



Miscellaneous

Patient awareness and perception of cardiovascular risk in rheumatic and musculoskeletal diseases: results from an international survey

Alessia Alunno^{1,*}, Javier Rodríguez-Carrio^{2,3}, Sander van Leuven⁴, Valentin Ritschl^{5,6}, Valentina Schmolik^{5,6}, Peter Böhm⁷, Francesca Marchiori⁷, Karen Schreiber^{8,9,10}, Dina Husum⁸, Tanja Stamm^{5,6}, Gabriella Szucs¹¹, Fabiola Atzeni¹², Zoltan Szekanecz¹¹, Michael Nurmohamed^{13,14}, EULAR Cardiovascular in inflammatory arthritis (CVIIA) Study Group members[†]

¹ Department of Clinical Medicine, Life, Health and Environmental Science, Internal Medicine and Nephrology Division, University of L'Aquila, L'Aquila, Italy

² Area of Immunology, Department of Functional Biology, Faculty of Medicine, University of Oviedo, Oviedo, Spain

³ Department of Metabolism, Instituto de Investigación Sanitaria del Principado de Asturias (ISPA), Oviedo, Spain

⁴ Department of Rheumatology, Radboud University Medical Center, Nijmegen, The Netherlands

⁵ Institute of Outcomes Research, Center for Medical Data Science, Medical University of Vienna, Vienna, Austria

⁶ Ludwig Boltzmann Institute for Arthritis and Rehabilitation, Vienna, Austria

⁷ EULAR PARE, Zurich, Switzerland

⁸ Danish Center for Expertise in Rheumatology (CeViG), Danish Hospital for Rheumatic Diseases, University Hospital of Southern Jutland, Sønderborg, Denmark

⁹ Department of Regional Health Research, University of Southern Denmark, Odense, Denmark

¹⁰ Thrombosis and Haemostasis, Guy's and St Thomas NHS Foundation Trust, London, UK

¹¹ Department of Rheumatology, Faculty of Medicine, University of Debrecen, Debrecen, Hungary

¹² Rheumatology Unit, Department of Experimental and Internal Medicine, University of Messina, Messina, Italy

¹³ Department of Rheumatology and Clinical Immunology, Amsterdam University Medical Center, Amsterdam, The Netherlands

¹⁴ Department of Rheumatology, Reade, Amsterdam, The Netherlands

* Correspondence to Dr. Alessia Alunno, Department of Clinical Medicine, Life, Health and Environmental Science, Internal Medicine and Nephrology Division, University of L'Aquila, L'Aquila, Italy.

E-mail address: alessia.alunno82@gmail.com (A. Alunno).

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Alessia Alunno, Javier Rodríguez-Carrio, and Sander van Leuven shared first authorship.

[†] EULAR Cardiovascular in inflammatory arthritis (CVIIA) Study Group members

Rabia Agca, Department of Rheumatology, Reade and Amsterdam University Medical Center, Amsterdam, The Netherlands

Miguel Ángel González-Gay, Department of Medicine and Psychiatry, University of Cantabria, Santander, Spain and Division of Rheumatology, IIS-Fundación Jiménez Díaz, Madrid, Spain

George Kitas Department of Rheumatology, Hygeia Hospital, Athens, Greece and University of Birmingham, Birmingham, UK

Sreen Mohamed, Department of Rheumatology and Clinical Immunology Amsterdam University Medical Center & Dept of Rheumatology, Reade, Amsterdam, The Netherlands

Elena Nikiforou, Centre for Rheumatic Diseases, School of Immunology and Microbial Sciences, and Centre for Education, Faculty of Life Sciences, King's College London, London, UK and Rheumatology Department, King's College Hospital NHS Foundation Trust, London, UK

Calin Popa, Department of Rheumatology, Sint Maartenskliniek and Radboudumc Nijmegen, The Netherlands

Hennie G Raterman, Department of Rheumatology, Noordwest Ziekenhuisgroep, Alkmaar, The Netherlands

Ágnes Szappanos, Heart and Vascular Center, Semmelweis University, Budapest, Hungary and Department of Rheumatology and Clinical Immunology, Semmelweis University, Budapest, Hungary

Lai-Shan Tam, Department of Medicine & Therapeutics, The Chinese University of Hong Kong

Caroline van Durme, Department of Rheumatology, Maastricht University Medical Centre +, Maastricht, The Netherlands

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ABSTRACT

Objectives: Inflammatory rheumatic and musculoskeletal diseases (RMDs) are hallmarked by an increased risk of cardiovascular (CV) disease compared with the general population. Evidence suggests that CV risk remains under-recognised and underdiscussed in routine care, although data on patient experience is lacking. We aimed to assess awareness, perceptions, and experiences regarding CV risk and prevention in patients with RMDs.

