Crowdsourcing trainees in a living systematic review provides valuable experiential learning opportunities: A mixed-methods study

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Abstract:

Objective: To understand trainee experiences of participating in a living systematic review (LSR) for rheumatoid arthritis, and the potential benefits in terms of experiential evidence-based medicine (EBM) education.

Study Design and Setting: We conducted a mixed-methods study with trainees that participated in the LSR who were recruited broadly from training programs in two countries. Trainees received task-specific training and completed one or more tasks in the review: assessing article eligibility, data extraction, quality assessment. Trainees completed a survey followed by a 1-on-1 interview. Data were triangulated to produce broad themes.

Results: Twenty-one trainees, most of whom had little prior experience with systematic reviews, reported a positive overall experience. Key benefits included learning opportunities, task segmentation (ability to focus on a single task, as opposed to an entire review), working in a supportive environment, international collaboration, and incentives such as authorship or acknowledgement. Trainees reported improvement in their competency as a Scholar, Collaborator, Leader, and Medical Expert. Challenges included communication and technical difficulties, and appropriate matching of tasks to trainee skillsets.

Conclusion: Participating in a LSR provided benefits to a wide range of trainees and may provide an opportunity for experiential EBM training, while helping LSR sustainability.

Keywords: living systematic review, systematic review, medical education, evidence-based medicine, rheumatoid arthritis, experiential learning

Highlights

- Trainees from a wide range of backgrounds reported very positive overall experiences from participating in a LSR.
- LSRs may provide an ongoing opportunity for experiential learning in evidence-based medicine education.
- Engaging trainees in LSRs may help ensure review sustainability, while providing valuable learning opportunities that can be tailored to a trainees' skills and interest.

Background

In a living systematic review (LSR), new evidence is included as it is published, producing accurate and up-to-date information to inform clinical decision-making (1) . Conducting a LSR, however, remains both resource and time-intensive (1-3). While technological advancements such as automation, machine learning and crowdsourcing can improve efficiencies in some aspects of a review (4-6), other aspects of a review, at least for now, still require human decision-making. Given the large upfront and ongoing workload in a LSR, maintaining an active team over time is challenging (7).

While LSRs continually need reviewers, evidence-based medicine (EBM) educators are continually looking for new ways to engage trainees. While these are essential skills to develop, many medical schools struggle to teach EBM effectively. Challenges include a lack of innovative teaching resources and opportunities to apply EBM (8-10). Traditionally, skills in evidence-based medicine are acquired through didactic learning (11, 12). However, studies have reported that students are more likely to adopt EBM principles when linked to experiential learning (11-14). LSRs could serve as a mechanism for ensuring an ongoing opportunity for experiential EBM learning.

We recently initiated a Cochrane LSR and network meta-analysis (NMA) on drug therapy for rheumatoid arthritis (RA) that will inform living guidelines in Canada and Australia (15). A LSR was established due to the continual evolution of RA treatment, and the high priority of RA treatment to patients, healthcare providers and decision-makers. RA impacts 0.5-1% of the

adult population (16), is associated with substantial reductions in quality of life (16, 17), and requires life-long treatment that is one of the highest costs to payers (18). In addition to using machine learning and crowdsourcing approaches for article screening, we developed and leveraged training resources to engage a wide range of medical trainees to assess the eligibility of articles and extract data, as described in further detail below. The purpose of this research study was to understand the experiences of the trainees participating in this living review and to evaluate the potential value for EBM learning.

Methods

2.1 Overview of living systematic review

This study was conducted alongside an ongoing Cochrane LSR and network meta-analysis (NMA) (15). Full details of the review methods are available in the published protocol (15). In brief, the systematic review includes three separate NMAs of randomized controlled trials (RCTs), comparing the risks and benefits of disease modifying anti-rheumatic drugs (DMARDs) at three time-points: initial treatment (DMARD-naïve); after failure of conventional DMARD therapy (DMARD-inadequate response (IR)); and after failure of biologic DMARDs (biologic-IR). In addition to identifying relevant articles for our NMAs, the search is designed to identify *any* RCT in patients with RA, to serve as a centralized living source for other Cochrane reviews. Monthly database searches combining terms for 'rheumatoid arthritis' and 'randomized controlled trial' are filtered through a machine learning algorithm, then through Cochrane Crowd, a citizen science platform, to exclude records that are not RCTs (19, 20). The resulting

list of probable RCTs are then returned to our team, to undergo further article selection, classification, and data extraction.

