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ORIGINAL RESEARCH

Procedures for the content, conduct and format of EULAR/PReS paediatric musculoskeletal ultrasound courses

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ABSTRACT

Background Despite the worldwide increasing request of education on paediatric musculoskeletal ultrasound (PedMSUS), content, conduct and format of PedMSUS courses have never been internationally agreed.

Objectives To produce educational procedures for the conduct, content and format of EULAR/PReS PedMSUS courses.

Methods After a systemic literature review and expert opinion collection, a panel of items for the development of procedures on PedMSUS courses was identified. Agreement on the items was assessed through Delphi surveys among a taskforce of 24 members, which included 18 experts in PedMSUS (8 rheumatologists, 1 radiologist, 9 paediatric rheumatologists), 1 methodologist and rheumatologist expert in MSUS, 2 patient research partners, 1 health professional in rheumatology and 2 EMEUNET/EMERGE members, from 8 different European countries. Each item was assessed through a 5-point Likert scale (0, full disagreement; 5, full agreement); agreement was reached for ≥75% of answers rating 4–5. All items with agreement were included in the preliminary core set of educational procedures, which underwent external assessment by a broader Consensus group (Faculty and Tutors of previous EULAR PedMSUS courses and PReS Imaging Working Party members), through Delphi survey.

Results Two Delphi surveys produced the preliminary core set of procedures for basic, intermediate, advanced and teach-the-teachers (TTT) PedMSUS courses. A Delphi survey within the Consensus group produced agreement on the proposed procedures.

Conclusions Shared EULAR/PReS procedures for the conduct, content and format of basic, intermediate, advanced and TTT PedMSUS courses were identified on international basis.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Despite the flourishing of paediatric musculoskeletal ultrasound (PedMSUS) courses on international ground in the recent years, the content, conduct and format of such courses have never been internationally agreed so far. The current project is the first one dealing with the need of international standardised, high-level education in PedMSUS.

WHAT THIS STUDY ADDS

⇒ The study produced shared procedures for the content, conduct and format of PedMSUS courses, through the involvement of physicians with different background, health professionals in rheumatology and patient research partners, from all over the world.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE AND/OR POLICY

⇒ The results of the project provide a number of procedures that will efficiently support the fruitful organisation of future PedMSUS courses at high level of standardised education, for successful training on an increasingly requested imaging technique.

INTRODUCTION

The potentialities of musculoskeletal ultrasound (MSUS) in the evaluation of children with arthritis have been widely acknowledged in the recent years, as confirmed by the blooming of literature on the topic.[1–6] The quality advances in the resolution of small and superficial structures, along with the decrease in costs of US equipment and concomitant wider accessibility, spread its use in the clinical setting, enhanced its potential role in research and led to an increasing need for specific education on paediatric MSUS (PedMSUS), among a variety of specialists, ranging from paediatric and adult rheumatologists to radiologists and physiotherapists.[7–10]

Since 2007, lectures on MSUS in children have been included in the advanced level of the EULAR Sonography Courses and, since 2012, several EULAR endorsed PedMSUS courses have been held. More recently, two joined EULAR/PReS (Paediatric Rheumatology European aSsociation) PedMSUS courses took place in Madrid, in 2017 and 2019, respectively, with much appreciation

by participants as well as by faculty members and tutors. These educational events demonstrated the effectiveness of joined efforts of EULAR ultrasound experts and teachers, who holds a long-lasting MSUS educational experience,[11–15] and the younger PReS ultrasonographer community, who is particularly aware of the peculiar US features and changes in joints at different paediatric ages, entailing absolutely specific issues in PedMSUS training.[16–26] Further, they highlighted that the variability in background (certified education) and experience in PedMSUS in different countries has a relevant impact on the quality of the courses. Nonetheless, content, conduct and format of PedMSUS courses have never been internationally agreed so far.

The purpose of the project was to produce practical and educational procedures for the conduct, content and format of different levels of EULAR/PReS PedMSUS courses (ie, basic, intermediate, advanced and teach-the-teachers (TTT) level), to ensure high-quality and homogeneous training by an international consensus.