Methods: An anonymous, online survey was codesigned by rheumatologists, researchers, and patient research partners in English language and translated into 9 languages. This was distributed through patient organisations/forums and social media.

Results: A total of 951 patients with RMDs from 43 countries (mainly females, aged 50–70 years, and with a diagnosis of rheumatoid arthritis, spondyloarthritis, or systemic lupus erythematosus) completed the survey. Although 68% of respondents acknowledged an increased CV risk in RMDs, and traditional CV risk factors were recognised by up to 60% of the participants, knowledge of disease-specific contributors (eg, disease activity) to CV risk was limited. Only 35% of respondents had ever discussed CV risk with a healthcare provider, mainly rheumatologists or cardiologists, and the content primarily focused on lifestyle advice. Lack of awareness on the topic relevance (38%), perceived complexity of the topic (25%), limited time of clinical visits (35%), and lack of informative materials (33%) emerged as the main key barriers among those poorly/not informed.

Conclusions: This large, multinational survey demonstrates substantial gaps in CV risk awareness, knowledge, and patient–provider communication among patients with RMDs. These figures support the development of structured, patient-centred educational strategies and enhanced multidisciplinary communication schemes to improve CV prevention in RMDs.

INTRODUCTION

Compared to the general population, the risk of developing atherosclerotic cardiovascular disease (ASCVD) is increased in many rheumatic and musculoskeletal diseases (RMDs) including rheumatoid arthritis (RA), spondyloarthritis (SpA), psoriatic arthritis, systemic lupus erythematosus (SLE), and Sjögren's disease [1,2]. The increased cardiovascular (CV) risk in patients with RMDs is caused by a complex interplay between traditional risk factors (eg, dyslipidaemia and hypertension) and chronic (auto)-immune inflammation [3] and can even precede confirmation of an imminent RMD diagnosis [4,5].

To reduce the burden of CV in patients with RMDs, the European League Against Rheumatism (EULAR) has developed recommendations to manage CV risk. These recommendations include regular screening and management of risk [6,7]. Unfortunately, recent studies show CV risk factors are still often under-recognised and undertreated in patients with RMD [8,9].

The 2022 update of the EULAR guidelines also acknowledged for the first time that patient education and counselling are important instruments in the management of CV risk in RMDs [7]. Studies preceding these guidelines have previously shown that patient awareness of CV risk is often low. A US survey among 226 patients with SLE, for instance, revealed only 31% of patients recognised SLE as a definite CV risk factor [10]. Similarly, a meta-analysis including 478 patients with RA showed a very high proportion (range 73%–97%) were unaware of an increased risk of developing ASCVD in relation to their RA [11]. Little evidence is available from other RMD populations, and comparisons among studies are challenging. Insufficient patient education is in sharp contrast with the potentially beneficial effects of patient counselling [12–14] and exposes an unmet clinical need.

In the current study, we set out to explore the current knowledge and perceptions of patients regarding the augmented CV risk in RMDs, in general, following the latest EULAR guidelines. In addition, we assessed the personal experiences of patients

regarding discussions with their healthcare providers about CV risk and prevention.

