ May include discontinuation (tapering to 0), but then only after slow reduction</li> </ul>
Cessation, discontinuation	Stopping of a particular drug
<i>Disease activity states</i>	
Remission	ACR-EULAR Boolean or index-based remission definition <sup>22</sup>
Low disease activity	Low disease activity state according to any of the validated composite disease activity measures that include joint counts <sup>79–81</sup>
Moderate, high disease activity	Respective disease activity state according to any of the validated composite disease activity measures that include joint counts <sup>79–81</sup>
<i>DMARD nomenclature</i> <sup>12</sup>	
Synthetic DMARDs	<ul style="list-style-type: none"> <li>▶ Conventional synthetic DMARDs (csDMARDs)      For example, methotrexate, leflunomide, sulfasalazine, hydroxychloroquine</li> <li>▶ Targeted synthetic DMARDs (tsDMARDs)      For example, tofacitinib, baricitinib</li> </ul>
Biological DMARDs	<ul style="list-style-type: none"> <li>▶ Biological originator DMARDs (boDMARDs)</li> <li>▶ Biosimilar DMARDs (bsDMARDs)</li> </ul>

ACPA, anticitrullinated protein antibody; ACR, American College of Rheumatology; DMARDs, disease-modifying antirheumatic drugs; EULAR, European League Against Rheumatism; RF, rheumatoid factor.

updated.<sup>70</sup> The present recommendations address the management of patients with RA from the time of its diagnosis and not pre-RA or undifferentiated arthritis.

### Overarching principles

As in previous versions, the Task Force endorsed the presentation of general principles for the treatment of patients with RA as overarching (table 2). Their nature is so generic that there was no requirement to base them on specific searches or LoE, but at the same time the group believed it is crucial to communicate them as a foundation on which the actual recommendations were based. However, while all three former overarching principles were maintained as formulated in 2010, the Task Force added a fourth one as overarching principle B.

- A. *Treatment of patients with RA should aim at the best care and must be based on a shared decision between the patient and the rheumatologist.* This principle remained unchanged both in its textual details and in its place as item A, a prominent position within the recommendations. Shared decision-making between patient and rheumatologist involves all aspects of the disease: information on the disease and its risks, the modalities of disease assessment, decisions on the therapeutic target and the potential means to reach the target, the development of a management plan and discussions on the benefits and risks of individual therapies. These aspects have also been detailed in recommendations on standards of care.<sup>82</sup> Naturally, 'best care' refers to the recommendations presented here and inherently 'shared decision' relates to all individual recommendations. To this end also quality indicators have been developed more recently.<sup>83</sup>
- B. *Treatment decisions are based on disease activity and other patient factors, such as progression of structural damage, comorbidities and safety issues.* This is a new principle.

It derives from previous recommendation 14, the last item of the 2013 version, which was deemed by the current Task Force to represent such a central and self-evident rule to any therapeutic approach that it should constitute an overarching principle rather than a recommendation. Indeed, in line with these considerations, the level of evidence of this recommendation had been rather low in 2013. Withdrawing this item from the recommendations elicited some discussions. Especially the patients brought forward that ending the list of recommendations with an item on patient-related factors would convey prominence to patient preferences and patient aspects in the management of RA. However, the reasoning that this item would even benefit more from being a general principle than a recommendation, which was unlikely to ever be studied in all its subtleties, prevailed to an extent that principle B was unanimously accepted (table 2).

- C. *Rheumatologists are the specialists who should primarily care for patients with RA.* Originally presented as item B, the wording of this principle was not changed. Of interest, in 2010 this was even presented as overarching principle A. However, over the last years, it was recognised that shared decision-making and considerations of patient factors should receive the most prominent recognition. Whether positioned as A, B or C, this item addresses the importance of specialty care for a complex disease like RA. There is compelling evidence that being cared for by a rheumatologist is advantageous for the patients in terms of early initiation of therapy, prevention of damage and reduction in surgical procedures.<sup>84–88</sup> Moreover, rheumatologists have the most profound experience regarding the use of csDMARDs and bDMARDs. This includes the adverse event profiles of these drugs, as well as awareness of and experience with comorbidities in RA. Therefore, rheumatologists

**Table 2** The 2016 EULAR updated recommendations

<b>Overarching principles</b>	
A	Treatment of patients with RA should aim at the best care and must be based on a shared decision between the patient and the rheumatologist
B	Treatment decisions are based on disease activity and other patient factors, such as progression of structural damage, comorbidities and safety issues
C	Rheumatologists are the specialists who should primarily care for patients with RA
D	RA incurs high individual, medical and societal costs, all of which should be considered in its management by the treating rheumatologist
<b>Recommendations</b>	
1.	Therapy with DMARDs should be started as soon as the diagnosis of RA is made
2.	Treatment should be aimed at reaching a target of sustained remission or low disease activity in every patient
3.	Monitoring should be frequent in active disease (every 1–3 months); if there is no improvement by at most 3 months after the start of treatment or the target has not been reached by 6 months, therapy should be adjusted
4.	MTX should be part of the first treatment strategy
5.	In patients with a contraindication to MTX (or early intolerance), leflunomide or sulfasalazine should be considered as part of the (first) treatment strategy
6.	Short-term glucocorticoids should be considered when initiating or changing csDMARDs, in different dose regimens and routes of administration, but should be tapered as rapidly as clinically feasible
7.	If the treatment target is not achieved with the first csDMARD strategy, in the absence of poor prognostic factors, other csDMARDs should be considered
8.	If the treatment target is not achieved with the first csDMARD strategy, when poor prognostic factors are present, addition of a bDMARD* <sup>1,2</sup> or a tsDMARD* <sup>3</sup> should be considered; current practice would be to start a bDMARD <sup>§</sup>
9.	bDMARDs* <sup>1,2</sup> and tsDMARDs <sup>#3</sup> should be combined with a csDMARD; in patients who cannot use csDMARDs as comedication, IL-6 pathway inhibitors and tsDMARDs may have some advantages compared with other bDMARDs
10.	If a bDMARD* or tsDMARD <sup>§</sup> has failed, treatment with another bDMARD or a tsDMARD should be considered; if one TNF-inhibitor therapy has failed, patients may receive another TNF-inhibitor or an agent with another mode of action
11.	If a patient is in persistent remission after having tapered glucocorticoids, one can consider tapering bDMARDs, especially if this treatment is combined with a csDMARD
12.	If a patient is in persistent remission, tapering the csDMARD could be considered

The symbols (\*, §, #) indicate different levels of evidence which are correspondingly provided together with voting results and levels of agreement in [table 3](#).  
<sup>1</sup>TNF-inhibitors: adalimumab, certolizumab pegol, etanercept, golimumab, infliximab, bDMARDs or the respective EMA-approved/FDA-approved biosimilars.  
<sup>2</sup>Abatacept, rituximab (as first bDMARD under special circumstances—see text), or tocilizumab or respective EMA-approved/FDA-approved biosimilars, as well as other IL-6 pathway inhibitors, sarilumab and/or sirukumab, once approved.  
<sup>3</sup>Jak-inhibitors (where approved).  
 bDMARDs, biological originator DMARDs; bsDMARD, biosimilar DMARDs; csDMARDs, conventional synthetic DMARDs; DMARDs, disease-modifying antirheumatic drugs; EULAR, European League Against Rheumatism; Jak, Janus kinase; MTX, methotrexate; RA, rheumatoid arthritis; TNF, tumour necrosis factor; tsDMARDs, targeted synthetic DMARDs.

can provide the ‘best care’ in accordance with item A, in the sense of a holistic approach. The reasoning behind the term ‘primarily’ has been discussed amply in previous versions of the recommendations and relates to considerations of multi-disciplinary care, including specialty nurses, and to the fact that in certain areas of the world rheumatology training is not sufficiently provided and other experts may have experience in the management of RA. Moreover, some comorbidities, such as chronic hepatitis or interstitial lung disease, may require consultation of, and treatment by, other specialists.

**Table 3** Evidence levels, voting results and agreement

	LoE	SoR	Final vote (%)	Level of agreement (0–10)
A	n.a.	n.a.	100	9.9
B	n.a.	n.a.	100	9.9
C	n.a.	n.a.	100	9.8
D	n.a.	n.a.	98	9.7
1.	1a	A	96	9.9
2.	1a	A	91	9.6
3.	2b		100	9.5
4.	1a	A	71	9.8
5.	1a	A	85	9.0
6.	1a	A	98	8.7
7.	5	D	94	8.5
8.	*1b §5	*A §D	96	9.0
9.	*1a #1b	*A #A	96	9.2
10.	*1a §5	A* §D	71	9.1
11.	2b	B	86	9.0
12.	4	C	86	8.5

The symbols (\*, §, #) relate to the corresponding symbols in the recommendations ([table 2](#)), showing the respective LoE. LoE, levels of evidence; n.a., not available; SoR, strength of recommendation.

D. RA incurs high individual, medical and societal costs, all of which should be considered in its management by the treating rheumatologist. Again, this principle is worded exactly as last time, except that it was item C, but also last.<sup>16</sup> It is meant to remind all stakeholders that effective RA therapy—in spite of its direct costs—will reduce the economic burden on the individual patients, their families and society, which includes direct medical costs and indirect costs such as work disability and premature retirement. In this context, it must be borne in mind that direct medical costs accrue beyond those attributed to directly treating the overt manifestations of RA and include costs ensuing from comorbidities related to the inflammatory process. This point, however, is also meant to echo that cost-effective treatment approaches must be preferred as long as safety and outcomes are similar compared with more costly ones and in line with the therapeutic paradigms.<sup>46</sup> In some countries, the high cost of treatment is an important factor limiting the availability of modern therapies (inequity), and this factor has to be considered when choosing a treatment strategy.<sup>89</sup> In this respect, the advent of biosimilars provides potential for reduction of pressure on healthcare budgets.<sup>48</sup> At this point, it also must be considered that many patients still do not attain the therapeutic targets, despite all of our modern therapies and therapeutic strategies. Furthermore, any of the bDMARDs, if applied after at least one csDMARD and a bDMARD has failed, leads to only about 10% good treatment responses in terms of ACR70 rates.<sup>90</sup> These aspects impose the need to continue the search for new therapies or strategies.

## Recommendations

### General aspects

The Task Force’s deliberative process resulted in 12 recommendations. The reduction by two recommendations compared with the past EULAR document may be somewhat surprising given

the allegedly increasing intricacy of therapeutic modalities and strategies. However, the content of recommendation 14 was shifted into the overarching principles as discussed above. Moreover, item 11 of the 2013 version, which addressed the use of tofacitinib, was deleted as a separate item, because Janus kinase (Jak) inhibitors as tsDMARDs have now entered into and expanded other recommendations; this will be discussed in more detail in the context of items 8, 9 and 10. Also former recommendation 6, which addressed the use of csDMARD combinations, was deleted by the Task Force; combination therapy with csDMARDs and the reasons to remove it from its previous prominence within the list of recommendations and the algorithm will be addressed in the discussion on recommendations 4 and 5. While three of the 2013 recommendations were deleted via either complete omission or incorporation into other items, former recommendation 8 which addressed the absence or presence of prognostic risk factors was split into new recommendations 7 and 8; a detailed rationale for this decision is discussed below.

The 12 recommendations form a logical sequence. They start with the need to initiate effective therapy immediately after diagnosis and the requirement to set a treatment target and to assess the disease on the way towards that target, employing a treat-to-target strategy. Such strategy has been strongly embedded into the recommendations since their first version in 2010. With these prerequisites in mind, different drugs or combinations of agents are recommended in the course of the therapeutic procedures, with suggested sequential increments, taking prognostic factors and all approved agents into account. They also mention some agents of potential future interest, even though not yet approved by international regulatory authorities. Thus, the recommendations also include a prospective view on drugs that have undergone phase III trials and were available for evidence assessment; obviously their actual prescription will depend on the regulatory approval status in individual countries. The set of recommendations concludes with suggestions towards reduction of therapy and even withdrawal of some drugs when the desired target has been attained and is sustained.

### Individual recommendations

1. *Therapy with DMARDs should be started as soon as the diagnosis of RA is made.* This recommendation remained unchanged compared with 2013 and is one of the mainstays of any treatment approach to RA. It implies (i) the necessity to establish a diagnosis as early as possible, as has been reflected also in the 2010 ACR-EULAR classification criteria<sup>14 91 92</sup> and (ii) the advantage of early initiation of DMARD treatment ('as soon as possible'), which enables prevention of damage in a large proportion of patients.<sup>87 93–95</sup> Because of the generic nature of this bullet point, the Task Force did not specify the type of DMARD here. Indeed, all DMARDs enable a better long-term outcome on early, compared with delayed institution, and the sequence of the types of DMARD therapies is addressed in subsequent recommendations. The Task Force did not deal with pre-RA or undifferentiated arthritis and thus assumed that a diagnosis of RA had already been made. However, it should be borne in mind that any chronic arthritis, even if undifferentiated, requires appropriate treatment, including consideration of DMARD therapy, because it usually does not subside spontaneously,<sup>96 97</sup> and an update of the recommendations for management of early arthritis has just been presented by EULAR.<sup>70</sup> With a LoA of 9.9, this recommendation achieved the highest agreement of all items (table 2). LoE 1a; LoA 9.9.

2. *Treatment should be aimed at reaching a target of sustained remission or low disease activity in every patient.* This recommendation addresses two treatment targets: remission, especially in DMARD-naïve patients, and low disease activity, primarily in patients who failed previous therapies. Since clinical remission or low disease activity are mentioned as the sole therapeutic targets, any higher disease activity state has to be regarded as inadequate disease control, thus mandating a therapeutic change, obviously unless patient factors preclude this.<sup>15</sup> Communication with the patient to clarify and agree on the treatment goal and the means to attain this goal is of utmost importance. It allows alignment of the patient's and provider's considerations and aims and enhances adherence. In 2010, the notion 'as soon as possible' was also part of this item<sup>98</sup> and in the current discussion it was specifically decided to mention that the treatment target should be rapidly attained rather than aiming to achieve it in a more distant future. Indeed, there is sufficient evidence that most patients who do not attain significant improvement within 3 months, or do not achieve the treatment target within 6 months, will not reach the desired state subsequently<sup>31 99–101</sup>; exceptions pertain to those patients whose disease activity has been reduced to a level close to the treatment target.