2.2 Trainee involvement in living systematic review

Trainees were undergraduates, medical students, residents, fellows, practicing rheumatologists, and researchers and were involved in the living systematic review at two steps: assessing article eligibility and data extraction. The engagement of trainees occurred through an open call, consistent with a crowdsourcing philosophy, but restricted to trainees most likely to benefit and be interested in participating. Canadian trainees were recruited through the Canadian Rheumatology Association (CRA) Residents' Pre-Course that is attended by both rheumatology fellows and internal medicine residents interested in rheumatology, and in a promotional CRA email to rheumatology fellows. Australian trainees were recruited through the Australian Rheumatology Association Early Career Group mailing list. Additional trainees, including undergraduate students, were also invited to participate after they had contacted senior researchers for research opportunities.

All trainees received task-specific training. For PICO annotation, this included an RCT identification task through the Cochrane Crowd platform, a webinar/online training session with a central team, and a task-specific training manual. For data extraction, this included a 1-on-1 training session, a data extraction guide with RA-specific examples and direct review/feedback of the initial extracted studies. All trainees could reach out at any time to the central methods team for questions or feedback.

Trainees assessing article eligibility logged into the Cochrane Crowd online platform and completed the 'PICO annotation' task that we generated specifically for this project (21). Reviewers were shown abstracts and asked to answer six questions that first confirmed the articles' eligibility (RCTs of DMARDs in RA), then classified the review to the appropriate NMA, or to other reviews on treatment tapering, and use of glucocorticoids (Figure 1). Trainees assigned to data extraction evaluated 12 outcomes at multiple time-points and completed risk of bias assessment using Covidence, an online systematic review management platform (22). To ensure data quality in the review, any abstract with conflicting judgements from the 2 PICO annotators was reviewed by an expert member of the review team for the final judgement. All data extraction was conducted in duplicate, with consensus judgements also made by an expert team member.

2.3 Study design

We conducted a mixed-methods study comprised of sequential quantitative and qualitative phases to understand the experiences of trainees. All trainees who participated in the LSR were invited to participate in this study. First, trainees were invited to complete a cross-sectional, online survey about their experience. Second, trainees were invited to an online interview to elaborate on specific survey responses and provide further feedback. This study was approved by the University of Calgary Conjoint Research Ethics Board (REB# 19-0472). For the online survey, a consent form was provided on the first page, and implied consent was obtained on completion of the survey. For the interviews, a consent form was provided with the invitation

e-mail, and reviewed with each participant prior to the interview to obtain explicit verbal consent.

2.4 Survey

To quantify trainee experience, trainees who participated in the review from June 2019 to June 2020 were invited by email to complete a voluntary online survey (Qualtrics, Toronto, ON, Canada). The ten-minute online survey consisted of multiple choice, free text, and rating scales to assess demographics, participant roles and training, and experiences of trainees. As is common with medical education in Canada, participants rated their self-reported improvement in the seven roles of physician competency according to the CanMEDS framework: Medical Expert (central role), Communicator, Collaborator, Leader, Health Advocate, Scholar, and Professional (23). Survey questions and branch logic were evaluated and tested by the research team for clarity. Three personalized reminder emails were sent to trainees who had not completed the survey 7, 14, and 21 days after the initial email.