METHODS

An anonymous online survey was codesigned by rheumatologists and patient research partners within the *EULAR CardioVascular Involvement in Inflammatory Arthritis* (CVIIA) study group. The survey was developed in English language ([Supplementary Table S1](#)) and then translated into 9 other languages (Italian, French, Spanish, German, Portuguese, Hungarian, Bulgarian, Dutch, and Danish) using DeepL with a double-check by native-speaker physician and patients. The introductory questions ($n = 7$) of the survey aimed to ascertain the fulfilment of inclusion criteria (age of 18 years or above, a diagnosis of RMD) and to collect general demographic information (age range, biologic sex, country, and socioeconomic status). The first part of the survey included questions ($n = 4$) to explore the knowledge and opinions of respondents on CV risk in RMDs. The second part of the survey included questions ($n = 23$) assessing the personal experience of respondents regarding discussion/advice on CV risk and prevention as well as patient satisfaction. The survey was uploaded to the SoSci Survey platform and distributed via patient associations through emails, social media, newsletters, and forums. Anonymous responses were collected upon survey closure and analysed with IBM SPSS v23. Variables were summarised as number (%) or mean $\pm$ SD, and Chi-square test, analysis of variance with Dunn's post hoc multiple comparison test, or binary logistic regression were applied as appropriate. Descriptive statistics were used to analyse the data. Open-ended answers were translated via DeepL and in case of doubts a double-check by a native speaker was performed. All participants gave their informed consent for the use of their anonymous responses before starting the survey. The study was conducted in accordance with the Declaration of Helsinki, and it was impossible at any time to link responses to individuals. By completing the survey, the patients gave their agreement to the use

WHAT IS ALREADY KNOWN ON THIS TOPIC

- People with inflammatory rheumatic and musculoskeletal diseases (RMDs) have an increased risk of cardiovascular (CV) disease, driven by both traditional risk factors and disease-related inflammation.
- EULAR has published recommendations for assessing and managing CV risk in individuals with RMDs, however the extent to which patients are aware of this topic remain unclear.

WHAT THIS STUDY ADDS

- This international survey shows that only a low number of patients had discussions about CV risk with their rheumatologist and most of the patients was unaware of EULAR recommendations on this topic.
- Lack of awareness that CV risk should be discussed with their rheumatologist, the complexity of the topic and lack of time during clinical visits were identified as reasons to self-rate poorly informed on CV risk and management.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- The knowledge gap identified by this survey highlights the need for targeted educational strategies aimed at empowering patients on this important aspect of their RMD.
- Our findings may inform future EULAR implementation strategies, guideline dissemination approaches, and development of patient-targeted training programs to strengthen CV risk management.

of their anonymous answers for the objectives of the study. Ethical approval was not required because this was patient-led research conducted via patient associations outside the hospital setting, no personal information was collected at any point, participation was voluntary, and respondents could terminate their participation at any point.

RESULTS

The survey was launched on November 25, 2024 and remained open until April 30, 2025. The survey received 1805 initial submissions. Of these, 8 respondents were below the age of 18, whereas 84 reported not having being diagnosed with an RMD and therefore all of them were redirected to the end of the survey. Upon reviewing metadata and response times of the remaining 1713 submissions, 743 responses were identified as

Table 1
Demographic features and reported RMD diagnosis of the 951 survey respondents

Biologic sex	N	%
Female	820	86
Male	124	13
Prefer not to say	7	1
Age (y)	N	%
19-29	38	4
30-49	268	28
50-70	534	56
71 and above	111	12
RMD diagnosis	N	%
Rheumatoid arthritis	390	41
Spondyloarthritis	190	20
Systemic lupus erythematosus	133	14
Psoriatic arthritis	124	13
Antiphospholipid syndrome	124	13
Sjögren disease	38	4
Myositis	29	3
Juvenile idiopathic arthritis	19	2
Polymyalgia rheumatica and/or giant cell arteritis	19	2
Systemic sclerosis	19	2
Still disease	19	2
Gout	19	2
Vasculitis	10	1
Behcet disease	10	1
Other RMD	124	13

RMD, rheumatic and musculoskeletal disease.

bot activity (eg, sub-10 second completion) and therefore removed resulting in a final dataset of 970 verified, human-generated responses from patients with RMDs. Of these, 951 respondents from 43 countries completed the survey, and these data were used for the analysis (Fig 1 and Supplementary Table S2). Patients were mainly females (N = 820, 86%) and mainly aged 50 to 70 years (N = 534, 56%) or 30 to 49 years (N = 268, 29%). Table 1 shows the RMD diagnoses reported by respondents, with RA being the most prevalent disease, followed by SpA and SLE. The mean disease duration was 16 years and regarding the socioeconomic status, 84% of respondents self-positioned in the moderate or high area.