METHODS

Study design

The convenors (EN, SM-M), EULAR Methodologist (MAD'A) and project Fellow (VM) (Core Team) led a multidisciplinary Taskforce, in accordance with the EULAR standardised operating procedures.[27] The Taskforce was composed of 24 members from 8 different countries and included PedMSUS experts (8 rheumatologists, 1 radiologist, 9 paediatric rheumatologists), 1 methodologist and rheumatologist, 2 patient research partners previously involved in PedMSUS projects/educational events,[28] 1 health professional in rheumatology (HPR) and 2 EMEUNET (EMerging EULAR NETwork)/PReS EMERGE (EMErging RheumatoloGists and rEsearchers) members.

A Consensus group was recruited among faculty members and tutors of previous PedMSUS courses, PReS Imaging Working Party members, colleagues and fellows with interest in PedMSUS education on Taskforce members' knowledge. It included 114 people from 29 countries all over Europe, North America, South America, Central America, Asia and Africa.

The project was developed in three main phases, as summarised in figure 1.

Questionnaire design

In the initial step, a systematic literature and events review, including extensive search on educational projects/events regarding PedMSUS on websites and networks, was performed in December 2018. The search engines consulted were: PubMed, Cochrane, Embase, ERIC, Medline, CINAHL complete, Google, Yahoo, Ask, Baidu, Bing, Lycos, Duckduckgo. The keywords entered were: "musculoskeletal", "ultrasound", "sonography", "course", "education", "training", "children", "paediatrics", "pediatrics". Only courses/events, articles and

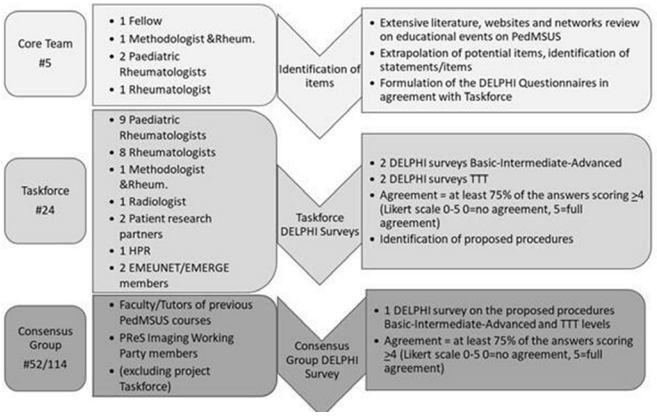

Figure 1 Summary of the three study phases. TTT, teach-the-teachers

books in English were considered. No articles neither books on educational recommendations for the content, conduct and format of PedMSUS courses were found. A total of 17 PedMSUS courses were identified: five were not in English language; additional two online courses and three residential were not consistent with the purpose of our task, and were excluded. The literature review was extended (ELR) with inclusion of courses of Taskforce's knowledge with available complete information (n=1). Eight courses were finally included for the analysis (figure 2).

The documentation retrieved was registered according to three main areas: content, conduct and format (table 1). Descriptive analysis was performed and results discussed online within the Taskforce for the selection of items on each area to be investigated (qualitative Delphi).[29] Final drafts of the questionnaires for the different level of competency PedMSUS courses were approved online by the Taskforce.

The questionnaire dealing with basic, intermediate and advanced PedMSUS courses was composed of 121 questions divided into three sections, according to the areas of content, conduct and format.

The conduct section comprised: educational model, distribution between theoretical and practical part, number of participants per teacher in practical sessions, type of models to be included in the practical part, course duration and hours distribution per day. The educational model ranged among these possibilities: two-level education (basic, advanced), three-level education (basic, intermediate and advanced), two-level education and/or additional courses on selected subjects. that is, focused courses. Three options were identified regarding the distribution between theoretical and practical part: 50%–50%, 40%–60%, 30%–70%. The questions about the number of participants per teacher in practical sessions included three options: four, five or six course participants. Healthy children or patients were the two possibilities offered for models in the practical sessions. The hours distribution per day provided three options:

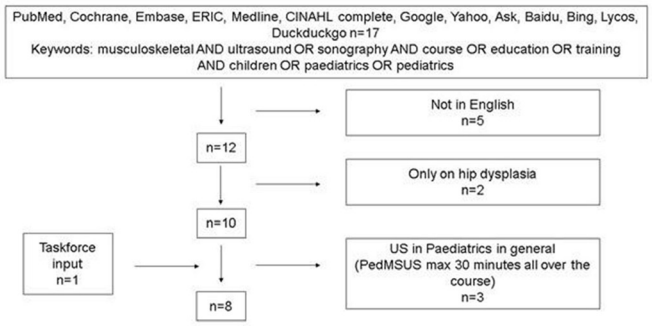

Figure 2 Flow chart of the extended systematic literature and events review. PedMSUS, paediatric musculoskeletal ultrasound.