Regarding remission, EULAR and ACR have agreed on Boolean and index-based definitions, the latter based on the Simplified or Clinical Disease Activity Index (SDAI, CDAI).<sup>22</sup> Both correlate highly with the absence of subclinical synovitis by MRI and sonography<sup>102 103</sup> and absence of progression of joint damage.<sup>23</sup> They can even be reliably used when drugs that interfere directly with the acute phase response are employed.<sup>104–107</sup> Moreover, recent strategic clinical trials that compared targeting sonographic remission with targeting clinical remission or low disease activity resulted in the conclusions that aiming at imaging remission had no advantages over the clinical target, but had economic disadvantages.<sup>108 109</sup> Low disease activity also needs to be properly defined and measured. Measures that highly weigh C reactive protein or erythrocyte sedimentation rate (eg, the disease activity score (DAS)28) may not convey sufficiently reliable results when used with agents that interfere with the acute phase response, such as anticytokine agents (especially interleukin (IL)-6 inhibitors) or Jak-inhibitors.<sup>104 107 110</sup>

It is important that the target-state should be sustained. The term 'sustained' is still not defined precisely, and different studies have used different definitions, but some voices in the Task Force suggested at least 6 months as a minimal time frame. This requires follow-up and a strategy to adapt therapy intensity upward or downward, aspects that are dealt with in subsequent recommendations. However, treatment intensification must take patient factors into consideration, especially risks and comorbidities (overarching principle B). LoE 1a; LoA 9.6.

3. *Monitoring should be frequent in active disease (every 1–3 months); if there is no improvement by at most 3 months after the start of treatment or the target has not been reached by 6 months, therapy should be adjusted.* This recommendation on treat-to-target is unchanged in position and formulation from the 2013 version. The frequencies of follow-up examinations should be adjusted in accordance with the level of disease activity, namely more frequently, such as monthly, when patients have high disease activity, and less frequently, such as every 6–12 months when the treatment target has been attained and sustained. EULAR generally recommends the use of a composite measure of disease activity that includes joint counts and the ACR-EULAR definitions for remission.<sup>22 111</sup> Improvement by

3 months refers to the fact that if a minimal change is not achieved, there is only a low likelihood of reaching the treatment target. Thus, a change to a better disease activity state should be seen at 3 months or a relative improvement, pertaining to at least 50% improvement in activity by a composite score, at that point in time, in order to have a considerable chance of reaching the target.<sup>31 100 112 113</sup> Of note, adjustment of therapy includes the optimisation of MTX (or other csDMARD) dose or route of administration,<sup>4</sup> or intra-articular injections of GC in the presence of one or few residual active joints, and refers to a change of drugs only if these measures have not been successful or are not appropriate. Furthermore, in an individual patient the treatment target may not have been fully achieved yet at 6 months. But if disease activity is close to the target, one may think about continuing the effective therapy for a few more weeks to make a final judgement, especially since a considerable proportion of patients may attain the target at a slightly later time point than at 6 months.<sup>114 115</sup> Consequently, the change in disease activity from baseline, and its slope should be considered when making treatment decisions. LoE 2b; LoA 9.5.

4. *MTX should be part of the first treatment strategy.* Compared with 2013, when this item read 'MTX should be part of the first treatment strategy in patients with active RA', the recommendation was slightly shortened. The Task Force felt that pointing to active disease was not necessary, since the EULAR recommendations primarily address patients with active disease. Based on its efficacy, safety (especially in the presence of folic acid), the possibility to individualise dose and method of administration as well as relatively low costs, MTX continues to be the anchor ('first') drug for patients with RA both as monotherapy as well as in combination with other drugs ('treatment strategy'; see below). Moreover, MTX appears to reduce comorbidities and mortality in RA.<sup>116 117</sup> In clinical trials of bDMARDs in early arthritis patients, MTX monotherapy has been associated with 25% ACR70 response rates (which brings patients into the range of low disease activity) within 6 months, even though it had not been combined with de novo GC in these trials.<sup>90</sup> MTX should be rapidly escalated, usually to 25–30 mg/week, orally or subcutaneously administered, with folic acid supplementation,<sup>4</sup> and the maximal MTX dose, if tolerated, should be sustained for about 8–12 weeks to judge the MTX treatment response. Indeed, when MTX is rapidly escalated to 25 mg/week, the response rate may even be higher (~40% low disease activity).<sup>118</sup> Of course, contraindications and the potential of early toxicity have to be taken into account; this is addressed in item 5. The doses mentioned here do not pertain to Asian patients. In China, it is not recommended to exceed 20 mg/week<sup>115</sup> and in Japan the maximum recommended dose for MTX is 16 mg/week.<sup>119</sup>

Of note, at this point in time the Task Force decided to delete previous recommendation 6 ('in DMARD-naïve patients, irrespective of the addition of GC, csDMARD monotherapy or combination therapy of csDMARDs should be used'). The inclusion or exclusion of combinations of csDMARDs within the bullet points elicited long debates within the respective breakout group and the whole Task Force (and the withdrawal of one Task Force member).

The first ballot of the Task Force involved a choice of the following two wordings: (a) 'MTX should be part of the first treatment strategy' and (b) 'in DMARD-naïve patients, irrespective of the addition of GC, csDMARD monotherapy or combination therapy of csDMARDs should be used' (identical with the respective 2013 recommendation), with 23 votes favouring (a),

22 votes favouring (b) and one abstention. Therefore, further discussions took place. Advocates in favour of including combination therapy referred to publications suggesting its superior efficacy compared with csDMARD monotherapy and similar efficacy compared with biological agents<sup>120–124</sup>; moreover, in some countries, csDMARD combination therapy is recommended by the national societies as preferred initial therapy.

Other Task Force members pointed to trials that did not show a real benefit of combination therapy (especially when csDMARD monotherapy was combined with GC in the comparator arms)<sup>125–127</sup>; differences in GC cointervention between combination and monotherapy arms in previous trials<sup>128</sup>; issues concerning the design of some investigator initiated trials suggesting superiority of csDMARD combinations<sup>129</sup>; the significantly higher rate of profound responses on combination with bDMARDs compared with the combination with csDMARD therapy after IR to MTX<sup>123</sup> and the higher level of toxicity of csDMARD combinations versus monotherapy.<sup>126 130</sup>

It was also argued that a higher prevalence of adverse events when using combination therapy, even though often mild, may preclude escalation of therapy and result in not reaching a full dose of some of the drugs. Also, the SLR on csDMARDs did not show evidence for superiority of csDMARD combinations compared with csDMARD monotherapy.<sup>52</sup> Moreover, the ACR Committee on the 2015 update of the ACR management guideline, in contrast to previous versions,<sup>131</sup> did not longer recommend csDMARD combination as initial therapy, but prioritised MTX monotherapy.<sup>17</sup> In line, the updated EULAR recommendations for the management of early arthritis do not advocate the use of csDMARD combination therapy.<sup>70</sup> It was also pointed out that choice (a) included the term 'treatment strategy' and thus comprised the option to use csDMARD combinations. These discussions resulted in a new ballot between two versions for recommendation 4: (a) 'MTX should be part of the first treatment strategy' (as above) and (b) 'MTX should be the first csDMARD, either as monotherapy or in combination with other csDMARDs'. In this second ballot a 71% majority voted for version (a). Thus, csDMARD combination therapy is no longer presented explicitly as initial treatment suggestion within the abbreviated list of recommendations. However, it should be mentioned that the simple fact that csDMARD combination therapy is not included in the bullet point anymore does not preclude using it. This is obviously at the discretion of the physician and the patient in light of all pros and cons that had been discussed ('shared decision').

This recommendation ultimately attained a very high LoA (9.8). The Task Force was well aware that in some countries, such as in the UK or Canada, rheumatologists are required to use at least two csDMARDs before the application of bDMARDs is approved by the payers and that combinations of two or three csDMARDs are accepted in lieu of two csDMARD courses. However, for the reasons just mentioned, the Task Force was not in favour of the practice to define an IR to a combination of csDMARDs as a failure of two or more csDMARDs (when in reality it constitutes only one therapeutic strategy) nor to preclude the approval of bDMARD use when a first csDMARD has failed and the patient has bad prognostic markers (see below item 8 and table 1). LoE 1a; LoA 9.8.

5. *In patients with a contraindication to MTX (or early intolerance), leflunomide or sulfasalazine should be considered as part of the (first) treatment strategy.* The contents of this recommendation were maintained; however, compared with the previous version of item 5, the wording 'in cases of MTX contraindications' was slightly amended, because it is patients

who have contraindications, rather than ‘cases’. The Task Force reiterated the relative safety of MTX and it was also discussed that the frequent fears of patients after reading the package insert should be addressed by providing appropriate information (overarching principle A). Nevertheless, there are occasional contraindications (eg, kidney or liver disease) or intolerances. Under these circumstances, leflunomide (dosed at 20 mg/day without loading dose)<sup>132</sup> or sulfasalazine (escalated to 3 g/day) are regarded the best alternatives. Older trials have suggested similar efficacy for both these drugs compared with MTX, although MTX was used at much lower doses than recommended today.<sup>133 134</sup> However, no new trials have been performed to disprove the previous conclusions. Among all the above agents, only sulfasalazine has an acceptable safety profile during pregnancy.<sup>135</sup> In some countries, parenteral gold is still used and, while clinical efficacy is undisputed, there are controversies regarding its safety<sup>136 137</sup>; in other countries, gold salts are not available any more. In contrast, the use of antimalarials, such as hydroxychloroquine and chloroquine, is still substantial, especially in combination therapy<sup>122</sup> or as monotherapy in patients with very mild disease,<sup>138</sup> particularly in China. Interestingly, antimalarials may have significant positive effects on lipid and glucose metabolism<sup>139</sup> and may reduce cardiovascular risk in RA.<sup>140</sup> However, joint damage is not retarded to a similar extent as with other csDMARDs.<sup>141</sup> This recommendation also uses the term ‘treatment strategy’ implying, as with MTX, that leflunomide and sulfasalazine can be used as monotherapy or in combination with other csDMARDs or biological agents.<sup>142–145</sup> Indeed, step-up combination therapy is frequently employed, even though comparing step-up combination with switching of csDMARD did not reveal significant differences in outcomes.<sup>146</sup> LoE 1a; LoA 9.0.

6. *Short-term GC should be considered when initiating or changing csDMARDs, in different dose regimens and routes of administration, but should be tapered as rapidly as clinically feasible.* The added efficacy of GC when combined with csDMARDs is well established. Indeed, hitherto all trials comparing GC plus csDMARD with bDMARDs plus csDMARD revealed similar efficacy.<sup>146 147</sup> In 2013, GC were dealt with in recommendation 7, but the wording was different: ‘low-dose GC should be considered as part of the initial treatment strategy (in combination with one or more csDMARDs) for up to 6 months, but should be tapered as rapidly as clinically feasible’. The current wording constitutes a compromise attempting to accommodate most of the concerns and suggestions raised during the Task Force’s debate.

The term ‘low-dose’ was critically discussed. While all members of the Task Force agreed that high doses of GC should not be used for prolonged periods, it also became clear that the label ‘low-dose’ (which means a daily dose of 7.5 mg or less prednisone per day),<sup>78 148</sup> while preferred by some Task Force members, does not capture several current ways of GC application. Indeed, recent clinical trials have revealed the efficacy of short-term GC, but at doses >7.5 mg/day, namely orally at 30 mg starting dose,<sup>126</sup> as a single intramuscular injection of 120 mg methylprednisolone<sup>125</sup> or as a single 250 mg intravenous pulse therapy of methylprednisolone.<sup>147</sup> Therefore, the term ‘low-dose’ was deleted and replaced by ‘short-term’, leaving the choice about ‘dose regimens and routes of administration’ (another new piece of wording in this item) to the individual rheumatologist and patient. Indeed, it was argued that a single intramuscular or intravenous application entails a much lower cumulative dose than a few weeks of oral low-dose therapy, but this view was not shared by all Task Force members.