Patient perception about CV risk and prevention

The first part of the survey sought to investigate the perception of respondents regarding the CV burden in people with RMDs. As shown in Figure 2A, although 647 (68%) respondents acknowledged that patients with RMDs have a higher CV risk

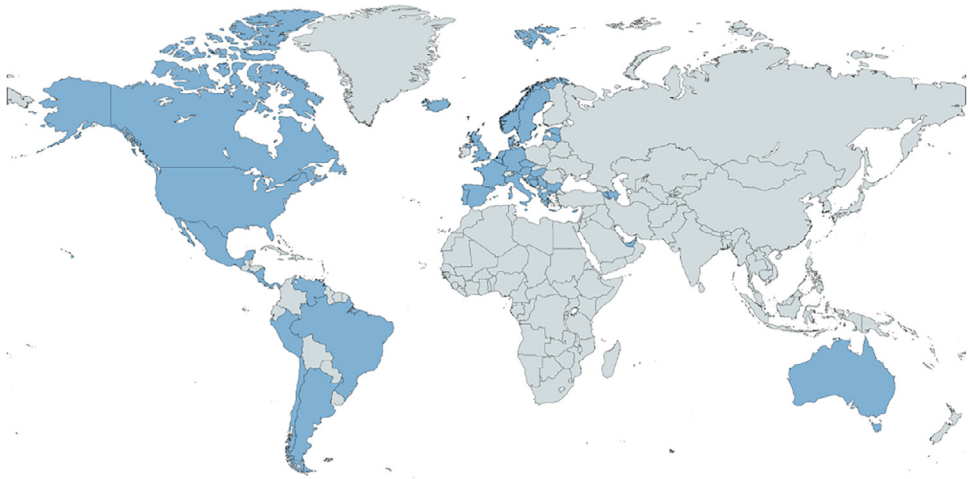


Figure 1. Geographic distribution of the 951 respondents (for details on the number of responses per country, see Supplementary Table S2).

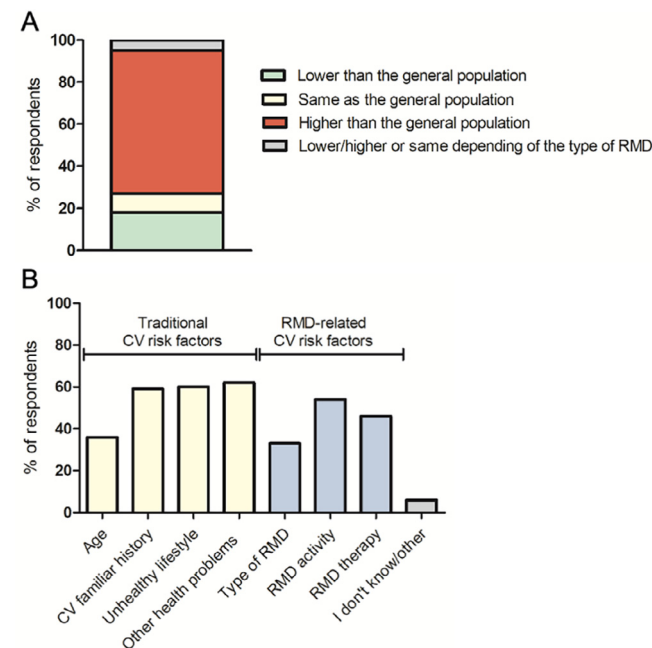


Figure 2. Perception of the 951 respondents regarding the burden of CV risk in patients with RMDs (panel A) and the contribution of traditional or RMD-specific risk factors (panel B). CV, cardiovascular; RMD, rheumatic and musculoskeletal disease.

compared with the general population, 95 (10%) thought that CV risk was either the same or even lower compared with the general population and 171 (18%) of respondents did not know it. Of interest, only less than 5% of respondents selected the option stating that CV risk may be lower, higher or the same as the general population based on the type of RMDs.

These results are in line with those related to the rating of CV prevention importance in patients with RMDs on a 0 to 100 scale (0 = not at all relevant, 100 = highly relevant). In fact, 704 (74%) of respondents provided scores of at least 80/100 or above. We then asked respondents to select which factor(s) could be the cause (or joint cause) of CV risk in people with RMDs. Traditional CV risk factors such as smoking, high cholesterol levels, or family history of CV disease were selected by 59% to 62% of respondents, whereas ageing was seen as a contributor to CV risk only by 36% of respondents. RMD-specific risk factors such as disease activity or pharmacological therapy were selected by only 46% and 54% of respondents, respectively (Fig 2B). Again, the type of RMD was deemed relevant by a small proportion of respondents (33%) (Fig 2B).