20 hours over 2 days, 20 hours over 3 days or 24 hours over 3 days.

The content section offered 46 questions about the topics that should have been treated respectively in the basic, intermediate and advanced level.

The format section included: course timing, requirements and/or restrictions for the participants, prerequisites for faculty and tutors, and certification of competency. Questions on residential/live courses vs or combined with complementary online courses, and on courses to be placed prior to or apart the annual PReS or EULAR congress composed the course timing part. The requirements and restrictions for the participants comprised: allowed specialty of course attendants (paediatric rheumatologists, adult rheumatologists, radiologists), attendance to previous MSUS courses (certification on current MSUS education), minimum and maximum time from previous MSUS course for acceding to higher level of competency course (evaluation of adequate time for practising and potential need of refreshing), number of MSUS scans performed per week (current practical status). Thirteen questions regarded faculty members /tutors prerequisites and included the possibility of being rheumatologists or paediatric rheumatologists highly expert in PedMSUS, the status of EULAR or PReS members, the years of experience in PedMSUS, the number of PedMSUS scans per week, the attendance to TTT and/or EULAR MSUS advanced courses, and the achievement of national/international certification for teaching MSUS. With regard to the certification of competency, the following options were given: if required or not (yes/no answer), and, if required, whether it should be obtained in attending the full course, in successful assessment of theoretical and practical skills and/or in passing a final examination.

The Delphi questionnaire regarding the TTT course included: content and evaluation of premeeting preparation; proportion between theoretical and practical part; duration of the course (options: 1,5 and 2 days); faculty's features; timing (options: just prior the EULAR Congress and just prior the PReS Congress); evaluation of teaching skills and TTT competency assessment.

Table 1 Summary of the main features of the eight PedMSUS courses analysed for developing of the survey questionnaires (I phase of the project)

n.	PedMSUS edition, location	Year	Duration (days)	Max No Attendees	No Faculty	No Tutors	Frontal lessons, hours (%)	Practical sessions, hours (%)	Fee (€)
1	PedMSUS course, Madrid—Spain	2012	3	50	14	14	9 (56)	7 (44)	NS
2	Fourth musculoskeletal sonography course for rheumatologists—basic level paediatric course, Belgrade—Serbia	2013	3	40	18	13	9 (56)	7 (44)	800*, 600†
3	Fifth musculoskeletal sonography course—basic level paediatric rheumatology, Belgrade—Serbia	2015	3	40	21	9	9 (56)	7 (44)	800*, 600†
4	Musculoskeletal ultrasound course basic paediatric, Bucharest—Romania	2016	3	36	10	13	9 (56)	7 (44)	850*
5	24th EULAR ultrasound course—PReS paediatric musculoskeletal course, Madrid—Spain	2017	3	50	34	15	9 (56)	7 (44)	1600*
6	Musculoskeletal ultrasound in paediatric patients, Aarhus—Denmark	2018	2	20	3	4	8 (57)	6 (43)	SS
7	PedMSUS course, Antalya—Turkey	2018	3	60	11	11	7 (50)	7 (50)	950*
8	PedMSUS course, Lisbon—Portugal	2018	3	50	11	17	9 (56)	7 (44)	1100*, 800†, ‡

*Accommodation, meals and coffee breaks included.
†Accommodation excluded.
‡Dinners excluded.
NS, not specified; PedMSUS, paediatric musculoskeletal ultrasound; PReS, Paediatric Rheumatology European Association; SS, supported by sponsors.

Internal consensus

In the second phase, the taskforce members tested internal agreement on each item of the questionnaires (5-point Likert scale: 0, full disagreement; 5, full agreement) through a Delphi technique, by online survey (SurveyMonkey). Free text space for comments and suggestions was available. Email reminders were sent after 1 month and then every 2 weeks for 2 months. Agreement was reached for ≥75% of answers rating 4–5. An additional questionnaire was planned for items with moderate consensus in the first Delphi, defined as 50%–75% of answers rating 4–5.