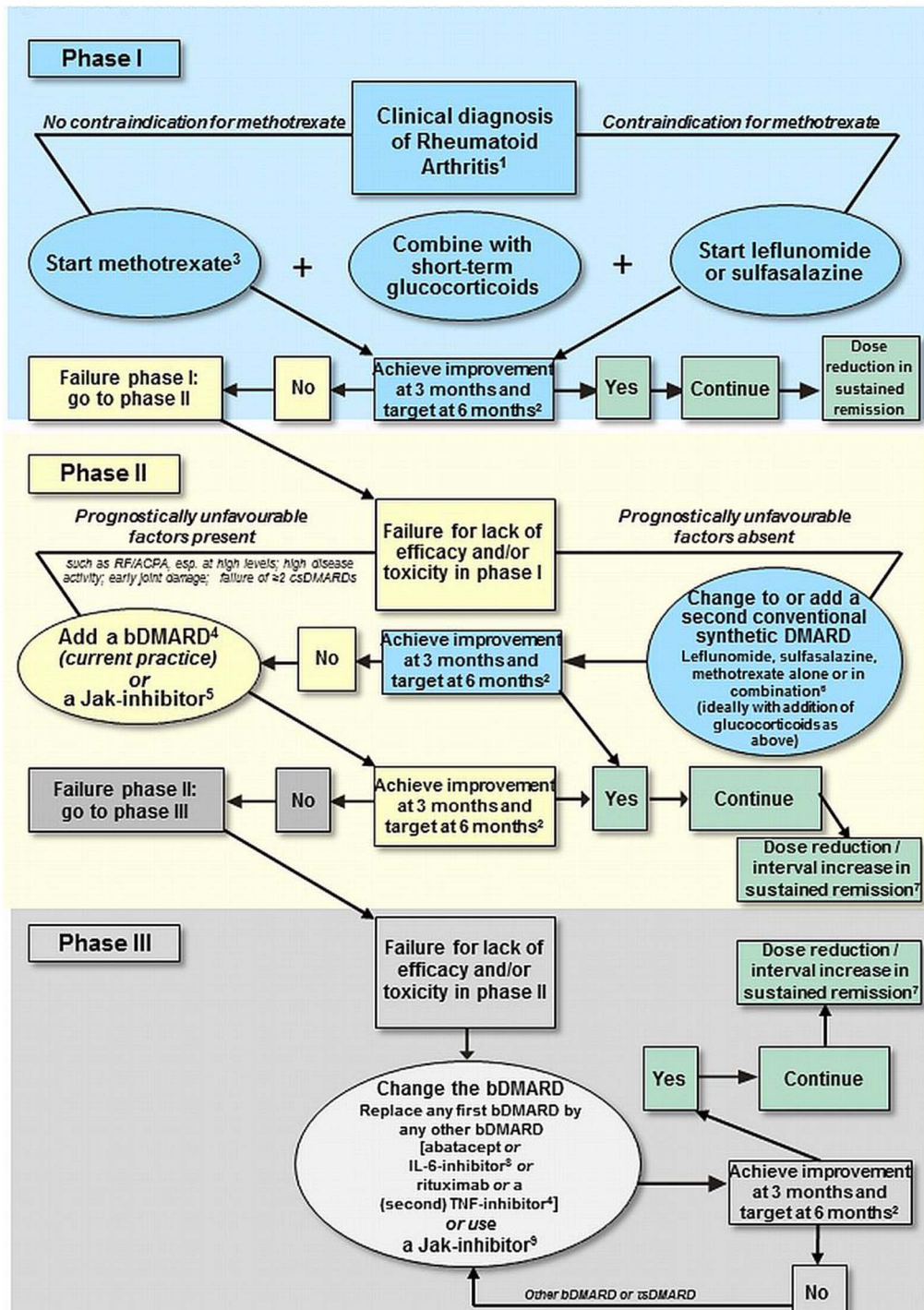
Yet another change involved the replacement of the phrase ‘part of the initial treatment strategy’ by ‘when initiating or changing csDMARDs’. This change clarifies the intention of the Task Force, in that GC should be considered with all csDMARD starts, either as part of a first csDMARD therapy at the time of diagnosis or subsequently if an initial strategy has failed. Finally, the fact that csDMARDs are mentioned specifically implies that GC are typically not needed as a bridging therapy when bDMARDs or tsDMARDs are used, as these usually have a rapid onset of action and the infection risks may be potentiated.<sup>149 150</sup> Thus, it is important to reiterate that the Task Force recommends using GC in combination with csDMARDs primarily as bridging therapy until the csDMARD reaches its maximum effect, and this should be done using one of the dosing and tapering approaches mentioned above, for which respective evidence exists. To reflect the position of the Task Force, the algorithm depicted in figure 1 was modified to show a ‘+’ for the use of GC in the new version rather than a ‘±’ as previously.

By stating ‘...tapered as rapidly as clinically feasible’, the Task Force underlines that GC should be gradually reduced and ultimately stopped, usually within 3 months from treatment start and only exceptionally by 6 months. Long-term use of GC, especially at doses above 5 mg/day, should be avoided because of the many potential risks presented in the SLR.<sup>50 52 57</sup> While some of these risk associations may be due to confounding by indication in patients with high disease activity,<sup>151</sup> the evidence for increased overall and cardiovascular mortality at a dose above a threshold of 7.5 mg/day or a cumulative dose of 40 g is considerable.<sup>152</sup> Of note, applying GC as a sole therapeutic change in patients with IR to csDMARD therapy does not convey good efficacy and is associated with significant adverse events.<sup>153</sup> Moreover, if GC cannot be withdrawn within the time frame mentioned above, the DMARD therapy may have to be considered a failure. Finally, intra-articular GC application may have to be considered in certain instances, such as a residually inflamed or a reactivated joint.

Some Task Force members advocated the chronic use of GC as a possibility for some patients; however, this proposal was not endorsed by the majority. While the bullet point on GC was, as in previous years, most heavily debated, the final wording received a 98% majority vote. However, the LoA was much lower (8.7), in line with previous versions of the recommendations. This relatively low LoA is presumably due to the fact that many Task Force members felt that this point was too liberal and the use of GC should be more restricted, while others were of the opinion that it was too restrictive. LoE 1a; LoA 8.7.

7. *If the treatment target is not achieved with the first csDMARD strategy, in the absence of poor prognostic factors, other csDMARDs should be considered.* This sentence constitutes the first part of previous recommendation 8. It is essentially worded in an identical way, except that the last portion, ‘change to another csDMARD strategy should be considered’, was reworded as ‘other csDMARDs should be considered’, in light of the fact that combination with GC has now been recommended clearly also for this step of the treatment algorithm (item 6) and combinations of csDMARDs are not specifically recommended as initial treatment strategy anymore. The poor prognostic factors are presented in table 1. The Task Force also discussed that early intolerance for a csDMARD should not be considered as a treatment failure, which would imply moving immediately to the next phase of the algorithm, but rather require reinstitution of another first csDMARD (replacement). LoE 5; LoA 8.5.





<sup>1</sup>2010 ACR-EULAR classification criteria can support early diagnosis. <sup>2</sup>The treatment target is clinical remission according to ACR-EULAR definition or, if remission is unlikely to be achievable, at least low disease activity; the target should be reached after 6 months, but therapy should be adapted or changed if no sufficient improvement is seen after 3 months. <sup>3</sup>"Methotrexate should be part of the first treatment strategy"; while combination therapy of csDMARDs is not preferred by the Task Force, starting with methotrexate does not exclude its use in combination with other csDMARDs. <sup>4</sup>TNF-inhibitors (adalimumab, certolizumab, etanercept, golimumab, infliximab, including EMA/FDA approved bsDMARDs), abatacept, IL-6-inhibitors, or rituximab; in patients who cannot use csDMARDs as comedication, IL6-inhibitors and tsDMARDs have some advantages. <sup>5</sup>Current practice would be to start with a bDMARD (in combination with MTX or another csDMARD) because of the long-term experience compared with tsDMARDs (Jak-inhibitors). <sup>6</sup>The most frequently used combination comprises methotrexate, sulfasalazine and hydroxychloroquine. <sup>7</sup>Dose reduction or interval increase can be safely done with all bDMARDs with little risk of flares; stopping is associated with high flare rates; most but not all patients can recapture their good state upon re-institution of the same bDMARD. <sup>8</sup>Efficacy and safety of bDMARDs after Jak-inhibitor failure is unknown; also, efficacy and safety of an IL-6 pathway inhibitor after another one has failed is currently unknown. <sup>9</sup>Efficacy and safety of a Jak-inhibitor after insufficient response to a previous Jak-inhibitor is unknown.

**Figure 1** Algorithm based on the 2016 European League Against Rheumatism (EULAR) recommendations on rheumatoid arthritis (RA) management. ACPA, anticitrullinated protein antibody; ACR, American College of Rheumatology; bDMARD, biological DMARD; bsDMARD, biosimilar DMARDs; csDMARDs, conventional synthetic DMARDs; DMARDs, disease-modifying antirheumatic drugs; EMA, European Medicines Agency; FDA, Food and Drug Administration; IL, interleukin; MTX, methotrexate; RF, rheumatoid factor; TNF, tumour necrosis factor; tsDMARDs, targeted synthetic DMARDs.

8. *If the treatment target is not achieved with the first csDMARD strategy, when poor prognostic factors are present, addition of a bDMARD\* or a tsDMARD\* should be considered; current practice would be to start a bDMARD<sup>§</sup>.* The separation of the second part of previous recommendation 8 ('when poor prognostic factors are present, addition of a bDMARD should be considered') and the new item 7 reflect the Task Force's desire to give stratification by prognostic factors more prominence. The bDMARDs currently available include a series of tumour necrosis factor (TNF)-inhibitors (adalimumab, certolizumab, etanercept, golimumab and infliximab); abatacept (a costimulation inhibitor); tocilizumab (an IL-6 receptor blocker, but in the future also possibly another IL-6 receptor inhibitor, sarilumab and IL-6 inhibitors, such as clazakizumab or sirukumab); rituximab (an anti-B-cell agent); both as biological originator (bo) DMARDs and as European Medicines Agency (EMA)-approved or Food and Drug Administration (FDA)-approved biosimilar (bs) DMARDs.

This recommendation was also expanded to include tsDMARDs, namely the Jak-inhibitor tofacitinib and further Jak-inhibitors, such as baricitinib. In the 2013 update, tsDMARDs (then recommendation 11) were recommended for use after a bDMARD had failed. Since then, more data on tofacitinib, especially regarding long-term safety aspects, and new data for baricitinib have been published. The data suggest that baricitinib may be more efficacious than a TNF-inhibitor.<sup>154</sup> Currently, the term tsDMARDs refers only to Jak inhibition. Tofacitinib is approved in many countries, such as in the USA, Latin America and Asia as well as some European countries, but at the time of developing the present recommendations still not in the European Union; baricitinib had completed phase III trials and was under regulatory review at that time and filgotinib and other Jak-inhibitors are undergoing evaluation in clinical trials (in the meantime both baricitinib and tofacitinib have been approved in the EU). However, similar to the 2010 recommendations, in which TNF-inhibitors had been given a slight preference over other biologics due to availability of long-term registry data for the former but not the latter, preference is given here to bDMARDs over Jak-inhibitors for the same reason. This notion on current practice is an expert opinion and not based on solid evidence. This bullet point still received a very high vote at the meeting and a high LoA.

The recommendation to use these agents in patients who have bad prognostic factors (rather than those who have not) is also not based on solid evidence in the literature. However, in most trials of bDMARDs and tsDMARDs, the existing inclusion criteria, such as high disease activity, presence of autoantibodies and pre-existing joint damage, assured that patients with bad prognostic factors were included. Nevertheless, formal trials comparing the use of any of these agents in patients with and without bad prognostic markers do not exist. On the other hand, several post hoc analyses revealed the value of using TNF-inhibitors in patients with bad prognostic markers (table 1) relative to those without.<sup>69 76</sup>

The footnote to bDMARDs mentions that all approved bDMARDs may be used without hierarchical positioning, and that EMA-approved or FDA-approved bsDMARDs have similar efficacy and safety as the respective boDMARDs, and should be preferred if they are indeed appreciably cheaper than originator or other bDMARDs or tsDMARDs. Since the 2013 update, several bsDMARDs targeting TNF have been approved in Europe and some in the USA.<sup>155–157</sup> Among the bDMARDs, there is no difference in outcomes, irrespective of their target. This conclusion rests on head-to-head trials, meta-analyses, the results of the SLRs<sup>50–52 158</sup> and indirect comparison (the latter

being less reliable and therefore least informative).<sup>13 159 160</sup> Of note, the SLR also included available data from clinical trials of sarilumab, a human anti-IL-6 receptor antibody, and sirukumab, a human anti-IL-6 antibody, both of which are not approved at the present time; based on the SLR, the Task Force regarded these two antibodies and tocilizumab as having overall similar efficacy and safety.<sup>51</sup>

While rituximab is approved for use after TNF-inhibitors have failed, there is ample evidence for its efficacy in bDMARD-naïve patients and early RA.<sup>60 159</sup> It is, therefore, frequently used after IR to csDMARDs, especially when there are specific contraindications to other biological agents, such as past lymphoma or demyelinating disorders, given its efficacy in these diseases.<sup>161 162</sup>

The separation of points 7 and 8 was also based on the reason that the previous bullet point comprised two recommendations and that separating them would give the stratification by prognostic factors better visibility. The poor prognostic factors are presented in table 1 and now also include failure of two csDMARDs; if patients have insufficient efficacy to two csDMARD courses, a further csDMARD may have only little additional impact.<sup>77 127</sup>

The Task Force also discussed whether the use of a bDMARD as first-line therapy should be reconsidered, as had been the case in the original 2010 recommendations. Such use has been tested in a large number of randomised trials and has consistently been found to be statistically superior to MTX monotherapy. Importantly, however, none of the respective phase III trials used a combination with de novo GC in the MTX monotherapy arm and the few investigator-initiated studies that compared first-line bDMARDs plus MTX with GC plus MTX (or with a combination of csDMARDs) did not show a clear clinical or structural advantage of early bDMARD therapy.<sup>127 147</sup> Also, embedded within responders to initial treatment with bDMARDs+MTX are 20%–25% good responders to MTX alone, leading to over-treatment of these patients.<sup>13</sup> Finally, it was shown that patients who had an IR to MTX but then rapidly received bDMARD responded to a similar extent as those who had started with the bDMARD plus MTX.<sup>68</sup> Thus, this proposal for the early use of bDMARDs did not find a majority vote.

Nevertheless, it is still conceivable that an induction regimen followed by the subsequent cessation of the bDMARD and continuation of the csDMARD may become a valuable option in the future; there is some support in the literature for such an approach.<sup>68 163–166</sup> However, this would need further confirmation by additional trials before it could be put into place, especially also because the number of initial responders in whom tapering could be considered does not comprise a majority of the patients. The recommendation, as worded above, received 94% of the Task Force members' votes. LoE \*1b, <sup>§</sup>5; LoA 9.0.