Individual survey responses associated with the trainee's user ID were reviewed prior to conducting an interview with the trainee to encourage elaboration or clarification of responses, and to prevent repetition in questions. Identifiable information including name, email and user ID were kept on a secure master list which remained separate from research data and was only accessible by two researchers (C.L and G.H). Due to a technical malfunction, data for one survey response was unrecoverable. Thus, the survey was repeated by the same trainee using a new

individualized link. Partially saved responses were shared with the trainee to maintain consistency in responses.

2.5 Interviews

To encourage timely follow-up, trainees were invited by email within 36 hours of survey completion to participate in an optional one-on-one online video interview via Zoom to further discuss their perceptions of participating in the living review. Trainees who completed the survey but had not scheduled an interview were sent three email reminders 7, 14, and 21 days after the initial invitation for an interview. Structured 20 to 30 minute interviews were conducted by one researcher (C.L), who had previously participated in both the assessment of article eligibility and data extraction. The interviews followed an interview guide revised by the research team. Trainees were asked to describe their overall experience, perceptions of the training resources provided, and to elaborate on specific survey responses.

2.6 Analysis

Survey data were analyzed using descriptive statistics. Survey and interview data were triangulated using sequential explanatory methods, and followed the pragmatic paradigm aimed to understand broad themes related to trainee experiences. All interview audio files were transcribed by a confidential medical transcription service (Canadian Transcription Services, ON, Canada). Interview data was analyzed by a single coder (C.L) using Braun and Clarke thematic analysis (24). The researcher synchronously reviewed all interview transcripts with audio files for accuracy and familiarity prior to analysis. Each de-identified interview

206 transcript was then coded, and key phrases highlighted. Codes were collated and further
207 refined to identify themes that emerged from each interview. Interview data was verified by
208 independent transcript analysis and coding by members of the research team (M.T, M.E, G.H),
209 triangulated in team discussion. Themes derived from all interviews were then assessed
210 together and refined into common overarching themes. Interview transcripts and codes were
211 reviewed a second time to generate sub-themes with supporting quotes.
212
213 **Results**
214 *3.1 Survey participants*
215 Of the 27 trainees invited to participate, 21 (78%) completed the trainee experience survey.
216 Individuals who did not complete the study included one non-medical undergraduate student,
217 one medical student, one rheumatology fellow and three internal medicine residents. The
218 characteristics of the trainees that participated in the study are presented in Table 1. Trainees
219 were at various stages of training, from both Canada and Australia, and the majority (76%) had
220 no prior experience in conducting systematic reviews. Trainee tasks included assessing article
221 eligibility (52%), data extraction (29%) and involvement in both tasks (19%). Total hours of
222 involvement ranged from 8 to 210.
223
224 *3.2 Survey results*
225 Trainees largely reported adequate training and resources to properly perform their tasks in
226 assessing article eligibility and data extraction, rating their agreement with the statements at a
227 mean of 8.5 (SD 2.1) and 8.7 (SD 1.5) out of 10, respectively (Table 2). Among the training

resources provided for assessing article eligibility, all or nearly all trainees found the experience from completing the task and other resources were helpful for their training (Table 2). All trainees involved in data extraction found the data extraction guide, feedback from the research coordinator, and the experience from completing the task to be beneficial for their learning (Table 2).

On a scale of 0 (completely disagree) to 10 (completely agree), trainees evaluated their overall experience at a mean of 8.6 (SD 1.4) and learning at 7.7 (SD 2.4) (Table 3). The highest rated learning benefits were a better understanding of the PICO criteria to conduct a systematic review, familiarity with outcome measures in rheumatology, and understanding how to assess risk of bias of a study (mean 8.3, SD 1.9; mean 8.9, SD 1.6; mean 7.7, SD 3.4, respectively). The most desired incentive for participation was authorship or acknowledgements. Trainees rated self-reported improvement in their ability to fulfill CanMEDS roles as a Scholar (95%), Collaborator (75%), Leader (70%), and Medical Expert (70%) (Table 4).