Furthermore, only 247 (26%) of respondents stated to be aware that EULAR had issued recommendations on CV risk prevention in RMDs.

Patient experiences and needs on CV risk and prevention

In the second part of the survey, the personal experiences of respondents about previous discussions, if any, about CV risk and prevention with healthcare providers were explored.

Only 333 respondents (35%) reported having discussed at least once with a healthcare provider about CV risk and prevention in RMD, whereas 618 (65%) patients reported no discussion at any time. The discussion mainly involved a rheumatologist (N = 207/333, 62%) followed by cardiologists (N = 152, 46%) and general practitioners (N = 135, 40%). Other healthcare providers, including health professionals, were rarely mentioned.

Discussions mainly occurred during follow-up visits (N = 150, 45%) or both at the time of RMD diagnosis and during follow-up (N = 73, 22%). Of interest, when asked who started the discussion, (N = 123, 37%) of respondents reported that the discussion was started by the healthcare provider all the times, whereas (N = 110, 33%) reported the discussion being started by the patient all the times. 24% of respondents (N = 80) reported that the discussion was started sometimes by the healthcare provider and sometimes by the patient. During the discussion, 60% of patients (N = 200) received advice on lifestyle modification, such as physical activity, stop smoking, and nutrition. 52% (N = 173) received advice on starting CV drugs for the management of traditional risk factors, mainly lipid lowering. However, only 15% of the 333 patients were aware that the healthcare provider had calculated their CV risk during the discussion, and of these, 72% had been informed about the size of their CV risk. Two hundred forty-three (73%) of the 333 patients discussing about CV risk with a healthcare provider confirmed being overall satisfied by that discussion.

Then, we explored in more detail the features and responses of patients based on having discussed or not about CV risk and prevention with a healthcare provider to identify any differences. The 2 groups were comparable regarding gender and type of RMD (all $P > .05$). Not surprisingly, the percentage of patients discussing about CV risk and prevention increased with age being below 20% in patients aged 18 to 29 years and up to 41% in individuals aged 71 or above. Likewise, patients having discussed about CV risk and prevention had a longer disease duration (mean value of 17 vs 11 years, $P < .01$).

Awareness of EULAR recommendations on CV risk and prevention was very poor in patients who never discussed about this matter with healthcare providers (Table 2). However, it was surprising to notice that less than 40% of patients having discussed about CV risk and prevention with a healthcare provider were not aware EULAR recommendations on this topic.

Regarding geographic distribution (analysing countries within the EULAR area and with at least 10 respondents), in some countries the difference between those who discussed and those who did not was striking in one sense or the other, whereas in other the proportions were similar (Supplementary Fig and Supplementary Table S3). However, neither a North-South nor an East-West gradient was observed.

Table 2
Characteristics and opinions of patients with RMDs who discussed or not with a healthcare provider about CV risk in RMDs

Survey items	Discussed		Not discussed		<i>P</i> value
	N = 333		N = 618		
	N	%	N	%	
The role of traditional risk factors					
Age	147	44	235	38	ns
Familiar history	233	70	396	64	ns
Unhealthy lifestyle	240	72	402	65	.03
Other health problems	256	77	402	65	<.001
The role of RMD-specific risk factors on CV risk					
Type of RMD	147	44	198	32	<.001
Type of therapy	200	60	284	46	<.001
Disease activity	240	72	340	55	<.001
Awareness of EULAR recommendations on CV risk and prevention	130	39	117	19	<.001

CV, cardiovascular; EULAR, European League Against Rheumatism; ns, not significant; RMD, rheumatic and musculoskeletal disease.