External consensus

All items with agreement within the Taskforce merged into the preliminary core set of procedures, which were tested for external agreement among the Consensus group. An explanatory and motivating letter introduced the online SurveyMonkey for recruiting answers as much as possible. Email reminders were sent every week for 6 weeks. Agreement and moderate consensus were defined as previously described.

Patient and public involvement

As above mentioned, two patient research partners were recruited in the Taskforce among young adults with juvenile idiopathic arthritis involved in previous international PedMSUS projects or educational events, who were motivated in improving educational PedMSUS courses, could understand and interact with the other Taskforce members. They provided their critical input and experience in the development, drafting and approval of the questionnaires for the different level of competency of the PedMSUS courses.

Due to the peculiarity of the topic, no additional public involvement was considered appropriate.

Analysis

Descriptive analysis was performed on the results of the ELR. Results from the Delphi survey were described as percentages.

RESULTS

Preliminary set of procedures

For the basic, intermediate and advanced courses questionnaires, the Taskforce response rate was of 92% (22 out of 24) in the first Delphi survey and 82% (18 out of 22) in the second one. In the first survey, a total of 70 items/procedures reached agreement: 17 for the basic level, 27 for the intermediate level and 26 for the advanced level. Sixty-eight procedures obtained moderate consensus (15 for the basic, 22 for the intermediate and 31 for the advanced level). In the second survey, the items/procedures with previous moderate consensus reached agreement in 44, respectively distributed in 13 for the basic, 10 the intermediate and 11 the advanced level.

Of note, for the basic level agreement was found in including colour/power Doppler physics and technology, and their application, indications and limitations in PedMSUS; however, optimisation of colour/power Doppler settings and artefacts, detection of synovial and entheseal inflammation, assessment and quantification of structural joint damage and US-guided intra-articular injections were excluded. Update on PedMSUS in paediatric rheumatology and the role of US in paediatric rheumatic diseases (PRDs) other than juvenile idiopathic arthritis were worthy to be content of the intermediate and the advanced level, respectively.

The preliminary set of procedures in basic, intermediate and advanced PedMSUS courses also included: a three-level education model (basic, intermediate and advanced), courses placed prior to the annual PReS and EULAR or joined EULAR/PReS congresses, proportion between theoretical and practical part of 50%–50% for basic courses and 40%–60% for intermediate courses, a maximum of 4 participants per tutor in practical sessions; healthy children as models at the basic course, whereas at the intermediate and the advanced courses models should be represented by patients with 2 years of age or more; courses may be attended by paediatric rheumatologists, adult rheumatologists as well as radiologists; faculty members and tutors should fulfil prerequisites and have successfully attended EULAR MSUS TTT courses or an equivalent one; basic, intermediate and advanced courses should include a certification of competency, obtained by attending the full course, successful assessment of theoretical and practical skills and passing the final exam.

With regard to the TTT course, the Taskforce response rate was 86% and 73%, in the first and second survey, respectively. Agreement was found in 11 out of 25 the items/procedures at the first survey, with concomitant moderate consensus on 9. Six out of these nine reached agreement in the second round. Among the procedures for the TTT level were the following: courses should be held just prior to the EULAR congress and linked to the EULAR/PReS Sonography course; the theoretical part should include how to prepare and deliver educational material, how to organise a PedMSUS course and how to conduct a practical session; practical and theoretical part in TTT should respectively cover 50% of the course; two types of certificate should be provided, namely a certificate of attendance and a certificate of successful achievement of competency.

All the levels of PedMSUS resulted with full agreement if residential, with complete no agreement on combination with introductory or focused virtual webinars. Finally, the proposed procedures included that they should be organised prior the EULAR or the PReS or the joined EULAR/PReS annual congresses and excluded to be separate events during the year; the few open comments highlighted the increased costs for participants in attending separate educational events in the same year. Moderate or even less consensus was found for the course duration, hours distribution per day and the time frame between courses for all the different levels of

Table 2 Final set of procedures and items to be considered for the basic, intermediate, advanced and teach-the-teachers (TTT) paediatric musculoskeletal ultrasound (PedMSUS) courses