3.3 Interview results

Sixteen trainees participated in a virtual one-on-one interview. Results were categorized into themes, described in the following sections (Table 5). Nearly all trainees (94%) reported a positive experience that was practical, enjoyable, and met or exceeded expectations. The five individuals who did not proceed with the interview had previously reported similar positive experiences on their survey, rating their overall experience at 9 (SD 1.2), and their learning at 8.3 (SD 1.7) out of 10.

Trainees reported several learning opportunities in rheumatology and scientific skill development that enhanced their experience (Theme 1A). Task segmentation, whereby a trainee can complete one task in a systematic review as opposed to taking on the entire review, was highly valued by most. Those focused on assessing article eligibility enjoyed the fast-paced screening that could be easily incorporated into a busy schedule (Theme 1B), and was ideal for trainees without prior systematic review experience. Trainees involved in data extraction found the task more challenging and detail oriented, but it provided further opportunities for learning. Due to the repetitive nature of the segmented tasks, trainees also reported increased familiarity and efficiency in task performance. Trainees reported a wide range of incentives for participating, including opportunities for authorship, impactful participation, and networking with other members of the team (Theme 1C). The detailed training provided the necessary guidance for trainees with limited experience in systematic reviews and helped foster a supportive environment (Theme 1D). Many trainees also enjoyed the opportunity for international collaboration and meaningful contribution (Theme 1E).

However, trainees noted that communication from the research team lacked clarity on deadlines and expectations for the project (Table 5, Theme 2A). Suggestions included regular follow up, frequent reminders and opportunities to interact with other team members. Another challenge was the technical difficulties experienced on the Cochrane Crowd or Covidence platforms. Several reviewers reported glitches during the PICO annotation task and in the recorded number of records screened (Theme 2B). While trainees generally enjoyed

participating in the review, one interviewee reported a mismatch in their skill set to the complexity of their assigned task (Theme 2C). Trainees also noted that their allocated tasks became tedious, as some involved in assessing article eligibility found it overly repetitive, while others involved in data extraction found it time-consuming and challenging to integrate into their schedules (Theme 2D).

3.6 Data Triangulation

Overall, interview data further supported survey findings. Most trainees reported that their experience in the LSR met or exceeded expectations, supporting the positive overall experience ratings in the survey. The most commonly reported benefit of participating was opportunities for learning, which was consistent with the survey rating of 7.7 (SD 2.7) out of 10. The presence of learning benefits was further supported by the finding that 95% of trainees reported improvement in their role as CanMEDS Scholars. Incentives were also a benefit for trainee participation, as authorship and acknowledgements were desired by 65% of trainees, and networking by 35% of trainees. This was supported by interview data, where many trainees expressed authorship as a main incentive for their involvement in the review.

Discussion

Our study showed that most trainees reported a positive overall experience participating in the LSR for rheumatology guidelines. Key benefits of participating included learning opportunities, working in a supportive and structured environment, opportunity for international collaboration, and incentives including authorship and acknowledgement. Trainees enjoyed the

task segmentation, whereby they could focus on a single task within a systematic review, as opposed to an entire review, which offered flexibility based on time commitment and skill level. Taken together our study supports the potential role of LSRs as a source of experiential EBM teaching for trainees.

Systematic reviews are the core of evidence-based medicine and are often excellent projects for trainees. However, conducting an entire high-quality systematic review is often not feasible due to the substantial training and time commitment required (7). By breaking up the tasks in a systematic review and assigning them to trainees with appropriate training material, even very inexperienced trainees from a wide variety of background gained valuable learning opportunities and felt well supported. While this same approach could theoretically be taken with a traditional systematic review, the additional up-front time and costs in developing training material can be better justified in a LSR, as they will help support the sustainability of the review into the future. From an EBM training perspective, LSRs could provide a predictable source of online training opportunities for educators looking to provide an experiential learning opportunity. While our study did not embed trainee engagement within a formal curriculum, it provides support for pursuing this as a next step. Cochrane has also developed additional learning resources, including a feedback mechanism for reviewers to compare their screening decisions against the final decision made, as well as Cochrane Classmate, an interactive online tool to enhance the teaching of evidence-based medicine with available Cochrane Crowd tasks. Extending these tools to incorporate tasks relevant to the maintenance of LSRs may further support EBM instruction. Extending these tools to incorporate tasks relevant to the

maintenance of LSRs may further support EBM instruction, while at the same time allowing trainees to contribute to international efforts to synthesize evidence in a timely fashion.