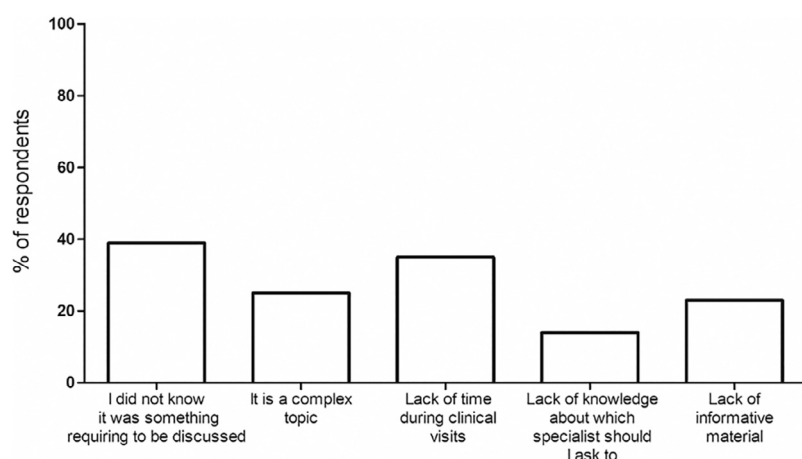


Figure 3. Reasons reported by respondents who perceived to be poorly/not at all informed about CV risk in RMDs (N = 606). CV, cardiovascular; RMD, rheumatic and musculoskeletal disease.

Regarding the impact of traditional risk factors on CV risk, such as family history of CV disease or an unhealthy lifestyle, the awareness was good in both groups of patients regardless of discussion with healthcare providers. Conversely, RMD-related risk factors, the awareness was overall lower compared with traditional risk factors in patients who never discussed about this matter. In addition, these variables were flagged as relevant by a significantly higher number of patients (even beyond 70% regarding disease activity) in the group who discussed CV risk and prevention with a healthcare provider (Table 2). We then asked all the survey respondents whether they ever discussed about CV risk in RMD with individuals outside the medical setting and this was only confirmed by 257 (27%) of them. Among these, the topic was mainly discussed with family members (N = 136, 53%) or other patients (N = 105, 41%). In addition, 200 (21%) of the 951 respondents had accessed information on CV risk in RMDs via other means (eg, television and newspapers).

Finally, we asked all the 951 respondents how well informed on the topic they would rate themselves on a 0 to 10 scale (0 = not at all informed, 10 = very well informed), and only 345 (36% of responders selected a score of 6 or above). Discussion with a healthcare provider was associated, albeit weakly, to higher values of self-rating of the level of information on this topic on a 0 to 10 scale (odds ratio [OR] = 0.94, 95% CI: 0.9–0.98). The same pattern was observed regarding discussion with individuals outside the medical setting (OR = 0.89, 95% CI: 0.85–0.94).

We then explored in more detail the reasons why 606 respondents rated themselves as poorly/not at all informed. As shown in Figure 3, 38% of them stated that they did not know it was required to discuss about this topic, 25% of respondents acknowledged the complexity of the topic as a reason to be poorly informed, whereas 35% of respondents pointed to the lack of time during clinical visits.

We also asked respondents whether they ever had a CV event and if they were receiving any CV therapies at the time of survey completion. A total of 190 respondents (20%) disclosed having had at least one previous CV event. Self-reported CV therapies were summarised in Supplementary Table S4.

DISCUSSION

Our results provide a global picture of patient awareness on CV risk associated with RMDs. Although previous studies had explored this question in the past [13,15–17], these were mainly derived from focus groups or reduced sample size

surveys (ranging from n = 5 to n = 44), included homogenous subsets (that is, RA or SLE only), and came mainly from US or other settings, whereas evidence from European countries was rather scarce. Importantly, our study suggests that lack of awareness seems to be a common hallmark among patients with RMDs, independently of the geographical regions as well as the type of RMDs. Of note, this was even the case in patients receiving CV-related medications, probably representing high-risk or secondary prevention disease subsets, as noticed in our survey. The results of our study are further reinforced by the fact that these figures were obtained in a population that likely represents the ‘best-case scenario’ for health literacy and socioeconomic level (namely, patients affiliated to patient associations and self-positioning mainly in the ‘moderate or high’ socioeconomic area).

Our figures about CV risk perception in RMDs were slightly higher than previous studies [10,13,15–17], which may indicate improved awareness in recent years, although intrinsic survey-related biases (as further discussed in the dedicated section) cannot be ruled out. Nevertheless, even if patient awareness has increased, our survey revealed that patients may not be equipped with proper knowledge to correctly identify the basis of this risk excess and its underlying factors (such as type of RMDs, therapy, or age). Furthermore, few patients were aware of the EULAR recommendations, what may impair the recognition of clinical targets and potential actions to dampen this risk, even despite the high priority score for importance retrieved in our survey. Patient awareness represents a pivotal step to allow consistent screening and treatment adherence by patients, hence strengthening their relevance in this scenario. Taken together, our findings point to the need of boosting this feature and provide patients with better and deeper knowledge on the real picture of CV risk excess and its characteristics in RMDs.