	Item/procedure	Level of agreement (%)
Basic	Content	
	Application, indications and limitations of PedMSUS in paediatric rheumatology	98
	Ultrasound physics and technology	96
	Sonographic pattern of the different musculoskeletal tissues	100
	PedMSUS artefacts and pitfalls	100
	Colour and power Doppler physics and technology	80
	Application, indications and limitations of colour and power Doppler in PedMSUS	88
	Sonoanatomy of musculoskeletal tissues in children only ≥2 years old	88
	Standard sonographic scan of the shoulder, elbow, wrist, hand, hip, knee, ankle and foot	98
	Reporting ultrasound (US) findings and diagnosis	84
	Joint synovitis	90
	Joint effusion	92
	Synovial hypertrophy	90
	Format	
	Distribution between theoretical and practical part: 50%–50%	75
	Number of participants per teacher in practical sessions: 4	94
	Models used during the practical part: healthy children	87
	Residential/live courses	98
	Courses placed prior to the annual PReS congress	92
	Courses placed prior to the annual EULAR congress	82
	Courses placed prior to the joined EULAR/PReS congress	88
	Conduct	
	Participants could be also (adult) rheumatologists	84
	Participants could be also radiologists	79
	Participants could be also paediatric radiologists	92
	No prerequisites (attendance to previous courses, minimum period from eventual previous courses, no of scans already performed) for attending the basic PedMSUS course	82
	The basic course should include a certification of competency	75
	The certificate of competency should be obtained in attending the full course	87
	The certificate of competency should be obtained in successful assessment of theoretical and practical skills	82
	The certificate of competency should be obtained in passing the final exam	75
Intermediate	Content	
	Application, indications and limitations of PedMSUS in paediatric rheumatology	88
	PedMSUS artefacts and pitfalls	86
	Colour and power Doppler physics and technology	73*
	Application, indications and limitations of colour and power Doppler in PedMSUS	82
	Use of the colour and power Doppler settings	91
	Optimisation of colour and power Doppler settings	98
	Colour and power Doppler artefacts	98
	Use of colour and power Doppler to detect synovial and entheseal inflammation	100
	Reporting US findings and diagnosis	98
	US-guided periarticular and intra-articular injections	82
	Joint synovitis	98
	Joint effusion	93
	Synovial hypertrophy	95

Continued

Table 2 Continued

	Item/procedure	Level of agreement (%)
	Bursitis	100
	Tenosynovitis	100
	Tendon calcification	93
	Enthesopathy	100
	Tendinosis	93
	Articular cartilage lesions	93
	Bone erosions	98
	Assessment and quantification of synovial, tenosynovial and entheseal inflammatory activity	95
	Update on PedMSUS in paediatric rheumatology	91
	Format	
	Distribution between theoretical and practical part: 40%–60%	87
	Number of participants per Faculty/tutor in practical sessions: 4	91
	Models used during the practical part: patients	98
	Residential/live courses	98
	Courses placed prior to the annual PReS congress	91
	Courses placed prior to the joined EULAR/PReS congress	93
	Conduct	
	Participants could be also (adult) Rheumatologists	86
	Participants could be also Radiologist	82
	Participants could be also Paediatric Radiologists	91
	The attendance to previous courses should be a prerequisite for attending the intermediate PedMSUS course	84
	The number of years of previous PedMSUS practice should be a prerequisite for attending the intermediate PedMSUS course	64*
	The number of MSUS scans performed should be a prerequisite for attending the intermediate PedMSUS course	75
	There should be a minimum period of 1 year for practising PedMSUS before the intermediate course	69*
	The intermediate course should include a certification of competency	75
	The certificate of competency should be obtained in attending the full course	84
	The certificate of competency should be obtained in successful assessment of theoretical and practical skills	89
	The certificate of competency should be obtained in passing the final exam	75
Advanced	Content	
	Application, indications and limitations of colour and power Doppler in PedMSUS	75
	Optimisation of colour and power Doppler settings	75
	Use of colour and power Doppler to detect synovial and entheseal inflammation	91
	Reporting US findings and diagnosis	89
	Assessment and quantification of structural joint damage	100
	US-guided periarticular and intra-articular injections	95
	Bursitis	91
	Tenosynovitis	93
	Tendon calcification	93
	Enthesopathy	93
	Tendinosis	91
	Articular cartilage lesion	91
	Bone erosions	91
	Complete and partial tendon tear	93