Our study also revealed what modifications can be made to further maximize trainee experience. As the project is entirely virtual, additional effort is required to facilitate engagement. Suggestions include more regular communication from the research team with project updates and deadline reminders. Opportunities to interact with other team members in group meetings or workshops may also encourage collaboration. Online platform workflow must also be optimized to prevent technical difficulties that may hinder trainee involvement. Finally, trainees should be allocated a task appropriate for their skillset or timeframe.

Our study builds on efforts to support the sustainability of LSRs. Through Cochrane, we were able to leverage machine learning approaches and their crowdsourcing platform (Cochrane Crowd) to facilitate article screening (19). Others have also developed similar approaches, which will likely grow in use over time (25). As we demonstrated, the approach of crowdsourcing trainees can be layered onto these technologies to further support review efficiency. Simple tasks, such as screening out records very unlikely to be RCTs can be accomplished by machine learning, then verified by a minimally trained crowd. However, data extraction and risk of bias assessment are more suitable for trainee engagement, as they have proven to be much more challenging to automate (26). Importantly, our process included oversight by a centralized team who would resolve any reviewer discrepancies and review extracted data.

Strengths of our study include the project being embedded within a living Cochrane review, and the involvement from a wide range of trainees in two countries. Our trainee response rate was 78% and the results of this study are likely generalizable, as data triangulation established the robustness of our findings. Limitations of this study include the limited duration of the living review to date. Future studies are required to evaluate the effectiveness of LSRs as experiential learning opportunities in EBM, and to assess the feasibility and impact of integrating EBM experiential learning into a medical or other curriculum. It is possible that a train-the-trainer approach could be valuable, with trainees assuming graduated responsibilities in line with their accumulated experience. Finally, the geographical diversity demonstrated in this study creates a model for even greater diversity and international collaboration in the future, as these learning opportunities could be extended to trainees worldwide.

Conclusion

Engaging trainees in a living systematic review for rheumatology guidelines facilitates sustainability and is mutually beneficial for learners. Participating in a living systematic review may enhance EBM training in medical education while providing valuable opportunities for learning and helping ensure review sustainability over time.

Abbreviations

RA: rheumatoid arthritis; EBM: evidence-based medicine; PICO: population, intervention, comparison and outcomes; DMARD: disease-modifying anti-rheumatic drug; NMA: network meta-analysis; RCT: randomized control trial.

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Authors' contributions

Chloe Lee: Conceptualization, methodology, investigation, formal analysis, data curation, writing – original draft, writing – review and editing **Megan Thomas**: Conceptualization, investigation, writing – review and editing **Maede Ejaredar**: Conceptualization, investigation, writing – review and editing **Aliya Kassam:** Conceptualization, methodology, writing – review and editing **Samuel L Whittle**: Conceptualization, resources, writing – review and editing **Rachelle Buchbinder**: Conceptualization, resources, writing – review and editing, funding acquisition **Peter Tugwell**: Conceptualization, resources, writing – review and editing **George Wells**: Conceptualization, resources, writing – review and editing, funding acquisition **Jordi Pardo Pardo**: Conceptualization, resources, writing – review and editing **Glen S Hazlewood**:

Conceptualization, methodology, investigation, formal analysis, data curation, writing – original draft, writing – review and editing, supervision, funding acquisition