Another remarkable breakthrough from our study was the analysis of the patient perceptions about discussions of CV risk with healthcare providers. Patients reported a surprisingly low frequency of discussions about CV risk, especially considering the recent recommendations [6,7]. Furthermore, the finding that rheumatologists are most of the time the health providers who start the discussion, might identify a knowledge gap among cardiologists and general practitioners regarding CV risk and RMDs. Of note, discussion topics were mostly related to lifestyle factors, whereas only a half of the respondents reported discussions about therapeutic preventive strategies, mostly lipid centred. These findings may relate to the low rates of screening and

treatment figures in RMDs populations reported elsewhere [8,9,18–20]. Keeping into account that respondents discussed CV risk mainly with rheumatologists, our findings about the topic of discussion are in line with the results of a recent survey conducted among rheumatologists regarding awareness on CV recommendations [21]. In more detail, a knowledge gap regarding the management of traditional risk factors with pharmacological treatment has emerged explaining at least in part why discussion topics were mostly related to lifestyle factors.

Another key finding of our survey pertains to the fact that only a negligible proportion of patients reported having discussed CV risk with Health Professionals in Rheumatology (HPR). Although the role of HPR may vary among countries and healthcare structures, HPR are integral for patient education [21]. More importantly, discussions on CV risk have been described to cover different aspects depending on the healthcare provider [13], hence reinforcing their complementary role.

Finally, discussions with other stakeholders beyond healthcare providers and the use of other sources of information or materials were rarely disclosed. This represents a major limitation, in view of the role of patient association and patient peers for (self-)management in people with RMDs, and the potential accessibility of other sources of information. Furthermore, based on these data, the development of high-quality, impactful, and accessible materials to increase CV risk awareness and enable discussions holds promise.

Our survey study also sheds new light into potential barriers and facilitators that may guide implementation in the clinical setting. For recommendations to be successfully implemented, an appropriate management of contextual determinants, including barriers and facilitators of the different stakeholders and levels, is imperative [22,23]. Then, a solid, predefined, and systematic, multilevel strategy founded on collaboration, inclusion, and partnership is warranted.

Our study showed low knowledge of EULAR recommendations by patients, even those who discussed about CV risk with healthcare providers, and others observed the marginal uptake of these recommendations in clinical practice [24].

Among respondents perceived as poorly/insufficiently informed, lack of realisation about the relevance of this topic, lack of time, and lack of informative materials were identified as predominant barriers. However, patients overall conferred a high priority for this topic, a relatively good proactivity to initiate discussions, and increasing (although yet suboptimal) awareness statistics. This aligns with the high willingness to participate in risk factor screening and treatment programmes if instructed to do so [25]. Collectively, several implementation objects emerged after this analysis, namely, (i) patient education, (ii) training to providers, and (iii) communication/coordination tools. As mentioned above, collaboration, inclusion, and partnership are the foundations to build these strategies and ensure their success. A key aspect is fully embracing the principle “Nothing about me without me”, namely involving patient representatives throughout all the phases. In addition, multidisciplinary collaborations that are already in place for the development of EULAR recommendations in this area would be instrumental also in the implementation phase. As an example, the European Heart Network, the European Atherosclerosis Society, and the European Society of Cardiology would be essential partners in improving CV prevention in clinical practice.

When working together to achieve these goals, it is imperative to develop new, specific tools for these implementation objects, due to a number of reasons. First, the sparsity of