Continued

Table 2 Continued

	Item/procedure	Level of agreement (%)
	Peripheral nerve entrapment and lesions	91
	Ligament lesions	93
	Fibrocartilage lesions	95
	Myopathy	82
	Myositis	93
	Muscle injury	83
	Soft tissues masses	77
	Foreign bodies	80
	Assessment and quantification of synovial, tenosynovial and entheseal inflammatory activity	95
	Role of US in paediatric rheumatic diseases other than chronic arthritides (scleroderma, dermatomyositis, vasculitis, etc)	97
	Uncommon sonographic pathological findings in paediatric rheumatology	93
	PedMSUS technological development	95
	Three-dimensional MSUS	70*
	Update on PedMSUS in paediatric rheumatology	98
	PedMSUS research and methodology	95
	Format	
	Number of participants per Faculty/tutor in practical sessions: 4	93
	Models used during the practical part: patients	100
	Residential/live courses	97
	Courses placed prior to the annual PReS congress	89
	Courses placed prior to the joined EULAR/PRES congress	93
	Conduct	
	Participants could be also adult rheumatologists	84
	Participants could be also radiologists	86
	Participants could be also paediatric radiologists	95
	The attendance to previous courses should be a prerequisite for attending the advanced PedMSUS course	93
	The number of years of previous PedMSUS practice should be a prerequisite for attending the advanced PedMSUS course	70*
	The number of MSUS scans performed should be a prerequisite for attending the advanced PedMSUS course	80
	The advanced course should include a certification of competency	95
	The certificate of competency should be obtained in attending the full course	91
	The certificate of competency should be obtained in successful assessment of theoretical and practical skills	93
	The certificate of competency should be obtained in passing the final exam	88
TTT	Content	
	The theoretical part of the TTT Ped-course should include teaching in how to prepare and deliver educational material in PedMSUS courses	98
	The theoretical part of the TTT Ped-course should include teaching in how to organise PedMSUS courses	93
	The lectures on how to organise a course given by the Faculty members of the TTT Ped-course should contain subjects on preparing a programme according to EULAR/PReS guidelines, financial aspects, recruiting models/patients and testing participants	93
	The practical part of the TTT Ped-course should include teaching in how to conduct a practical session in PedMSUS courses	93
	The participants should demonstrate their teaching skills by giving a representative lecture on a topic included in the EULAR/PReS basic level course and conducting a practical session on basic scanning technique during the TTT Ped-course	89
	The presentations sent and given during the TTT Ped-course by the Participants of the TTT Ped-course should include their own US images	88

Continued

Table 2 Continued

Item/procedure	Level of agreement (%)
The presentations sent and given during the TTT Ped-course by the participants should include didactic anatomical images	93
The presentation sent and given during the TTT Ped-course by the participants should show scanning technique, normal and basic pathological US findings at the assigned anatomic area or at different joint sites if applicable	95
When demonstrating practical teaching skills the participants should interact with participants, ask open questions and actively guide them in a positive way	98
Format	
The distribution between the practical and theoretical part in the TTT Ped-course should be 50%–50%	86
The TTT Ped-course should be placed just prior to the EULAR Congress and linked to the EULAR/PReS sonography courses	93
The Faculty of the TTT Ped-course should mostly include Paediatric Rheumatologists highly expert in MSUS and highly involved as Faculty members in the EULAR/PReS Sonography courses but may include other colleagues highly expert in education in MSUS	91
Conduct	
Two types of certificate should be provided to the TTT Ped-course participants: a certificate of attendance and a certificate of successful competency assessment	75
The certificate of successful competency assessment for the TTT Ped-course will be provided if the participants fulfil the following: (1) attendance to the full course; (2) successful assessment of theoretical and practical skills by the faculty members	98
The competency assessment for the TTT Ped-course should be performed during the course by assessing theoretical and practical skills of the participants by the faculty members	95
The competency assessment for the TTT Ped-course should include assessment of theoretical and practical skills of the Participants during the course by the faculty members and a final exam on teaching capabilities	89
Before the course the TTT Ped-course faculty members provide a feedback on the presentations that the participants will deliver during the course	93

*Moderate agreement, >50 and <75%.
MSK, musculoskeletal; MSUS, musculoskeletal ultrasound; PReS, Paediatric Rheumatology European Association.

competency; hence, this items were not included in the preliminary set of procedures.