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TABLES

Table 1. Characteristics of trainee survey respondents

Category	Value
Female, *n (%)*	16 (76)
Country of residence, *n (%)*	
Canada	16 (76)
Australia	5 (24)
Current position, *n (%)*	
Undergraduate student	4 (19)
Medical student	4 (19)
Internal medicine resident	4 (19)
Rheumatology fellow	5 (24)
Practicing rheumatologist	3 (14)
Researcher	1 (5)
Position prior to medicine (n=16), *n (%)*	
Undergraduate degree	9 (56)
Master's degree	3 (19)
PhD	2 (12.5)
No previous post-secondary	2 (12.5)
Prior systematic review experience, *n (%)*	
Prior experience	5 (24)
No prior experience	16 (76)
Prior training in conducting systematic reviews, *n (%)*	
Undergraduate/ graduate course	9 (43)
Training through Cochrane Crowd modules	4 (19)
None	8 (38)
Role in living systematic review, *n (%)*	
Assessing article eligibility (PICO annotation)	11 (52)
Data extraction	6 (29)
Both	4 (19)
Review involvement, *n (%)*	
Currently involved	14 (67)

No longer involved	7 (33)
Participation timeframe of trainees currently involved (n=14), *n (%)*	
≤ 4 months	5 (36)
5-8 months	3 (21)
9-12 months	1 (7)
≥ 13 months	5 (36)
Participation timeframe of trainees no longer involved (n=7), *n (%)*	
≤ 4 months	4 (57)
5-8 months	2 (29)
9-12 months	1 (14)
Hours contributed, (range)	
Assessing article eligibility (PICO annotation)	4-100
Data extraction	1-200
Total	8-210
Participation influenced by COVID-19, *n (%)*	
Yes	1 (5)
No	20 (95)

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Table 2. Trainee level of agreement with statements about their PICO annotation and data extraction experience

Question	Trainee response
Assessing article eligibility (PICO annotation)	***(n=15)***
	Mean (SD)
I found the Cochrane Crowd platform to be user friendly [a]	8.1 (2.1)
I was provided adequate training and resources to properly perform my tasks [a]	8.5 (2.1)
The PICO annotation guide was useful [a, b]	8.7 (1.5)
The PICO annotation webinar/ training session was useful [a, c]	8.4 (1.8)
I found the following useful for my learning in PICO annotation:	**n (%)**
PICO annotation guide [b]	13 (92.9)
PICO webinar/ training session [c]	6 (85.7)
Cochrane Crowd module [b]	14 (100)
Experience from completing the task	14 (93.3)
Data Extraction	***(n=10)***
	Mean (SD)
I found the Covidence platform to be user friendly [a]	8.7 (1.5)
I was provided adequate training and resources to properly perform my tasks [a]	8.6 (1.6)
The data extraction guide was useful [a]	9.8 (0.4)
I found the following useful for my learning in data extraction*:*	**n (%)**
Data extraction guide	10 (100)
Feedback from research coordinator	10 (100)
Experience from completing the task	10 (100)

[a] Response options on a scale of 0 (completely disagree) to 10 (completely agree).
[b] 14 trainees used the PICO annotation guide and completed Cochrane Crowd modules (n=14)
[c] 7 trainees attended a PICO annotation webinar/ training session (n=7)

466

467 **Table 3.** Trainee level of agreement with statements about their experience participating in the

468 living systematic review

Question	Trainee response
	Mean (SD)
Overall experience in this review	8.6 (1.4)
Experience was beneficial for my learning [a]	7.7 (2.4)
Through this review, I feel more comfortable reading a scientific paper and understanding the main findings [a]	7.4 (2.7)
Through this review, I am more knowledgeable in the common treatments for rheumatic disease [a]	7.3 (2.7)
Through this review, I have developed a better understanding of how to conduct a systematic review [a]	7.3 (2.5)
Through this review, I have developed a better understanding of the PICO criteria used to conduct a systematic review [a, b] (n=15)	8.3 (1.9)
Because of this review, I am more familiar with rheumatologic outcomes [a, c] (n=10)	8.9 (1.6)
Through this review, I have developed a better understanding of how to assess the quality of a study (risk of bias assessment) [a, c] (n=10)	7.7 (3.4)
Because of this review, I have developed a further interest in Rheumatology [a, d] (n=13)	7.4 (2.4)
Because of this review, I have developed a further interest in systematic reviews [a]	7.1 (3.3)
I enjoyed the virtual nature of this project [a]	8.6 (2.0)
I would recommend participating in this review to other classmates/colleagues [a]	7.9 (2.8)
Incentives to encourage other reviewers to participate (n=20)	**n (%)**
Authorship/ acknowledgements	13 (65.0)
Participation in further reviews	4 (20.0)
Networking	6 (30.0)

