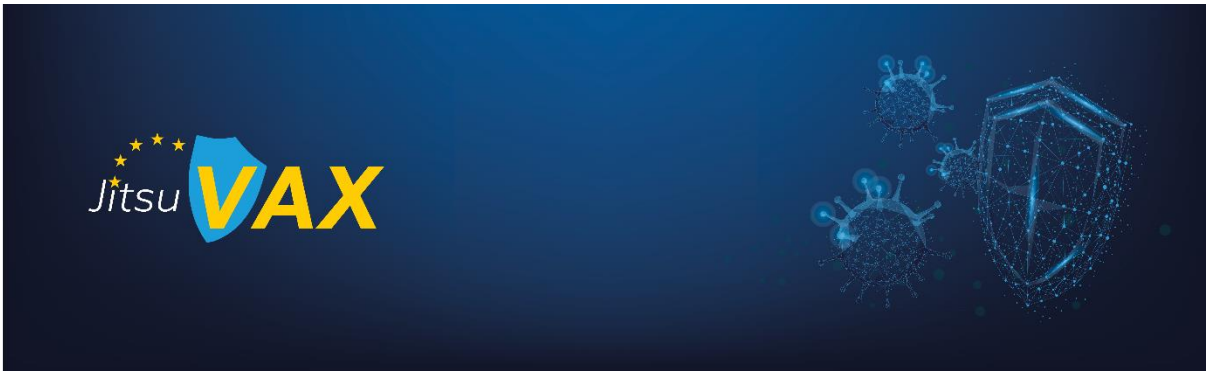

JITSUVAX:
Jiu-Jitsu with Misinformation in the Age of Covid

Report on intervention experiment in training

April 2024

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Contents

Summary

This document reports on the methods and results from a field study of Empathetic Refutational Interview (ERI) training conducted with Health Care Professionals (HCPs) in the UK and Germany (Work Package 3.3 of the JITSUVAX project).

Scope and purpose of this document

This document reports on the methods and results from a field test of Empathetic Refutational Interview (ERI) training conducted with Health Care Professionals (HCPs) in the context of their immunisation training (Work Package 3.3 of the JITSUVAX project). The ERI is an empathy-based refutational tool developed in WP2 of JITSUVAX, which provides a framework for HCPs to approach conversations about vaccination with hesitant patients and correct misconceptions patients hold about vaccination while simultaneously affirming and empathising with their core beliefs. The objective of the field study was to establish how the ERI can be effectively taught to HCPs within a training context, to prepare them for their role in communicating with patients about vaccination. ERI training was delivered in three different training contexts: (1) A brief ERI module embedded within an existing immunisation training programme in the UK and compared against the conventional communications training; (2) A brief ERI module delivered as a stand-alone session in the UK and Germany; (3) A two-day ERI "train the trainers" workshop in the UK. The results will inform the development of a guidance document and multiplier guide, which will be covered in future JITSUVAX Deliverables as part of Work Package 4.

Project overview

Vaccine hesitancy—the delay or refusal of vaccination without medical indication—has been cited as a serious threat to global health by the World Health Organization (WHO). The WHO has attributed much of hesitancy to misinformation on the internet. The WHO has also identified HCPs as the most trusted influencers of vaccination decisions.

JITSUVAX is leveraging those insights to turn toxic misinformation into a potential asset based on two premises:

1. The best way to acquire knowledge and to combat misperceptions is by employing misinformation itself, either in weakened doses as a cognitive "vaccine", or through thorough analysis of misinformation during "refutational learning".
2. HCPs form the critical link between vaccination policies and vaccine uptake.

The principal objective of JITSUVAX is to leverage misinformation about vaccinations into an opportunity by training HCPs through inoculation and refutational learning, thereby neutralizing misinformation among HCPs and enabling them to communicate more effectively with patients. We will disseminate and leverage our new knowledge for global impact through the team's contacts and previous collaborations with WHO and UNICEF.

Background

Although vaccination is the safest and most effective way to protect against several diseases (Di Pasquale et al., 2016), there remain in most countries pockets of hesitancy towards being vaccinated—defined as the refusal or delay of vaccination (e.g., by patients) despite the availability of vaccination services. Vaccine hesitancy threatens the success of immunisation programmes, which rely on a sufficient number of the population being protected to prevent the vaccine-

preventable disease from circulating. As a result of recent declines in vaccine coverage, there have been several outbreaks of vaccine-preventable diseases among communities, for example measles in the UK (UK Health Security Agency, 2024).

Encouraging individuals to vaccinate (or parents to vaccinate their children) requires a tailored approach that builds trust among members of the target communities (Dubé et al., 2018). Health Care Professionals (HCPs) are known to be trusted influencers of vaccine decisions (Betsch, 2017; Dubé, 2017; Paterson et al., 2016). Thus, HCPs' communication with individuals, especially hesitant ones, can be critical to encourage vaccination uptake. However, communicating with hesitant individuals about vaccination can be difficult for HCPs. Although HCPs are typically trained and knowledgeable about vaccination facts, these may not suffice to convince individuals whose opposition to vaccination may be traced to misinformed beliefs and other psychological motivators (Fasce et al., 2023).