9. *bDMARDs\* and tsDMARDs<sup>#</sup> should be combined with a csDMARD; in patients who cannot use csDMARDs as comedication, IL-6 pathway inhibitors and tsDMARDs may have some advantages compared with other bDMARDs.* This recommendation replaces former no. 9 ('in patients responding insufficiently to MTX and/or other csDMARD strategies, with or without GC, bDMARDs (TNF-inhibitors, abatacept or tocilizumab, and, under certain circumstances, rituximab) should be commenced with MTX'). While the individual bDMARDs and tsDMARDs have been already discussed above, item 9 now refers to the fact that all bDMARDs have superior efficacy when combined with MTX than as monotherapy. Compared with the 2013 update, more evidence has now accrued in favour of combination, even for tocilizumab.<sup>167–169</sup> Also for baricitinib, combination therapy conveys better structural, although not clinical or functional

efficacy than monotherapy.<sup>170</sup> However, regarding signs and symptoms, physical function and joint damage, there are indications for a somewhat better efficacy of tocilizumab monotherapy, and more strongly so for Jak-inhibitors compared with MTX.<sup>170–172</sup> Monotherapy of the other biological agents has not been found clinically superior to MTX monotherapy.<sup>66 67 173</sup> MTX can be used at 7.5–10 mg to provide added efficacy to TNF-inhibitors<sup>174 175</sup> and intolerance at these low doses leading to discontinuation is very rare. Moreover, biologics can also be effectively combined with other csDMARDs.<sup>142 144</sup>

Another aspect, namely the occurrence of antidrug antibodies (immunogenicity), was discussed, especially regarding secondary non-response. In this context, the lack of knowledge about the role of non-adherence and non-persistence was also addressed. The Task Force then discussed routine testing of antidrug antibodies and drug levels and felt that there was little place for these in clinical practice, since a good clinical response would not lead to cessation of therapy even in the presence of antidrug antibodies, or low drug levels, and vice versa. Of note, the use of MTX at the doses mentioned above reduces the incidence of antidrug antibodies.<sup>174 175</sup>

For all these reasons the Task Force felt strongly (96% majority) that bDMARDs (and tsDMARDs) should primarily be added to, that is, combined with csDMARDs, such as MTX or leflunomide, leaving the option of monotherapy, with a preference for certain drugs, as an exception in case of intolerance or contraindication to all csDMARDs. LoE \*1a, #1b; LOA 9.2.

10. *If a bDMARD\* or tsDMARD<sup>S</sup> has failed, treatment with another bDMARD or a tsDMARD should be considered; if one TNF-inhibitor therapy has failed, patients may receive another TNF-inhibitor or an agent with another mode of action.* A similar recommendation was presented in 2013: ‘If a first bDMARD has failed, patients should be treated with another bDMARD; if a first TNF-inhibitor therapy has failed, patients may receive another TNF-inhibitor or a biological agent with another mode of action’. Indeed, in a trial published after the elaboration of these recommendations, even primary non-responders to a TNF-inhibitor were shown to have some response to another anti-TNF, making it difficult to draw different conclusions for subsequent therapy for primary compared with secondary failures to TNF-blockers.<sup>176</sup> The addition in the first part (‘or tsDMARD’) was partly needed because tsDMARDs (Jak inhibition) are now included in the earlier recommendations 8 and 9; ‘first’ was deleted, because the Task Force did not decide to distinguish between failure of one or more bDMARDs. However, it must be noted that it is currently neither known if a Jak-inhibitor is effective once another one has failed nor established that a second IL-6 receptor inhibitor or inhibitors of the IL-6 ligand are effective if tocilizumab has failed—this is still part of the research agenda. We also lack studies exploring if TNF-inhibitors are efficacious and safe after bDMARDs with other modes of action have failed, and also studies investigating switching between these other modes of action. A few members raised the question if the use of csDMARDs should also be considered when bDMARDs had failed, but this suggestion did not find a majority.

The Task Force was also clear about its recommendations that any bDMARD, including another TNF-inhibitor, could be used if a TNF-inhibitor has previously failed. Thus, drugs with the same or with another mode of action are recommended in this situation. This was based on the data of clinical trials including meta-analyses<sup>158</sup> and on the fact that in contrast to registry data, which may be affected by a variety of confounders, several new prospective studies suggest that there is no difference between

these two approaches.<sup>177 178</sup> If a second TNF-inhibitor fails, patients should receive an agent with another mode of action. However, it is self-evident (and supported by the vast majority of the Task Force members) that a bsDMARD of any of the reference boDMARDs should not be used if the respective boDMARD (or another bsDMARD of the same molecule) has failed to induce sufficient efficacy or vice versa. LoE \*1a, §5; LoA 9.2.

11. *If a patient is in persistent remission after having tapered GC, one can consider tapering bDMARDs, especially if this treatment is combined with a csDMARD.* This item remained unchanged compared with the 2013 publication. No new data have been published that contest this conclusion. Tapering here means reduction of dose or extension of interval between applications (‘spacing’). It does not necessarily imply discontinuation of a bDMARD, which may lead to a recurrence of disease in a majority of patients.<sup>179 180</sup> However, even if treatment is stopped and patients flare, the majority of them (>80%) will recover their previous good outcome on reinstitution of therapy (but some do not),<sup>180 181</sup> and patients should be informed accordingly. There exist certain predictors in whom tapering will be likely successful and these relate primarily to early RA, depth of improvement and duration of remission<sup>182</sup>; prospective trials taking these aspects into consideration are needed in the future. This item also indirectly bolsters recommendation 9 on combination therapy of bDMARDs with MTX or another csDMARD, since it implies that bDMARDs should primarily, if not only, be tapered and possibly discontinued when combined with a csDMARD, while tapering and stopping of bDMARD monotherapy was not yet sufficiently studied. LoE 2b; LoA 9.0.

12. *If a patient is in persistent remission, tapering the csDMARD could be considered.* The 2013 version of the respective point 13 reads: ‘In cases of sustained long-term remission, cautious reduction of the csDMARD dose could be considered, as a shared decision between patient and physician’. This item elicited significant discussions, since it would mean leaving patients with RA either without any or with a low dose of a csDMARD. But in general, no new evidence for or against this view has been found over the last years. In the discussion, controversies emerged. It was mentioned that here tapering means primarily reducing the dose and that discontinuing csDMARDs may be possible only in exceptional cases. Many rheumatologists on the Task Force panel expressed a view stating that csDMARDs should never be stopped. Consequently, this item received the lowest LoA (8.5) of all, although still quite high on the scale of 0–10. Of note, the portion worded ‘as a shared decision between patient and physician’ was now deleted. It was felt by the Task Force that mentioning the shared decision for this item among all 12 would imply that the other recommendations may not need to involve the patient, or single out this specific recommendation in comparison with all other ones and thus offset overarching principle A. Obviously, the removal of this phrase does not mean that shared decision making with the patients is not important, on the contrary: in line with principle A it is of utmost importance for this and for all other recommendations. LoE 4; LoA 8.5.

The updated recommendations are depicted in an abbreviated way in figure 1. Part and parcel of this figure are the respective footnotes as well as the full text as presented here.

## DISCUSSION

The 2016 update of the EULAR RA management recommendations was developed by 50 experts, including patients,

rheumatologists and other healthcare professionals. This was the largest Task Force ever convened for the development of EULAR recommendations, both with respect to the overall number of members and the number of European countries involved, and it is also the first EULAR Task Force with a broad international representation, since rheumatologists from several other continents participated in this activity. This allowed us to also include some views from Asia, and Latin America and North America in the development of the recommendations, an input desired given the information provided in the recent publications of the updated ACR and the APLAR recommendations.<sup>17 39</sup>

The 2016 update presents the hitherto ‘leanest’ EULAR recommendations for RA management. While in 2010 the document comprised 3 overarching principles and 15 recommendations and in 2013 it contained 3 overarching principles and 14 recommendations, the 2016 update arrived with 4 principles and 12 recommendations. Despite this reduction, in light of a continuously increasing spectrum of therapeutic options and new information on existing agents and therapeutic strategies, this update covers more treatment aspects and is built on a better evidence base than ever before. This is due to the availability of at least partial answers to several of the research questions posed in 2013, such as items 4, 6, 9 and 21,<sup>16</sup> and of many new data on established and novel drugs as well as therapeutic strategies.

The Task Force adhered to several principles established in the course of the development of the 2013 update and even in 2010. For example, aside from evidence on efficacy and safety, economic aspects were generally considered in line with respective general specifications.<sup>45 46</sup> Also, agents that have not yet been approved by regulatory authorities but for which data from phase III trials were available, were considered with the caveat that their use would be only possible on such approval. This pertains to bsDMARDs, for which the Task Force relies on the stringency of the regulatory processes of EMA and FDA, for new IL-6 inhibitors and for Jak-inhibitors, the first of which was only licensed in some parts of the world at the time of developing these recommendations, with increasing availability of data on others. However, in the meantime tofacitinib and baricitinib have been approved in the European Union. Finally, the Task Force reiterated its previous conclusions on the importance of stratification according to risk factors of adverse RA outcome,<sup>69 76</sup> once an initial therapy has failed.

The individual recommendations are not numbered by importance, but rather by a logical sequence: what is the treatment target and how should the patient be followed? What is the most prudent treatment approach once the diagnosis has been made? How can therapeutic success be maximised? Which therapies should follow a first treatment failure (phase I) and under which circumstances? Which agent or type of drug should be preferred in the course of the development of the treatment strategies?

Consequently, the first three items, which were either left fully unchanged or were only minimally changed, deal with the time point of starting effective therapy (as soon as the diagnosis is made and thus without any loss of time); with the definition of the treatment target (sustained remission or low disease activity); and with monitoring and the need to reach a significant improvement of disease activity within 3 months and attainment of the targeted state within 6 months. The preferred instruments to be used when following patients have been defined in previous EULAR activities<sup>22 111</sup> and comprise composite measures that include joint counts, such as the CDAI, DAS28 and SDAI as

well as the ACR/EULAR remission definitions. Of note, instruments weighing acute phase reactants highly may exaggerate response, especially with IL-6 or Jak-inhibitors.

The treatment target (stringent remission or low disease activity) continues to be clinically defined, since focusing at ultrasonographic remission has not shown better outcomes compared with targeting clinical low disease activity or stringent remission, but rather induced overtreatment and thus inefficient use of healthcare resources.<sup>108 109</sup> Moreover, no strategy trial is available comparing the use of the serologic multibiomarker disease activity (MBDA) test with targeting remission using clinical disease activity assessment by a clinical composite measure (with which MBDA correlates anyway); of note, the MBDA test has been reported to improve to a larger extent on using a bDMARD that directly targets a cytokine compared with one that targets T-cell costimulation, despite similar clinical, functional and radiographic outcomes.<sup>183</sup> Moreover, it must be assumed that such test would falsely indicate high disease activity when an infection occurs. For all these reasons, the Task Force recommends to follow patients in clinical practice using a composite measure which comprises joint counts and may include an acute phase reactant. This clinical assessment is pertinent for every therapeutic phase (figure 1).

Subsequent recommendations, however, have undergone some significant changes compared with the 2013 update. While MTX (or in the presence of intolerance another csDMARD) continues to be considered the pivotal drug once the RA diagnosis has been made (item 4), it is recommended more strongly than before to escalate MTX to a dose of 25–30 mg weekly (with folate supplementation), given further recent insights on the high response rate with such strategy.<sup>4 118</sup> Moreover, the combination of csDMARDs, as monotherapy, with GC is more strongly suggested than before in light of increasing evidence that this combination is not surpassed by csDMARD combinations, even if they are applied with GC, or bDMARDs plus MTX in terms of efficacy and safety.<sup>126 147</sup> In the treatment algorithm (figure 1, phase I), this is reflected by the respective change from ‘±’ to ‘+’ for the addition of GC to csDMARDs. The term ‘low-dose’ GC has now been replaced by ‘short-term’ GC, given that various modes of application at different doses have shown to be efficacious. Moreover, the most important factors to reduce the risk of adverse event, such as cardiovascular events, infections, diabetes or hypertension,<sup>151 152 184</sup> was deemed to be rapid tapering to discontinuation and a low cumulative dose of GC. This is, indeed, the case with these alternative GC treatment modalities.

In contrast to the 2013 update, csDMARD combination therapy, with or without GC, is no longer an explicit part of the recommendations. This conclusion was based on the accruing evidence that this csDMARD combination therapy may not be superior to MTX monotherapy plus GC, but may be associated with an increase in adverse events.<sup>126 130</sup> A recent indirect-comparison meta-analysis has suggested a superiority of csDMARD combination versus MTX monotherapy.<sup>185</sup> This study was at odds with a previous direct-comparison meta-analysis<sup>35 186</sup> and with our own SLRs,<sup>35 52 133</sup> and indirect comparisons should also be considered with reservation since their rigour and value is insufficiently understood to date. Interestingly, using a somewhat different approach and based on an independent SLR, the ACR guideline has arrived at a similar conclusion as presented here and recommends MTX monotherapy as the first DMARD in early or established RA.<sup>17</sup> However, the use of csDMARD combination therapy is not precluded by the new recommendations, rather it is at the discretion of the

rheumatologist to apply it in the context of the recommendation on the use of MTX as a (first) treatment ‘strategy’.

Once phase I has failed to reach the treatment target, either in the presence of bad prognostic markers or in the absence of bad prognostic markers after a second csDMARD strategy has failed, the Task Force recommends to add any bDMARD or, less preferably, a tsDMARD. If phase II as depicted in the algorithm fails to arrive at the treatment target, another bDMARD or a tsDMARD should be used. The Task Force reiterated its position that if a TNF-inhibitor fails, another TNF-inhibitor—but not a biosimilar of the same molecule!—can be as effective as changing the mode of action. Vice versa, an effective biological agent should not be switched to another bDMARD for non-medical reasons. However, important data are missing for some of the drugs; for example, clinical trials did not address the efficacy of a TNF-inhibitor after bDMARDs with other modes of action or a Jak-inhibitor has failed. Similar questions arise for the other agents and also for the use of IL-6R or IL-6 inhibitors, such as sarilumab or sirukumab, after tocilizumab has failed (box 1).

Early bDMARD treatment, including an induction regimen with subsequent withdrawal of bDMARDs as supported by some strategy trials, was discussed but did not find a majority among the Task Force members. This decision was based on the lack of evidence for superiority of such therapy compared with the use of MTX plus GC. Moreover, when placed in the context of a treat-to-target strategy, the initial use of csDMARDs yields equal results in the long-term. Finally, the cost-effectiveness of

first-line bDMARD therapy, especially in light of the reasons just mentioned, is very poor.