Course/ research/ MainPro credits	5 (25.0)
Travel bursaries	1 (5.0)

[a] Response options on a scale of 0 (completely disagree) to 10 (completely agree).
[b] Applicable only to trainees involved in assessing article eligibility (PICO annotation) (n=15)
[c] Applicable only to trainees involved in data extraction (n=10)
[d] Excluding fellows and practicing rheumatologists (n=13)

Table 4. Trainee self-rated improvement in their ability to fulfill CanMEDS roles from participating in the living systematic review

CanMEDs roles	Trainees selecting somewhat agree or strongly agree[a], n (%)
Communicator	10 (50)
Collaborator	15 (75)
Leader	14 (70)
Health Advocate	12 (60)
Scholar	19 (95)
Professional	13 (65)
Medical Expert	14 (70)

[a] Response options included strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree.

Table 5. Trainee interview quotes on their experience in participating in the living systematic review

Subtheme	Quote
Overall Experience	
Positive overall experience	"Very positive experience, very clear communication, great opportunity, very happy to be involved and continue in the future."
	"It was fun. It was engaging, it was easy to participate in, there was a little background knowledge required."
Negative overall experience	"I didn't really feel like it was a valuable use of my time as a fellow… and you weren't really sure what the progress was. So, I think all of that contributed to being not the greatest experience."
Theme 1: Benefits of Participating in a Living Systematic Review	
Theme 1A: Learning opportunities	"I definitely understood the whole process of a systematic review a lot better…it was much more practical than learning about systematic review in the medical coursework, it was also good to see what different roles people undertook when completing a systematic review and understand just how big of a process it is."
	"It's educational because I learned about RCTs and quality of studies from doing all the data extractions… I see how the concepts of PICO are applied into real life research."
Theme 1B: Task segmentation	"[PICO annotation] was a good way to figure out what the study was for and why we were choosing certain studies and not others... It was a good way to introduce us into doing a systematic review"
	"I use [PICO annotation] as a fallback task if I need to break up my day or do something else, a change of pace. I find it's easy if I do it in little chunks."
	"[PICO annotation] is faster and easier to do, but the [data extraction]... you read through papers and you get to know a bit more about the whole condition and how to investigate it."
Theme 1C: Value and Incentives	"The impact is…more meaningful and since it is living systematic…it can really impact the care of Rheumatology in the future."
	"First of all publication, I would be happy if you…grant authorship with the systematic review. So, this was my main motive. The second motive is, I'm happy that I'm sharing a piece of evidence that I'm using as a clinician."

Theme 1D: Supportive environment	"I still think it was really good to have that opportunity to ask somebody...I think actually that was quite essential because you just can't get everything from the guide."
	"This was a really good project for trainees…who haven't had much research because there's a lot of guidance and there was very much a structure to how you went about it."
Theme 1E: Opportunities for collaboration	"The idea of doing something more international based as part of a bigger group was what interested me."
	"As a rheumatologist for me going forward, one of my visions is for the CRA to be at the ACR's [American College of Rheumatology] level of activity in terms of looking at guidelines…coming up with consensus statements that are reflective of what we do in Canada."
Theme 2: Challenges of Participating in a Living Systematic Review	
Theme 2A: Regular communication	"I wasn't really sure what the status of the project was at. So, I think it would have helped my engagement had there been more regular updates."
	"Knowing that you're part of a community, and knowing who else is doing this project with you. Because if not, everything just feels… a bit isolating, especially when you're doing it remotely."
Theme 2B: Technical difficulties	"I wasn't sure if my abstracts were being recorded… which always made me worried that I was doing this work but it wasn't actually being recognized by the system."
	"The only thing that's annoying is the glitching...if you screen 50 in a row it will just bring you back to a filled in one, but then you can refresh and it usually goes away."
Theme 2C: Task allocation	"I'm not really sure that doing PICO [annotation] is necessarily a good use of a subspecialty fellow's time. It might be better directed towards a more junior trainee, who is fully capable of doing during that task but has a little bit more time on their hands."
Theme 2D: Task complexity	"Sometimes you couldn't complete a whole data extraction in just one day and you needed to put it over a few days, which is very hard because when you go from data extraction to quality assessment and you've forgotten the whole text."