Final set of guidelines

The Consensus group response rate in the Delphi survey on the proposed guidelines was of 52 out of 114 (46%). Table 2 shows the agreement on the proposed guidelines for each level of competency. Due to the very high level of agreement, an additional Delphi survey was not required.

DISCUSSION

The recent technological improvement and increased accessibility of PedMSUS led to a terrific demand for education on its appropriate performance and use, which entails peculiar issues, not only with regard to the sono-anatomy changes in children during growth, but also in the education delivering.[29 30] As sonographer, the paediatric rheumatologist has the exclusive advantage of correlating the overall clinical assessment with imaging findings in an integrated way to enhance clinical assessment and thus optimise the management of children with rheumatological diseases.[31 32] Similarly to all imaging evaluations, PedMSUS is highly dependent on the operator expertise, which in this case is mainly due to the implicit real-time nature of the image acquisition and immediate interpretation of findings.[33–36] Therefore, accurate knowledge and high-level training are mandatory for a correct scanning and accurate and reliable image interpretation. The present project provides shared procedures for guiding the organisation of PedMSUS courses at different levels of competency, through the involvement of an international panel of partners in the project Taskforce and the extension to an even wider community in the Consensus group. To the best of our knowledge, this represents the first task that have encompassed experts in MSUS in adults with rheumatic diseases and sonographers with specific knowledge in PedMSUS for fostering high level education on PedMSUS, with the contribution of health professionals and young adult patients with experience in such educational events.

Of note, almost all the preliminary procedures reached high (≥75%) agreement in the Consensus group, with the sole exception of 5 out of 129 (0.04%), that reached moderate agreement (≥50%, <75%). For none of the proposed guidelines was observed disagreement. Despite the relatively low response rate in the Consensus group, the results appear quite strong in their global homogeneity.

Interestingly, the final guidelines included several items on colour and power Doppler modality in the basic course, with insights on physics and technology, application, indications and limitations in PedMSUS, which in previous international (ie, EULAR/ EULAR-PReS) courses have been treated more in general at the basic level of competency. Indeed, this result is in line with the current trend in improving more and more the sensitivity of depiction of increased or abnormal vascularity, particularly relevant in the overall much vascularised paediatric joint structures.[37] Conversely, US-guided injection guidelines were not included in the basic level content, but only in the intermediate and advanced ones. As expected, for intermediate and advanced courses, training on specific anatomic structures and their abnormalities was much more detailed than in the basic one. Notably, in both intermediate and advanced levels very high agreement was observed for updating on PedMSUS in paediatric rheumatology (91% and 98%, respectively) and on the role of US in PRDs other than chronic arthritides (97% in the advanced course), enhancing the paramount interest in PedMSUS and its application in the broad spectrum of PRDs, and not only in juvenile idiopathic arthritis, as frequently outlined in the recent years.[38–43]

All levels of PedMSUS should be residential; however, since the Delphi surveys were performed just at the initial stages of the COVID-19 pandemic, other education tools (introductory webinars, focused online courses), though proposed in the initial questionnaires, might not have been taken into the same consideration they may deserve now.[44] The Consensus group also showed agreement in organising PedMSUS courses just prior the EULAR or the PReS or the joined EULAR/PReS Meetings, likely due to the dampening of expenses in joined events.

Since the project was performed across the COVID-19 pandemic waves, we might have not captured responses from colleagues that have been meaningwhile committed to the emergency, thus lowering the response rate of our Consensus group. We are not able to solve the concern; nonetheless, the global very high agreement from the responders supplies solidity to our results.

In conclusion, the present EULAR/PReS project provides internationally shared procedures for content, conduct and format of PedMSUS courses, which will surely offer an efficient support in the fruitful organisation of future educational events on this topic.

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Contributors SM-M, JV, MAD'A and EN conceived, designed and planned the project. SM-M, VM performed the SLR, provided acquisition and interpretation of data. SMM, VM and DPM performed the analysis and wrote the manuscript. JV, MAD'A and EN supervised the project. All Authors contributed to the interpretation of the results and to the critical revision of the manuscript.

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