The 2016 update of the EULAR recommendations is based on the most recent evidence in the area of RA management and on discussions by a large and broadly international Task Force. The recommendations synthesise the current thinking on approaching RA treatment in a set of overarching principles and recommendations. These have been informed by SLRs on the efficacy and safety of the drugs. The Task Force is convinced that adhering to these recommendations, including shared decision making, defining the treatment target, assessing disease activity regularly with appropriate instruments and applying the sequence of drugs as proposed and in a treat-to-target strategy, will maximise the overall outcome in a vast majority of patients with RA. Still, a considerable proportion of patients will not reach the target despite all efforts, and for these patients new drugs will be needed. Also, new information from research activities on treatment strategies, predictive markers and other aspects will become available in the near future and will likely necessitate yet another update of the recommendations in about 3 years; maybe we will then have new data on the research agenda, including precision medicine approaches in RA which allow predicting who will best respond to which drug at which stage of the disease. Until then we hope that the 2016 update will be broadly applied in clinical practice and/or serve as a template for national societies to develop local recommendations.

### Box 1 Research agenda

1. How does MTX monotherapy in combination with glucocorticoids compare with monotherapies of sulfasalazine or leflunomide in combination with glucocorticoids, at the doses of csDMARDs as used today?
2. In what proportion of patients is an induction therapy with a bDMARD+MTX with subsequent cessation of the bDMARD effective in inducing sustained remission?
3. Is the application of a TNF-inhibitor after abatacept, tocilizumab, rituximab or a Jak-inhibitor has failed, safe and efficacious?
4. How safe and efficacious are abatacept, tocilizumab and rituximab after any of the other non-TNF-inhibitor-bDMARDs or a tsDMARD has failed?
5. How safe and efficacious is the use of an IL-6 pathway inhibitor if another IL-6 pathway inhibitor/a Jak-inhibitor has failed?
6. How safe and efficacious is the use of a Jak-inhibitor after another IL-6 pathway inhibitor/another Jak-inhibitor has failed?
7. Is the risk stratification as recommended by EULAR after failure of MTX improving outcome in those with risk factors and not harming those without bad prognostic markers? Do patients who lack bad prognostic factors benefit as much from a switch or addition of a csDMARD as from the addition of a bDMARD?
8. Can we find predictors of differential response to the different bDMARDs and tsDMARDs?
9. When starting a DMARD, how can we best predict who will attain the treatment target (remission or low disease activity) and who not?
10. Can we predict who will maintain remission after withdrawal of a bDMARD?
11. Will we be able to develop precision (personalised, stratified) medicine approaches in RA?
12. Is tapering of bDMARD monotherapy, where potentially indicated, comparable with bDMARD tapering in the presence of csDMARDs?
13. Will RCTs on tapering of bDMARDs following the deducted predictors for successful withdrawal of bDMARDs show success?
14. How good is patient adherence to a bDMARD or tsDMARD and can non-adherence explain secondary loss of efficacy?
15. Is measurement of serum drug or antidrug antibody levels useful in clinical practice?
16. Which biomarkers will help to find better predictors of bad outcome or response and which have failed in the numerous clinical trials that evaluated gene-expression and other biomarkers?
17. What is the effect of csDMARD, tsDMARD and bDMARD therapies on cardiovascular outcomes and to which extent is a potential effect dependent on a clinical response?

Is the use of telemedicine or e-medicine approaches as effective as direct contact in the clinic for treat-to-target strategies? bDMARDs, biological DMARDs; csDMARDs, conventional synthetic DMARDs; DMARDs, disease-modifying antirheumatic drugs; EULAR, European League Against Rheumatism; Jak, Janus kinase; MTX, methotrexate; RA, rheumatoid arthritis; RCT, randomised controlled trial; TNF, tumour necrosis factor; tsDMARDs, targeted synthetic DMARDs.

Author affiliations

- <sup>1</sup>Division of Rheumatology, Department of Medicine 3, Medical University of Vienna, Vienna, Austria
- <sup>2</sup>2nd Department of Medicine, Hietzing Hospital, Vienna, Austria
- <sup>3</sup>Amsterdam Rheumatology & Immunology Center, Amsterdam, The Netherlands
- <sup>4</sup>Zuyderland Medical Center, Heerlen, The Netherlands
- <sup>5</sup>Department of Rheumatology and Clinical Immunology, University Medical Center Utrecht, Utrecht, The Netherlands
- <sup>6</sup>Department of Rheumatology and Clinical Immunology, Charité—University Medicine Berlin, Free University and Humboldt University Berlin, Berlin, Germany
- <sup>7</sup>Rheumatology Department, Karolinska Institute, Stockholm, Sweden
- <sup>8</sup>Rhumatologie B, Hopital Cochin, Paris, France
- <sup>9</sup>NIHR Leeds Musculoskeletal Biomedical Research Unit, Leeds Teaching Hospitals NHS Trust and Leeds Institute of Rheumatic and Musculoskeletal Medicine, University of Leeds, Leeds, UK
- <sup>10</sup>Department of Rheumatology, Leiden University Medical Center, Leiden, The Netherlands
- <sup>11</sup>Department of Psychology, Health and Technology, University of Twente, Enschede, The Netherlands
- <sup>12</sup>Division of Rheumatology, Medizinische Klinik und Poliklinik III, Universitätsklinikum Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany
- <sup>13</sup>Department of Epidemiology and Biostatistics, VU University Medical Center, Amsterdam, The Netherlands
- <sup>14</sup>Birmingham NIHR Wellcome Trust Clinical Research Facility, Rheumatology Research Group, Institute of Inflammation and Ageing (IIA), University of Birmingham, Queen Elizabeth Hospital, Birmingham, UK
- <sup>15</sup>Department of Rheumatology, Hospital for Special Surgery, Weill Cornell Medical College, New York, New York, USA
- <sup>16</sup>Rebecca McDonald Center for Arthritis & Autoimmune Disease, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada
- <sup>17</sup>Centro de Investigación Clínica de Morelia SC, Michoacán, México
- <sup>18</sup>Rheumatology Department, Lapeyronie Hospital, Montpellier University, UMR 5535, Montpellier, France
- <sup>19</sup>Research Laboratory and Division of Clinical Rheumatology, University of Genoa, Genoa, Italy
- <sup>20</sup>Department of Patient & Care and Department of Rheumatology, University of Maastricht, Maastricht, The Netherlands
- <sup>21</sup>Division of Rheumatology, University Hospitals of Geneva, Geneva, Switzerland
- <sup>22</sup>Fundación Ramón Domínguez, Hospital Clínico Universitario, Santiago, Spain
- <sup>23</sup>Department of Rheumatology, Sorbonne Universités, Pitié Salpêtrière Hospital, Paris, France
- <sup>24</sup>Institut de Biologie Moléculaire et Cellulaire, Immunopathologie, et Chimie Thérapeutique, Strasbourg University Hospital and University of Strasbourg, CNRS, Strasbourg, France
- <sup>25</sup>Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands
- <sup>26</sup>Arthritis Research UK Centre for Epidemiology, Centre for Musculoskeletal Research, University of Manchester, Manchester, UK
- <sup>27</sup>V.A. Nasonova Research Institute of Rheumatology, Moscow, Russian Federation
- <sup>28</sup>European League Against Rheumatism, Zurich, Switzerland
- <sup>29</sup>Cyprus League against Rheumatism, Nicosia, Cyprus
- <sup>30</sup>Department of Rheumatology, Diakonhjemmet Hospital, Oslo, Norway
- <sup>31</sup>Department of Rheumatology and Immunology, Beijing University People's Hospital, Beijing, China
- <sup>32</sup>Assistance Publique-Hôpitaux de Paris, Hôpitaux Universitaires Paris-Sud, Université Paris-Sud, INSERM U1184, Center for Immunology of viral Infections and Autoimmune Diseases (IMVA), Le Kremlin Bicêtre, France
- <sup>33</sup>Institute of Infection, Immunity and Inflammation, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, UK
- <sup>34</sup>Organización Médica de Investigación, Buenos Aires, Argentina
- <sup>35</sup>Department of Medicine, University of Queensland, Queensland, Australia
- <sup>36</sup>Institute of Rheumatology and Clinic of Rheumatology, Charles University, Prague, Czech Republic
- <sup>37</sup>National Institute of Rheumatology and Physiotherapy, Semmelweis University, Budapest, Hungary
- <sup>38</sup>Rheumatology Department, FHU ACRONIM, Pellegrin Hospital and UMR CNRS 5164, Bordeaux University, Bordeaux, France
- <sup>39</sup>Department of Rheumatology, Bernhoven, Uden, The Netherlands
- <sup>40</sup>University of Cologne, Cologne, Germany
- <sup>41</sup>Division of Rheumatology, Department of Medicine, University of Alabama at Birmingham, Birmingham, Alabama, USA
- <sup>42</sup>Serviço de Reumatologia, Centro Hospitalar e Universitário de Coimbra Praceta Mota Pinto, Coimbra, Portugal
- <sup>43</sup>Section for Outcomes Research, Center for Medical Statistics, Informatics, and Intelligent Systems, Medical University of Vienna, Vienna, Austria
- <sup>44</sup>Keio University School of Medicine, Keio University Hospital, Tokyo, Japan
- <sup>45</sup>Department of Development and Regeneration, Skeletal Biology and Engineering Research Center, KU Leuven, Leuven, Belgium

- <sup>46</sup>Department of Rheumatology, University Hospitals Leuven, Leuven, Belgium
- <sup>47</sup>Department Medical Humanities, VU Medical Centre, Amsterdam, The Netherlands

**Twitter** Follow Mario Cardiel @mhcardiel and Meghna Jani @Meghnajani

**Acknowledgements** The Task Force gratefully acknowledges the financial support by EULAR. Participation in EULAR Task Forces requires a priori declaration of conflicts of interest which has been done by all Task Force members. One Task Force member, who had attended the face-to-face meeting and had participated in all voting processes thereof decided to withdraw from the Task Force subsequently because some of that person's views had not found a majority during the voting process. This withdrawal occurred without casting a vote for the level of agreement with the recommendations. We thank this member for the contributions to the discussion process.

**Funding** European League Against Rheumatism.

**Competing interests** A competing interests statement of all authors is attached as online supplementary material.

**Provenance and peer review** Not commissioned; externally peer reviewed.

REFERENCES

- 1 Wilske KR, Healey LA. Challenging the therapeutic pyramid: a new look at treatment strategies for rheumatoid arthritis. *J Rheumatol* 1990;17(Suppl 25):4–7.
- 2 McCarty DJ. Suppress rheumatoid inflammation early and leave the pyramid to the Egyptians. *J Rheumatol* 1990;17:1117–8.
- 3 Weinblatt ME. Efficacy of methotrexate in rheumatoid arthritis. *Br J Rheumatol* 1995;34(Suppl 2):43–8.
- 4 Visser K, van der Heijde D. Optimal dosage and route of administration of methotrexate in rheumatoid arthritis: a systematic review of the literature. *Ann Rheum Dis* 2009;68:1094–9.
- 5 Schumacher HR Jr, ed. *Primer on the rheumatic diseases*. 10th edn. Atlanta, GA: Arthritis Foundation, 1993.
- 6 van der Heide A, Jacobs JW, Bijlsma JW, et al. The effectiveness of early treatment with "second-line" antirheumatic drugs. A randomized, controlled trial. *Ann Intern Med* 1996;124:699–707.
- 7 Huizinga WJ, Machold KP, Breedveld FC, et al. Criteria for early rheumatoid arthritis: from Bayes' law revisited to new thoughts on pathogenesis. *Arthritis Rheum* 2002;46:1155–9.
- 8 van der Horst-Bruinsma IE, Speyer I, Visser H, et al. Diagnosis and course of early-onset arthritis: results of a special early arthritis clinic compared to routine patient care. *Br J Rheumatol* 1998;37:1084–8.
- 9 Emery P, Gough A. Why early arthritis clinics? *Br J Rheumatol* 1991;30:241–2.
- 10 Aletaha D, Breedveld FC, Smolen JS. The need for new classification criteria for rheumatoid arthritis. *Arthritis Rheum* 2005;52:3333–6.
- 11 Emery P, Salmon M. Early rheumatoid arthritis: time to aim for remission? *Ann Rheum Dis* 1995;54:944–7.
- 12 Smolen JS, van der Heijde D, Machold KP, et al. Proposal for a new nomenclature of disease-modifying antirheumatic drugs. *Ann Rheum Dis* 2014;73:3–5.
- 13 Smolen JS, Aletaha D, McInnes IB. Rheumatoid arthritis. *Lancet* 2016;388:2023–38.
- 14 Aletaha D, Neogi T, Silman AJ, III, et al. 2010 rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. *Ann Rheum Dis* 2010;69:1580–8.
- 15 Smolen JS, Breedveld FC, Burmester GR, et al. Treating rheumatoid arthritis to target: 2014 update of the recommendations of an international task force. *Ann Rheum Dis* 2016;75:3–15.
- 16 Smolen JS, Landewé R, Breedveld FC, et al. EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs: 2013 update. *Ann Rheum Dis* 2014;73:492–509.
- 17 Singh JA, Saag KG, Bridges SL Jr, et al. 2015 American College of Rheumatology Guideline for the treatment of rheumatoid arthritis. *Arthritis Care Res (Hoboken)* 2016;68:1–25.
- 18 van der Heijde DMFM, van 't Hof M, van Riel PL, et al. Development of a disease activity score based on judgment in clinical practice by rheumatologists. *J Rheumatol* 1993;20:579–81.
- 19 Prevoo MLL, van't Hof MA, Kuper HH, et al. Modified disease activity scores that include twenty-eight-joint counts. Development and validation in a prospective longitudinal study of patients with rheumatoid arthritis. *Arthritis Rheum* 1995;38:44–8.
- 20 Smolen JS, Breedveld FC, Schiff MH, et al. A Simplified disease activity index for rheumatoid arthritis for use in clinical practice. *Rheumatology (Oxford)* 2003;42:244–57.
- 21 Aletaha D, Nell VPK, Stamm T, et al. Acute phase reactants add little to composite disease activity indices for rheumatoid arthritis: validation of a clinical activity score. *Arthritis Res* 2005;7:R796–806.