Figure legends

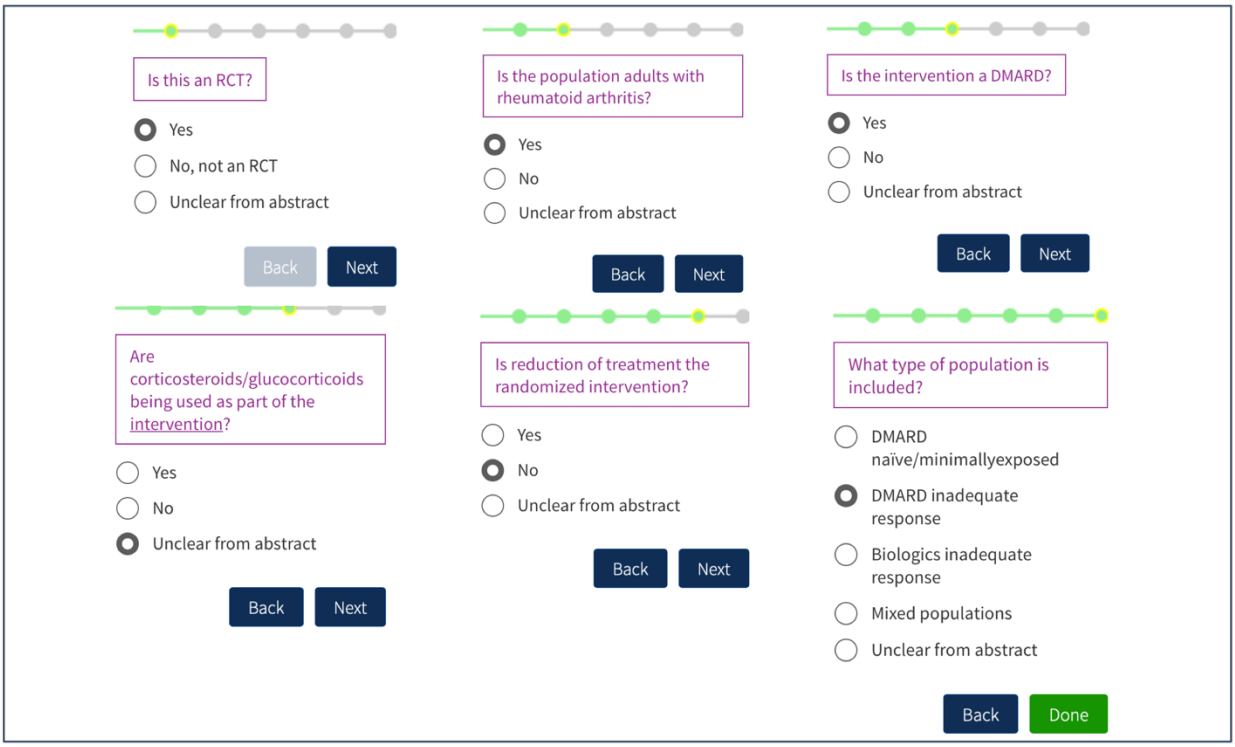

Figure 1. Screenshots of the six questions asked on the custom Cochrane Crowd PICO annotation tool to confirm article eligibility and classify to the appropriate reviews.