consistent instruments in current practice was noted. Second, specific tools are essential to maximise the effect, and to induce behaviour change [12]. Third, it would be important to develop flexible instruments that will allow the adaptation to different diseases and contexts, including mesolevels and microlevels. Finally, communicating future risks and the need of preventive therapies requires a shift in the approach that the patients are usually receiving (drugs required to alleviate symptoms that they are already experiencing) [26], hence precluding the use of existing instruments for (index) disease management. Consequently, and also based on the implementation objects, the need to provide optimal patient education poses a major challenge in this scenario. It is important to note that the adoption of patient education schemes has yielded significant effects in other CV settings [27,28]. Evidence is modest in RMDs, with a small pilot study in RA having been published [29], thereby reinforcing the need to deliver dedicated resources for patients with RMDs in general. Again, it is crucial to develop such resources *de novo*, and avoid adapting or applying resources for other target audiences, as patients are known to have different interests than doctors or HPR in rheumatology [30,31]. Furthermore, technological advances offer increased possibilities to use digital tools like apps or chatbots to facilitate remote monitoring of CV health. In fact, tailoring education programmes to patient needs and disease course must be considered [32], hence supporting our approach to collect patient needs and perceptions. Finally, evaluation frameworks should be conceived, in conjunction with implementation objects. Notably, other domains of the process model (related to methodological and dissemination features and the organisation) show a considerable promise to progress towards the implementation roadmap, according to similar initiatives [33].

Our study displays some limitations deserving to be discussed. First, self-reported data presents difficulties due to potential memory and selection bias and lack of verification through medical records may affect accuracy. Furthermore, the distribution of the questionnaire in patient organisations and self-help groups may account for a significant selection bias, meaning that the majority of respondents have a better health literacy and health awareness compared with the average population. In addition, over 80% of respondents self-positioned in the ‘moderate or high’ socioeconomic area. However, although we acknowledge the weight of the selection bias on the interpretation of results, somehow this also reinforces the relevance of our findings and may allow us to speculate that an even poorer CV education in the general RMD population with lower health literacy levels and experiencing lower socioeconomic conditions. In this regard, another valuable learning outcome of our survey is the need to develop strategies that fully capture the patient heterogeneity, such as targeted campaigns or specific adaptations. Other limitations are low participation from some countries and partial coverage of language translations for certain regions. On this basis, although the study encompasses a wide demographic, certain subgroups may be underrepresented and the lack of qualitative data does not allow us to give the patient ‘voices’ behind the statistics. In addition, since this project stemmed from an EULAR Study Group, we performed a more detailed analysis in respondents from the EULAR area and therefore comparisons with other geographical areas, such as the US, were not performed.

Nonetheless, our survey study has the strength to fully embrace the principle ‘Nothing about me without me’ being involving patient representatives from the very beginning of the project, including survey design, language and cultural

adaptations, interpretation, and discussion, according to the latest evidence [34]. Consequently, patients were not just the focus of this survey, but a leading force with a central role throughout the project. This represents a major landmark of our study, as patient involvement has been largely neglected in this topic. This approach has certainly helped us to delve into certain aspects and identify certain objects that hold promise to warrant future implementation strategies. In this sense, we consider that the role of patient research partners would be instrumental in assisting and coleading this process. This notion is supported by the output of our survey itself, and also by recent literature on peer coaches [35,36]. In fact, contemporary evidence has reinforced the role of patients in shaping accessibility, inclusivity, and impact of patient education resources in the setting of SLE [17]. Collectively, these lines of evidence encourage the involvement of diverse patient populations to achieve our goal.

In conclusion, although CV risk management and monitoring in RMDs have evolved in recent decades [1,6,7], less attention has been paid to the role of patient perceptions and preferences. To the best of our knowledge, this is the largest study conducted on patient perceptions in CV risk, and the first multinational study addressing this topic. Our study identified that limited awareness about elevated CV risk may be a common hallmark among patients with a broad range of RMDs, with significant gaps in identifying disease-specific factors underlying risk excess. The findings herein presented identify several unmet needs in this scenario, and inform potential aspects to guide implementation strategies. This evidence represents an overarching step in gaining understanding towards this situation, but also to close the gap between recommendations and real-world care. Remarkably, after developing the first RMD-specific clinical recommendations, this project moves forward by characterising patient preferences at the international level, hence strengthening the pioneering work under the EULAR umbrella in this setting.

Competing interests

All authors declare they have no competing interests.

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Contributors

This study was designed by AA, JR-C, SvL, PB, FM, and MN. The data were collected and analysed by AA, JR-C, SvL, VR, VS, TS and the results were critically examined by all authors. AA, JR-C, and SvL had a primary role in preparing the manuscript, which was edited by VR, VS, PB, FM, GS, FA, ZS, MN, KS, and DH. All authors and collaborators have approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Orcid

Alessia Alunno: <http://orcid.org/0000-0003-1105-5640>

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