- 22 Felson DT, Smolen JS, Wells G, *et al.* American college of rheumatology/European league against rheumatism provisional definition of remission in rheumatoid arthritis for clinical trials. *Ann Rheum Dis* 2011;70:404–13.
- 23 Kavanaugh A, Fleischmann RM, Emery P, *et al.* Clinical, functional and radiographic consequences of achieving stable low disease activity and remission with adalimumab plus methotrexate or methotrexate alone in early rheumatoid arthritis: 26-week results from the randomised, controlled OPTIMA study. *Ann Rheum Dis* 2013;72:64–71.
- 24 van der Heijde D. Remission by imaging in rheumatoid arthritis: should this be the ultimate goal? *Ann Rheum Dis* 2012;71(Suppl 2):i89–92.
- 25 Radner H, Smolen JS, Aletaha D. Remission in rheumatoid arthritis: benefit over low disease activity in patient-reported outcomes and costs. *Arthritis Res Ther* 2014;16:R56.
- 26 Linde L, Sørensen J, Østergaard M, *et al.* Does clinical remission lead to normalization of EQ-5D in patients with rheumatoid arthritis and is selection of remission criteria important? *J Rheumatol* 2010;37:285–90.
- 27 Provan SA, Semb AG, Hisdal J, *et al.* Remission is the goal for cardiovascular risk management in patients with rheumatoid arthritis: a cross-sectional comparative study. *Ann Rheum Dis* 2011;70:812–7.
- 28 Thiele K, Huscher D, Bischoff S, *et al.* Performance of the 2011 ACR/EULAR preliminary remission criteria compared with DAS28 remission in unselected patients with rheumatoid arthritis. *Ann Rheum Dis* 2013;72:1194–9.
- 29 Bruynesteyn K, Landewé R, van der Linden S, *et al.* Radiography as primary outcome in rheumatoid arthritis: acceptable sample sizes for trials with 3 months' follow up. *Ann Rheum Dis* 2004;63:1413–8.
- 30 Cohen SB, Dore RK, Lane NE, *et al.* Denosumab treatment effects on structural damage, bone mineral density, and bone turnover in rheumatoid arthritis: a twelve-month, multicenter, randomized, double-blind, placebo-controlled, phase II clinical trial. *Arthritis Rheum* 2008;58:1299–309.
- 31 Aletaha D, Alasti F, Smolen JS. Optimisation of a treat-to-target approach in rheumatoid arthritis: strategies for the 3-month time point. *Ann Rheum Dis* 2016;75:1479–85.
- 32 van der Heijde D, Aletaha D, Carmona L, *et al.* 2014 Update of the EULAR standardised operating procedures for EULAR-endorsed recommendations. *Ann Rheum Dis* 2015;74:8–13.
- 33 Ramiro S, Gaujoux-Viala C, Nam JL, *et al.* Safety of synthetic and biological DMARDs: a systematic literature review informing the 2013 update of the EULAR recommendations for management of rheumatoid arthritis. *Ann Rheum Dis* 2014;73:529–35.
- 34 Nam JL, Ramiro S, Gaujoux-Viala C, *et al.* Efficacy of biological disease-modifying antirheumatic drugs: a systematic literature review informing the 2013 update of the EULAR recommendations for the management of rheumatoid arthritis. *Ann Rheum Dis* 2014;73:516–28.
- 35 Gaujoux-Viala C, Nam J, Ramiro S, *et al.* Efficacy of conventional synthetic disease-modifying antirheumatic drugs, glucocorticoids and tofacitinib: a systematic literature review informing the 2013 update of the EULAR recommendations for management of rheumatoid arthritis. *Ann Rheum Dis* 2014;73:510–5.
- 36 Cardiel MH, Díaz-Borjón A, Vázquez del Mercado EM, *et al.* Update of the Mexican College of Rheumatology guidelines for the pharmacologic treatment of rheumatoid arthritis. *Rheumatol Clin* 2014;10:227–40.
- 37 Wollenhaupt J, Albrecht K, Krüger K, *et al.* The new 2012 German recommendations for treating rheumatoid arthritis: differences compared to the European standpoint. *Z Rheumatol* 2013;72:6–9.
- 38 Brenol CV, Nava JI, Soriano ER. Proper management of rheumatoid arthritis in Latin America. What the guidelines say? *Clin Rheumatol* 2015;34(Suppl 1):S51–5.
- 39 Lau CS, Chia F, Harrison A, *et al.* APLAR rheumatoid arthritis treatment recommendations. *Int J Rheum Dis* 2015;18:685–713.
- 40 European Medicines Agency. Guideline on clinical investigation of medicinal products other than NSAIDs for treatment of rheumatoid arthritis. 2015. [http://www.ema.europa.eu/docs/en\\_GB/document\\_library/Scientific\\_guideline/2015/06/WC500187583.pdf](http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2015/06/WC500187583.pdf)
- 41 Gaujoux-Viala C, Gossec L, Cantagrel A, *et al.* Recommendations of the French Society for Rheumatology for managing rheumatoid arthritis. *Joint Bone Spine* 2014;81:287–97.
- 42 Bykerk VP, Schieff O, Akhavan P, *et al.* Emerging issues in pharmacological management of rheumatoid arthritis: results of a national needs assessment survey identifying practice variations for the development of Canadian Rheumatology Association clinical practice recommendations. *J Rheumatol* 2012;39:1555–8.
- 43 Dougados M, Betteridge N, Burmester GR, *et al.* EULAR standardised operating procedures for the elaboration, evaluation, dissemination, and implementation of recommendations endorsed by the EULAR standing committees. *Ann Rheum Dis* 2004;63:1172–6.
- 44 Brouwers MC, Kho ME, Browman GP, *et al.* AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ* 2010;182:E839–42.
- 45 Guyatt GH, Oxman AD, Kunz R, *et al.* Incorporating considerations of resources use into grading recommendations. *BMJ* 2008;336:1170–3.
- 46 Holloway K, van Dijk L. *The world medicines situation 2011. Rational use of medicines.* WHO/EMP/MIE/2011.2.2. Geneva: World Health Organization, 2011.
- 47 Schoels M, Wong J, Scott DL, *et al.* Economic aspects of treatment options in rheumatoid arthritis: a systematic literature review informing the EULAR recommendations for the management of rheumatoid arthritis. *Ann Rheum Dis* 2010;69:995–1003.
- 48 Dörner T, Strand V, Cornes P, *et al.* The changing landscape of biosimilars in rheumatology. *Ann Rheum Dis* 2016;75:974–82.
- 49 OCEBM Levels of Evidence Working Group, Oxford Centre for Evidence-Based Medicine. The Oxford 2011 Levels of Evidence. 2011. <http://www.cebm.net/oxford-centre-evidence-based-medicine-levels-evidence-march-2009/>.
- 50 Ramiro S, *et al.* SLR on safety aspects of DMARDs to inform the EULAR RA management task force. *Ann Rheum Dis* 2016. In press.
- 51 Nam J, *et al.* SLR on bDMARDs to inform the EULAR RA management task force. *Ann Rheum Dis* 2016. In press.
- 52 Chatzidionysiou K. SLR on csDMARDs to inform the EULAR RA management task force 2016. *Ann Rheum Dis* 2016. In press.
- 53 Peters MJ, Symmons DP, McCarey D, *et al.* EULAR evidence-based recommendations for cardiovascular risk management in patients with rheumatoid arthritis and other forms of inflammatory arthritis. *Ann Rheum Dis* 2010;69:325–31.
- 54 van der Goes MC, Jacobs JW, Boers M, *et al.* Monitoring adverse events of low-dose glucocorticoid therapy: EULAR recommendations for clinical trials and daily practice. *Ann Rheum Dis* 2010;69:1913–9.
- 55 Hoes JN, Jacobs JW, Boers M, *et al.* EULAR evidence-based recommendations on the management of systemic glucocorticoid therapy in rheumatic diseases. *Ann Rheum Dis* 2007;66:1560–7.
- 56 van Assen S, Agmon-Levin N, Elkayam O, *et al.* EULAR recommendations for vaccination in adult patients with autoimmune inflammatory rheumatic diseases. *Ann Rheum Dis* 2011;70:414–22.
- 57 Strehl C, Bijlsma JW, de Wit M, *et al.* Defining conditions where long-term glucocorticoid treatment has an acceptably low level of harm to facilitate implementation of existing recommendations: viewpoints from an EULAR task force. *Ann Rheum Dis* 2016;75:952–7.
- 58 Baillet A, Gossec L, Carmona L, *et al.* Points to consider for reporting, screening for and preventing selected comorbidities in chronic inflammatory rheumatic diseases in daily practice: a EULAR initiative. *Ann Rheum Dis* 2016;75:965–73.
- 59 Furst DE, Keystone EC, So AK, *et al.* Updated consensus statement on biological agents for the treatment of rheumatic diseases, 2012. *Ann Rheum Dis* 2013;72(Suppl 2):ii2–34.
- 60 Buch MH, Smolen JS, Betteridge N, *et al.* Updated consensus statement on the use of rituximab in patients with rheumatoid arthritis. *Ann Rheum Dis* 2011;70:909–20.
- 61 Pereira R, Lago P, Faria R, *et al.* Safety of anti-TNF therapies in immune-mediated inflammatory diseases: focus on infections and malignancy. *Drug Dev Res* 2015;76:419–27.
- 62 Smolen JS, Schoels MM, Nishimoto N, *et al.* Consensus statement on blocking the effects of interleukin-6 and in particular by interleukin-6 receptor inhibition in rheumatoid arthritis and other inflammatory conditions. *Ann Rheum Dis* 2013;72:482–92.
- 63 Strangfeld A, Eveslage M, Schneider M, *et al.* Treatment benefit or survival of the fittest: what drives the time-dependent decrease in serious infection rates under TNF inhibition and what does this imply for the individual patient? *Ann Rheum Dis* 2011;70:1914–20.
- 64 Zink A, Manger B, Kaufmann J, *et al.* Evaluation of the RABBIT Risk Score for serious infections. *Ann Rheum Dis* 2014;73:1673–6.
- 65 St Clair EW, van der Heijde DM, Smolen JS, *et al.* Combination of infliximab and methotrexate therapy for early rheumatoid arthritis: a randomized, controlled trial. *Arthritis Rheum* 2004;50:3432–43.
- 66 Klareskog L, van der Heijde D, de Jager JP, *et al.* Therapeutic effect of the combination of etanercept and methotrexate compared with each treatment alone in patients with rheumatoid arthritis: double-blind randomised controlled trial. *Lancet* 2004;363:675–81.
- 67 Breedveld FC, Weisman MH, Kavanaugh AF, *et al.* The PREMIER study: a multicenter, randomized, double-blind clinical trial of combination therapy with adalimumab plus methotrexate versus methotrexate alone or adalimumab alone in patients with early, aggressive rheumatoid arthritis who had not had previous methotrexate treatment. *Arthritis Rheum* 2006;54:26–37.
- 68 Smolen JS, Emery P, Fleischmann R, *et al.* Adjustment of therapy in rheumatoid arthritis on the basis of achievement of stable low disease activity with adalimumab plus methotrexate or methotrexate alone: the randomised controlled OPTIMA trial. *Lancet* 2014;383:321–32.
- 69 Vastesaeger N, Xu S, Aletaha D, *et al.* A pilot risk model for the prediction of rapid radiographic progression in rheumatoid arthritis. *Rheumatology (Oxford)* 2009;48:1114–21.
- 70 Combe B, Landewé R, Daien CI, *et al.* 2016 update of the EULAR recommendations for the management of early arthritis. *Ann Rheum Dis* 2016; doi: 10.1136/annrheumdis-2016-210602. [Epub ahead of print 15 Dec 2016].
- 71 Smolen JS, Han C, Van der Heijde DM, *et al.* Radiographic changes in rheumatoid arthritis patients attaining different disease activity states with methotrexate monotherapy and infliximab plus methotrexate: the impacts of remission and tumour necrosis factor-blockade. *Ann Rheum Dis* 2009;68:823–7.

- 72 Smolen JS, Van Der Heijde DM, St Clair EW, *et al.* Predictors of joint damage in patients with early rheumatoid arthritis treated with high-dose methotrexate without or with concomitant infliximab: results from the ASPIRE trial. *Arthritis Rheum* 2006;54:702–10.
- 73 van Leeuwen MA, van Rijswijk MH, Sluiter WJ, *et al.* Individual relationship between progression of radiological damage and the acute phase response in early rheumatoid arthritis. Towards development of a decision support system. *J Rheumatol* 1997;24:20–7.
- 74 Van der Heijde DM, van Riel PL, van Leeuwen MA, *et al.* Prognostic factors for radiographic damage and physical disability in early rheumatoid arthritis. A prospective follow-up study of 147 patients. *Br J Rheumatol* 1992;31:519–25.
- 75 Scott DL, Symmons DP, Coulton BL, *et al.* Long-term outcome of treating rheumatoid arthritis: results after 20 years. *Lancet* 1987;1:1108–11.
- 76 Visser K, Goekoop-Ruiterman YP, de Vries-Bouwstra JK, *et al.* A matrix risk model for the prediction of rapid radiographic progression in patients with rheumatoid arthritis receiving different dynamic treatment strategies: post hoc analyses from the BeSt study. *Ann Rheum Dis* 2010;69:1333–7.
- 77 Kiely P, Walsh D, Williams R, *et al.* Outcome in rheumatoid arthritis patients with continued conventional therapy for moderate disease activity—the early RA network (ERAN). *Rheumatology (Oxford)* 2011;50:926–31.
- 78 Duru N, van der Goes MC, Jacobs JW, *et al.* EULAR evidence-based and consensus-based recommendations on the management of medium to high-dose glucocorticoid therapy in rheumatic diseases. *Ann Rheum Dis* 2013;72:1905–13.
- 79 Fransen J, van Riel PL. The Disease Activity Score and the EULAR response criteria. *Clin Exp Rheumatol* 2005;23:S93–9.
- 80 Aletaha D, Ward MM, Machold KP, *et al.* Remission and active disease in rheumatoid arthritis: defining criteria for disease activity states. *Arthritis Rheum* 2005;52:2625–36.
- 81 Aletaha D, Smolen JS. The definition and measurement of disease modification in inflammatory rheumatic diseases. *Rheum Dis Clin North Am* 2006;32:9–44.
- 82 Stoffer MA, Smolen JS, Woolf A, *et al.* Development of patient-centred standards of care for rheumatoid arthritis in Europe: the eumusc.net project. *Ann Rheum Dis* 2014;73:902–5.
- 83 Navarro-Compán V, Smolen JS, Huizinga TW, *et al.* Quality indicators in rheumatoid arthritis: results from the METEOR database. *Rheumatology (Oxford)* 2015;54:1630–9.
- 84 Widdifield J, Bernatsky S, Paterson JM, *et al.* Quality care in seniors with new-onset rheumatoid arthritis: a Canadian perspective. *Arthritis Care Res (Hoboken)* 2011;63:53–7.
- 85 Memel DS, Somerset M. General practitioner and specialist care: the perceptions of people with rheumatoid arthritis. *Prim Health Care Res Dev* 2003;4:29–37.
- 86 Robinson PC, Taylor WJ. Time to treatment in rheumatoid arthritis: factors associated with time to treatment initiation and urgent triage assessment of general practitioner referrals. *J Clin Rheumatol* 2010;16:267–73.
- 87 Kyburz D, Gabay C, Michel BA, *et al.* The long-term impact of early treatment of rheumatoid arthritis on radiographic progression: a population-based cohort study. *Rheumatology (Oxford)* 2011;50:1106–10.
- 88 Feldman DE, Bernatsky S, Houde M, *et al.* Early consultation with a rheumatologist for RA: does it reduce subsequent use of orthopaedic surgery? *Rheumatology (Oxford)* 2013;52:452–9.
- 89 Nasonov EL, Karateev DE. Does Russia need a treat-to-target initiative? *Rheumatology (Oxford)* 2015;54:381–2.
- 90 Smolen JS, Aletaha D. Rheumatoid arthritis therapy reappraisal: strategies, opportunities and challenges. *Nat Rev Rheumatol* 2015;11:276–89.
- 91 Cader MZ, Filer A, Hazlehurst J, *et al.* Performance of the 2010 ACR/EULAR criteria for rheumatoid arthritis: comparison with 1987 ACR criteria in a very early synovitis cohort. *Ann Rheum Dis* 2011;70:949–55.
- 92 Radner H, Neogi T, Smolen JS, *et al.* Performance of the 2010 ACR/EULAR classification criteria for rheumatoid arthritis: a systematic literature review. *Ann Rheum Dis* 2014;73:114–23.
- 93 van Aken J, Lard LR, le Cessie S, *et al.* Radiological outcome after four years of early versus delayed treatment strategy in patients with recent onset rheumatoid arthritis. *Ann Rheum Dis* 2004;63:274–9.
- 94 Nell VP, Machold KP, Eberl G, *et al.* Benefit of very early referral and very early therapy with disease-modifying anti-rheumatic drugs in patients with early rheumatoid arthritis. *Rheumatology (Oxford)* 2004;43:906–14.
- 95 Moura CS, Abrahamowicz M, Beauchamp ME, *et al.* Early medication use in new-onset rheumatoid arthritis may delay joint replacement: results of a large population-based study. *Arthritis Res Ther* 2015;17:197.
- 96 Machold KP, Landewé R, Smolen JS, *et al.* The Stop Arthritis Very Early (SAVE) trial, an international multicentre, randomised, double-blind, placebo-controlled trial on glucocorticoids in very early arthritis. *Ann Rheum Dis* 2010;69:495–502.
- 97 Verstappen SM, McCoy MJ, Roberts C, *et al.* Beneficial effects of a 3-week course of intramuscular glucocorticoid injections in patients with very early inflammatory polyarthritis: results of the STIVEA trial. *Ann Rheum Dis* 2010;69:503–9.
- 98 Smolen JS, Landewé R, Breedveld FC, *et al.* EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs. *Ann Rheum Dis* 2010;69:964–75.
- 99 Klarenbeek NB, Güler-Yüksel M, van der Kooij SM, *et al.* The impact of four dynamic, goal-steered treatment strategies on the 5-year outcomes of rheumatoid arthritis patients in the BeSt study. *Ann Rheum Dis* 2011;70:1039–46.
- 100 Aletaha D, Funovits J, Keystone EC, *et al.* Disease activity early in the course of treatment predicts response to therapy after one year in rheumatoid arthritis patients. *Arthritis Rheum* 2007;56:3226–35.
- 101 Schipper LG, Fransen J, den Broeder AA, *et al.* Time to achieve remission determines time to be in remission. *Arthritis Res Ther* 2010;12:R97.
- 102 Ranganath VK, Motamedi K, Haavardsholm EA, *et al.* Comprehensive appraisal of magnetic resonance imaging findings in sustained rheumatoid arthritis remission: a substudy. *Arthritis Care Res (Hoboken)* 2015;67:929–39.
- 103 Sakellariou G, Scirè CA, Verstappen SM, *et al.* In patients with early rheumatoid arthritis, the new ACR/EULAR definition of remission identifies patients with persistent absence of functional disability and suppression of ultrasonographic synovitis. *Ann Rheum Dis* 2013;72:245–9.
- 104 Genovese MC, Kremer J, Zamani O, *et al.* Baricitinib in patients with refractory rheumatoid arthritis. *N Engl J Med* 2016;374:1243–52.
- 105 Gabay C, Emery P, van Vollenhoven R, *et al.* Tocilizumab monotherapy versus adalimumab monotherapy for treatment of rheumatoid arthritis (ADACTA): a randomised, double-blind, controlled phase 4 trial. *Lancet* 2013;381:1541–50.
- 106 Smolen JS, Aletaha D. Interleukin-6 receptor inhibition with tocilizumab and attainment of disease remission in rheumatoid arthritis: the role of acute-phase reactants. *Arthritis Rheum* 2011;63:43–52.
- 107 Fleischmann R, van der Heijde D, Koenig AS, *et al.* How much does Disease Activity Score in 28 joints ESR and CRP calculations underestimate disease activity compared with the Simplified Disease Activity Index? *Ann Rheum Dis* 2015;74:1132–7.
- 108 Dale J, Stirling A, Zhang R, *et al.* Targeting ultrasound remission in early rheumatoid arthritis: the results of the TaSER study, a randomised clinical trial. *Ann Rheum Dis* 2016;75:1043–50.
- 109 Haavardsholm EA, Aga AB, Olsen IC, *et al.* Ultrasound in management of rheumatoid arthritis: ARCTIC randomised controlled strategy trial. *BMJ* 2016;354:i4205.
- 110 Fleischmann R, Kremer J, Cush J, *et al.* Placebo-controlled trial of tofacitinib monotherapy in rheumatoid arthritis. *N Engl J Med* 2012;367:495–507.
- 111 Aletaha D, Landewé R, Karonitsch T, *et al.* Reporting disease activity in clinical trials of patients with rheumatoid arthritis: EULAR/ACR collaborative recommendations. *Ann Rheum Dis* 2008;67:1360–4.
- 112 Curtis JR, Lujtjens K, Kavanaugh A. Predicting future response to certolizumab pegol in rheumatoid arthritis patients: features at 12 weeks associated with low disease activity at 1 year. *Arthritis Care Res (Hoboken)* 2012;64:658–67.
- 113 van der Heijde D, Keystone EC, Curtis JR, *et al.* Timing and magnitude of initial change in disease activity score 28 predicts the likelihood of achieving low disease activity at 1 year in rheumatoid arthritis patients treated with certolizumab pegol: a post-hoc analysis of the RAPID 1 trial. *J Rheumatol* 2012;39:1326–33.
- 114 Smolen JS, Wollenhaupt J, Gomez-Reino JJ, *et al.* Attainment and characteristics of clinical remission according to the new ACR-EULAR criteria in abatacept-treated patients with early rheumatoid arthritis: new analyses from the Abatacept study to Gauge Remission and joint damage progression in methotrexate (MTX)-naïve patients with early erosive rheumatoid arthritis (AGREE). *Arthritis Res Ther* 2015;17:157.
- 115 Li R, Zhao JX, Su Y, *et al.* High remission and low relapse with prolonged intensive DMARD therapy in rheumatoid arthritis (PRINT): a multicenter randomized clinical trial. *Medicine (Baltimore)* 2016;95:e3968.
- 116 Choi HK, Hernán MA, Seeger JD, *et al.* Methotrexate and mortality in patients with rheumatoid arthritis: a prospective study. *Lancet* 2002;359:1173–7.
- 117 Wasko MC, Dasgupta A, Hubert H, *et al.* Propensity-adjusted association of methotrexate with overall survival in rheumatoid arthritis. *Arthritis Rheum* 2013;65:334–42.
- 118 Emery P, Bingham CO III, Burmester GR, *et al.* Certolizumab pegol in combination with dose-optimised methotrexate in DMARD-naïve patients with early, active rheumatoid arthritis with poor prognostic factors: 1-year results from C-EARLY, a randomised, double-blind, placebo-controlled phase III study. *Ann Rheum Dis* 2017;76:96–104.
- 119 Atsumi T, Yamamoto K, Takeuchi T, *et al.* The first double-blind, randomised, parallel-group certolizumab pegol study in methotrexate-naïve early rheumatoid arthritis patients with poor prognostic factors, C-OPERA, shows inhibition of radiographic progression. *Ann Rheum Dis* 2016;75:75–83.
- 120 Mottonen T, Hannonen P, Leirisalo-Repo M, *et al.* Comparison of combination therapy with single-drug therapy in early rheumatoid arthritis: a randomised trial. FIN-RACo trial group. *Lancet* 1999;353:1568–73.
- 121 O'Dell JR, Haire CE, Erikson N, *et al.* Treatment of rheumatoid arthritis with methotrexate alone, sulfasalazine and hydroxychloroquine, or a combination of all three medications. *N Engl J Med* 1996;334:1287–91.
- 122 Moreland LW, O'Dell JR, Paulus HE, *et al.* A randomized comparative effectiveness study of oral triple therapy versus etanercept plus methotrexate in early aggressive rheumatoid arthritis: the treatment of Early Aggressive Rheumatoid Arthritis Trial. *Arthritis Rheum* 2012;64:2824–35.



- 123 O'Dell JR, Mikuls TR, Taylor TH, *et al.* Therapies for active rheumatoid arthritis after methotrexate failure. *N Engl J Med* 2013;369:307–18.
- 124 van Vollenhoven RF, Geborek P, Forslind K, *et al.* Conventional combination treatment versus biological treatment in methotrexate-refractory early rheumatoid arthritis: 2 year follow-up of the randomised, non-blinded, parallel-group Swefot trial. *Lancet* 2012;379:1712–20.
- 125 de Jong PH, Hazes JM, Han HK, *et al.* Randomised comparison of initial triple DMARD therapy with methotrexate monotherapy in combination with low-dose glucocorticoid bridging therapy; 1-year data of the tREACH trial. *Ann Rheum Dis* 2014;73:1331–9.
- 126 Verschuere P, De Cock D, Corlyu L, *et al.* Methotrexate in combination with other DMARDs is not superior to methotrexate alone for remission induction with moderate-to-high-dose glucocorticoid bridging in early rheumatoid arthritis after 16 weeks of treatment: the CareRA trial. *Ann Rheum Dis* 2015;74:27–34.
- 127 Goekoop-Ruiterman YP, de Vries-Bouwstra JK, Allaart CF, *et al.* Comparison of treatment strategies in early rheumatoid arthritis: a randomized trial. *Ann Intern Med* 2007;146:406–15.
- 128 Smolen JS, Aletaha D, Keystone E. Superior efficacy of combination therapy for rheumatoid arthritis. Fact or fiction? *Arthritis Rheum* 2005;52:2975–83.
- 129 Landewé RB, Smolen JS, Weinblatt ME, *et al.* Can we improve the performance and reporting of investigator-initiated clinical trials? Rheumatoid arthritis as an example. *Ann Rheum Dis* 2014;73:1755–60.
- 130 Verschuere P, De Cock D, Corlyu L, *et al.* Effectiveness of methotrexate with step-down glucocorticoid remission induction (COBRA Slim) versus other intensive treatment strategies for early rheumatoid arthritis in a treat-to-target approach: 1-year results of CareRA, a randomised pragmatic open-label superiority trial. *Ann Rheum Dis* 2017;76:511–20.
- 131 Singh JA, Furst DE, Bharat A, *et al.* 2012 update of the 2008 American College of Rheumatology recommendations for the use of disease-modifying antirheumatic drugs and biologic agents in the treatment of rheumatoid arthritis. *Arthritis Care Res (Hoboken)* 2012;64:625–39.
- 132 Cutolo M, Bolosiu H, Perdriet G. Efficacy and safety of leflunomide in DMARD-naïve patients with early rheumatoid arthritis: comparison of a loading and a fixed-dose regimen. *Rheumatology (Oxford)* 2013;52:1132–40.
- 133 Gaujoux-Viala C, Smolen JS, Landewé R, *et al.* Current evidence for the management of rheumatoid arthritis with synthetic disease-modifying antirheumatic drugs: a systematic literature review informing the EULAR recommendations for the management of rheumatoid arthritis. *Ann Rheum Dis* 2010;69:1004–9.
- 134 Emery P, Breedveld FC, Lemmel EM, *et al.* A comparison of the efficacy and safety of leflunomide and methotrexate for the treatment of rheumatoid arthritis. *Rheumatology (Oxford)* 2000;39:655–65.
- 135 Götestam Skorpen C, Hoeltzenbein M, Tincani A, *et al.* The EULAR points to consider for use of antirheumatic drugs before pregnancy, and during pregnancy and lactation. *Ann Rheum Dis* 2016;75:795–810.
- 136 Rau R, Herborn G, Menninger H, *et al.* Radiographic outcome after three years of patients with early erosive rheumatoid arthritis treated with intramuscular methotrexate or parenteral gold. Extension of a one-year double-blind study in 174 patients. *Rheumatology (Oxford)* 2002;41:196–204.
- 137 Lehman AJ, Esdaile JM, Klinkhoff AV, *et al.* A 48-week, randomized, double-blind, double-observer, placebo-controlled multicenter trial of combination methotrexate and intramuscular gold therapy in rheumatoid arthritis: results of the METGO study. *Arthritis Rheum* 2005;52:1360–70.
- 138 Katz SJ, Russell AS. Re-evaluation of antimalarials in treating rheumatic diseases: re-appreciation and insights into new mechanisms of action. *Curr Opin Rheumatol* 2011;23:278–81.
- 139 Hage MP, Al-Badri MR, Azar ST. A favorable effect of hydroxychloroquine on glucose and lipid metabolism beyond its anti-inflammatory role. *Ther Adv Endocrinol Metab* 2014;5:77–85.
- 140 Sharma TS, Wasko MC, Tang X, *et al.* Hydroxychloroquine use is associated with decreased incident cardiovascular events in rheumatoid arthritis patients. *J Am Heart Assoc* 2016;5:e002867.
- 141 Van der Heijde DM, van Riel PL, Nuver-Zwart IH, *et al.* Sulphasalazine versus hydroxychloroquine in rheumatoid arthritis: 3-year follow-up. *Lancet* 1990;335:539.
- 142 Strangfeld A, Hiesse F, Kekow J, *et al.* Comparative effectiveness of tumour necrosis factor alpha inhibitors in combination with either methotrexate or leflunomide. *Ann Rheum Dis* 2009;68:1856–62.
- 143 De Stefano R, Frati E, Nargi F, *et al.* Comparison of combination therapies in the treatment of rheumatoid arthritis: leflunomide-anti-TNF-alpha versus methotrexate-anti-TNF-alpha. *Clin Rheumatol* 2010;29:517–24.
- 144 Burmester GR, Mariette X, Montecucco C, *et al.* Adalimumab alone and in combination with disease-modifying antirheumatic drugs for the treatment of rheumatoid arthritis in clinical practice: the Research in Active Rheumatoid Arthritis (ReAct) trial. *Ann Rheum Dis* 2007;66:732–9.
- 145 Genovese MC, McKay JD, Nasonov EL, *et al.* Interleukin-6 receptor inhibition with tocilizumab reduces disease activity in rheumatoid arthritis with inadequate response to disease-modifying antirheumatic drugs: the tocilizumab in combination with traditional disease-modifying antirheumatic drug therapy study. *Arthritis Rheum* 2008;58:2968–80.
- 146 Goekoop-Ruiterman YP, De Vries-Bouwstra JK, Allaart CF, *et al.* Clinical and radiographic outcomes of four different treatment strategies in patients with early rheumatoid arthritis (the BeSt study): a randomized, controlled trial. *Arthritis Rheum* 2005;52:3381–90.
- 147 Nam JL, Villeneuve E, Hensor EM, *et al.* Remission induction comparing infliximab and high-dose intravenous steroid, followed by treat-to-target: a double-blind, randomised, controlled trial in new-onset, treatment-naïve, rheumatoid arthritis (the IDEA study). *Ann Rheum Dis* 2014;73:75–85.
- 148 Buttgerit F, da Silva JA, Boers M, *et al.* Standardised nomenclature for glucocorticoid dosages and glucocorticoid treatment regimens: current questions and tentative answers in rheumatology. *Ann Rheum Dis* 2002;61:718–22.
- 149 Listing J, Kekow J, Manger B, *et al.* Mortality in rheumatoid arthritis: the impact of disease activity, treatment with glucocorticoids, TNF $\alpha$  inhibitors and rituximab. *Ann Rheum Dis* 2015;74:415–21.
- 150 Lahiri M, Dixon WG. Risk of infection with biologic antirheumatic therapies in patients with rheumatoid arthritis. *Best Pract Res Clin Rheumatol* 2015;29:290–305.
- 151 van Sijl AM, Boers M, Voskuyl AE, *et al.* Confounding by indication probably distorts the relationship between steroid use and cardiovascular disease in rheumatoid arthritis: results from a prospective cohort study. *PLoS ONE* 2014;9:e87965.
- 152 del Rincón I, Battafarano DF, Restrepo JF, *et al.* Glucocorticoid dose thresholds associated with all-cause and cardiovascular mortality in rheumatoid arthritis. *Arthritis Rheumatol* 2014;66:264–72.
- 153 Choy EH, Kingsley GH, Khoshaba B, *et al.* A two year randomised controlled trial of intramuscular depot steroids in patients with established rheumatoid arthritis who have shown an incomplete response to disease modifying antirheumatic drugs. *Ann Rheum Dis* 2005;64:1288–93.
- 154 Taylor PC, Keystone EC, van der Heijde D, *et al.* Baricitinib versus placebo or adalimumab in patients with active rheumatoid arthritis (RA) and an inadequate response to background methotrexate therapy: results of a phase 3 study [Abstract]. *Arthritis Rheum* 2015;67(Suppl 10):L2.
- 155 Yoo DH, Prodanovic N, Jaworski J, *et al.* Efficacy and safety of CT-P13 (biosimilar infliximab) in patients with rheumatoid arthritis: comparison between switching from reference infliximab to CT-P13 and continuing CT-P13 in the PLANETRA extension study. *Ann Rheum Dis* 2017;76:355–363.
- 156 Choe JY, Prodanovic N, Niebrzydowski J, *et al.* A randomised, double-blind, phase III study comparing SB2, an infliximab biosimilar, to the infliximab reference product Remicade in patients with moderate to severe rheumatoid arthritis despite methotrexate therapy. *Ann Rheum Dis* 2017;76:58–64.
- 157 Emery P, Vencovsky J, Sylwestrzak A, *et al.* A phase III randomised, double-blind, parallel-group study comparing SB4 with etanercept reference product in patients with active rheumatoid arthritis despite methotrexate therapy. *Ann Rheum Dis* 2017;76:51–57.
- 158 Schoels M, Aletaha D, Smolen JS, *et al.* Comparative effectiveness and safety of biological treatment options after tumour necrosis factor  $\alpha$  inhibitor failure in rheumatoid arthritis: systematic review and indirect pairwise meta-analysis. *Ann Rheum Dis* 2012;71:1303–8.
- 159 Porter D, van Melckebeke J, Dale J, *et al.* Tumour necrosis factor inhibition versus rituximab for patients with rheumatoid arthritis who require biological treatment (ORBIT): an open-label, randomised controlled, non-inferiority, trial. *Lancet* 2016;388:239–47.
- 160 Weinblatt ME, Schiff M, Valente R, *et al.* Head-to-head comparison of subcutaneous abatacept versus adalimumab for rheumatoid arthritis: findings of a phase IIIb, multinational, prospective, randomized study. *Arthritis Rheum* 2013;65:28–38.
- 161 Hauser SL, Waubant E, Arnold DL, *et al.* B-cell depletion with rituximab in relapsing-remitting multiple sclerosis. *N Engl J Med* 2008;358:676–88.
- 162 Coleman M, Lammers PE, Ciceri F, *et al.* Role of rituximab and rituximab biosimilars in diffuse large B-cell lymphoma. *Clin Lymphoma Myeloma Leuk* 2016;16:175–81.
- 163 Emery P, Hammoudeh M, Fitzgerald O, *et al.* Sustained remission with etanercept tapering in early rheumatoid arthritis. *N Engl J Med* 2014;371:1781–92.
- 164 Deter J, Bastian H, Listing J, *et al.* Induction therapy with adalimumab plus methotrexate for 24 weeks followed by methotrexate monotherapy up to week 48 versus methotrexate therapy alone for DMARD-naïve patients with early rheumatoid arthritis: HIT HARD, an investigator-initiated study. *Ann Rheum Dis* 2013;72:844–50.
- 165 Bijlsma JW, Welsing PM, Woodworth TG, *et al.* Early rheumatoid arthritis treated with tocilizumab, methotrexate, or their combination (U-Act-Early): a multicentre, randomised, double-blind, double-dummy, strategy trial. *Lancet* 2016;388:343–55.
- 166 Bejarano V, Conaghan PG, Quinn MA, *et al.* Benefits 8 years after a remission induction regime with an infliximab and methotrexate combination in early rheumatoid arthritis. *Rheumatology (Oxford)* 2010;49:1971–4.

- 167 Burmester GR, Rigby WF, van Vollenhoven RF, *et al.* Tocilizumab in early progressive rheumatoid arthritis: FUNCTION, a randomised controlled trial. *Ann Rheum Dis* 2016;75:1081–91.
- 168 Kaneko Y, Atsumi T, Tanaka Y, *et al.* Comparison of adding tocilizumab to methotrexate with switching to tocilizumab in patients with rheumatoid arthritis with inadequate response to methotrexate: 52-week results from a prospective, randomised, controlled study (SURPRISE study). *Ann Rheum Dis* 2016;75:1917–23.
- 169 Dougados M, Kissel K, Conaghan PG, *et al.* Clinical, radiographic and immunogenic effects after 1 year of tocilizumab-based treatment strategies in rheumatoid arthritis: the ACT-RAY study. *Ann Rheum Dis* 2014;73:803–9.
- 170 Fleischmann R, Takeuchi T, Schlichting D, *et al.* Baricitinib, methotrexate, or baricitinib plus methotrexate in patients with early rheumatoid arthritis who had received limited or no treatment with disease-modifying anti-rheumatic drugs (DMARDs): phase 3 trial results [abstract]. *Arthritis Rheum* 2015;67(Suppl 10). <http://acrabstracts.org/abstract/baricitinib-methotrexate-or-baricitinib-plus-methotrexate-in-patients-with-early-rheumatoid-arthritis-who-had-received-limited-or-no-treatment-with-disease-modifying-anti-rheumatic-drugs-dmards-p/> (accessed 4 Jan 2016).
- 171 Lee EB, Fleischmann RM, Hall S, *et al.* Radiographic, clinical and functional comparison of tofacitinib monotherapy versus methotrexate in methotrexate-naïve patients with rheumatoid arthritis. *Arthritis Rheum* 2012;64:S1049.
- 172 Jones G, Sebba A, Gu J, *et al.* Comparison of tocilizumab monotherapy versus methotrexate monotherapy in patients with moderate to severe rheumatoid arthritis: the AMBITION study. *Ann Rheum Dis* 2010;69:88–96.
- 173 Emery P, Burmester GR, Bykerk VP, *et al.* Evaluating drug-free remission with abatacept in early rheumatoid arthritis: results from the phase 3b, multicentre, randomised, active-controlled AVERT study of 24 months, with a 12-month, double-blind treatment period. *Ann Rheum Dis* 2015;74:19–26.
- 174 Maini RN, Breedveld FC, Kalden JR, *et al.* Therapeutic efficacy of multiple intravenous infusions of anti-tumor necrosis factor alpha monoclonal antibody combined with low-dose weekly methotrexate in rheumatoid arthritis. *Arthritis Rheum* 1998;41:1552–63.
- 175 Burmester GR, Kivitz AJ, Kupper H, *et al.* Efficacy and safety of ascending methotrexate dose in combination with adalimumab: the randomised CONCERTO trial. *Ann Rheum Dis* 2015;74:1037–44.
- 176 Smolen JS, Burmester GR, Combe B, *et al.* Head-to-head comparison of certolizumab pegol versus adalimumab in rheumatoid arthritis: 2-year efficacy and safety results from the randomised EXXELERATE study. *Lancet* 2016;388:2763–74.
- 177 Torrente-Segarra V, Acosta Pereira A, Morla R, *et al.* VARIAR study: assessment of short-term efficacy and safety of rituximab compared to an tumor necrosis factor alpha antagonists as second-line drug therapy in patients with rheumatoid arthritis refractory to a first tumor necrosis factor alpha antagonist. *Reumatol Clin* 2016;12:319–322.
- 178 Manders SH, Kievit W, Adang E, *et al.* Cost-effectiveness of abatacept, rituximab, and TNFi treatment after previous failure with TNFi treatment in rheumatoid arthritis: a pragmatic multi-centre randomised trial. *Arthritis Res Ther* 2015;17:134.
- 179 Emery P, Hammoudeh M, Fitzgerald O, *et al.* Assessing maintenance of remission with reduced dose etanercept plus methotrexate, methotrexate alone, or placebo in patients with early rheumatoid arthritis who achieved remission with etanercept and methotrexate: the PRIZE study. *Ann Rheum Dis* 2013;72(Suppl 3):399.
- 180 Smolen JS, Emery P, Ferraccioli GF, *et al.* Certolizumab pegol in rheumatoid arthritis patients with low to moderate activity: the CERTAIN double-blind, randomised, placebo-controlled trial. *Ann Rheum Dis* 2015;74:843–50.
- 181 Tanaka Y, Hirata S, Saleem B, *et al.* Discontinuation of biologics in patients with rheumatoid arthritis. *Clin Exp Rheumatol* 2013;31(Suppl 78):522–7.
- 182 Schett G, Emery P, Tanaka Y, *et al.* Tapering biologic and conventional DMARD therapy in rheumatoid arthritis: current evidence and future directions. *Ann Rheum Dis* 2016;75:1428–37.
- 183 Fleischmann R, Connolly SE, Maldonado MA, *et al.* Brief report: estimating disease activity using multi-biomarker disease activity scores in rheumatoid arthritis patients treated with abatacept or adalimumab. *Arthritis Rheumatol* 2016;68:2083–9.
- 184 Dixon WG, Abrahamowicz M, Beauchamp ME, *et al.* Immediate and delayed impact of oral glucocorticoid therapy on risk of serious infection in older patients with rheumatoid arthritis: a nested case-control analysis. *Ann Rheum Dis* 2012;71:1128–33.
- 185 Hazlewood GS, Barnabe C, Tomlinson G, *et al.* Methotrexate monotherapy and methotrexate combination therapy with traditional and biologic disease modifying antirheumatic drugs for rheumatoid arthritis: abridged Cochrane systematic review and network meta-analysis. *BMJ* 2016;353:i1777.
- 186 Katchamart W, Trudeau J, Phumethum V, *et al.* Methotrexate monotherapy versus methotrexate combination therapy with non-biologic disease modifying anti-rheumatic drugs for rheumatoid arthritis. *Cochrane Database Syst Rev* 2010;(4): CD008495.