Communicating effectively in these cases requires HCPs to practise an empathetic and participatory style of engagement (Connors et al., 2017) as well as employ skills in debunking misinformation and false beliefs (Lewandowsky et al., 2012; Lewandowsky & Oberauer, 2016). Earlier work in JITSUVAX (WP1) found that HCPs find it challenging to respond effectively when individuals cite misinformed argumentation against vaccines. HCPs typically receive limited training in vaccine communication, and may even avoid difficult vaccine conversations if they suspect it might lead to conflict with their patient. It is therefore important to identify approaches HCPs can take when engaging in challenging conversations with vaccine-hesitant patients and build HCPs' confidence in using such approaches.

A framework for effective vaccine communication

Individuals' resistance to getting vaccinated is typically motivated by a range of underlying psychological attributes, known as "attitude roots" (Hornsey, 2020). Previous work in JITSUVAX WP2 generated a taxonomy of 11 different attitude roots that motivate specific concerns individuals may express, which often contain misconceptions or are fuelled by misinformation that is persuasive given their psychological motivators (Fasce et al., 2023). For example, an individual who has a tendency to believe in conspiracy theories (an attitude root known as "conspiracist ideation") may find the false narrative that vaccines contain microchips designed to track the population a compelling concern. In contrast, an individual who is highly religious would be compelled by the concern that vaccines violate their dietary norms, even if they do not (i.e., they are motivated by the attitude root of "religious concerns"). Understanding the attitude root of individuals' vaccination concerns can thus help HCPs to align their responses with the individuals' motivations, thereby enhancing the success of the communication.

Communicating in a manner that is consistent and respectful of individuals' attitude roots requires further skills in communicating. In particular, HCPs need techniques that can help them elicit those attitude roots, demonstrate that they are empathetic towards the patient's feelings and beliefs, and finally engage the patient in cognitive processes to effectively correct misconceptions. JITSUVAX WP2 proposed and tested a four-step procedure to achieve these objectives in a conversation with a hesitant individual. This procedure, called the "Empathetic Refutational Interview" (ERI), proposes that the HCP should first elicit the individuals' concerns about vaccination, which gives the HCP a chance to identify the attitude roots that motivate the individual's hesitancy. Second, the HCP should affirm the individual; this step involves an empathetic validation of the individual's position and feelings and can be done, for example, by acknowledging the (partial) truth in the individual's concerns. Third, the HCP should offer a tailored refutation of misconceptions that the individual holds about vaccination by following best practice in refutational learning (explaining why the misconception is wrong and providing a plausible alternative; Lewandowsky et al., 2012) and appealing to the individual's attitude root. Finally, the HCP should provide factual information about

vaccination that is known to increase willingness to vaccinate, such as the severity of the vaccine-preventable disease.

The ERI was tested in WP2 through experimental studies with vaccine-hesitant individuals; compared to a control condition that used a factual approach, the ERI generated better receptivity and support from participants, and also produced increased willingness to vaccinate and decreased belief in anti-vaccination arguments (Holford et al., 2024a; also reported in Deliverable 2.4). In experiments with HCPs, the ERI was also found to be perceived as a better way to handle conversations with hesitant patients than a factual approach; in addition, HCPs who read about the ERI were more likely to describe using empathetic affirmations and less likely to describe taking a factual approach in their responses to fictitious patients (Holford et al., 2024b; also reported in Deliverable 2.3). The available evidence thus points to the ERI as a promising tool for debunking vaccine misinformation while promoting trust between HCPs and their patients. However, for HCPs to be able to leverage the ERI as a conversation tool, HCPs need to be trained to use the tool effectively and also feel comfortable and confident to use it.

Challenges in delivering vaccine communication training for HCPs

While the ERI approach was successfully tested for effectiveness among vaccine-hesitant individuals and acceptability to HCPs, it is not yet known how best to educate HCPs about the approach nor how well HCPs can pick up the techniques required. Indeed, this is the case for many interventions documented in the literature around vaccine communication. Although past work has reported improvements in vaccine communication confidence and communication skills after various formats of training delivery, ranging from brief online modules (Szilagyi et al., 2021) to in-person workshops over several days (Garrison et al., 2023a), a recent scoping review found that few of these could be reproduced or accessed for implementation in clinical training contexts (Lip et al., 2023). It is therefore difficult to assess best practice for translating an intervention into clinical training.

Previous work done in JITSUVAX WP1.3 indicated that flexibility in training delivery is an important consideration for HCPs (Holford et al., 2024d). Although longer interventions in continuing medical education are associated with stronger effects on trainees (Mansouri & Lockyer, 2007), clinical pressures exacerbated by a shrinking workforce can leave limited time for HCPs to attend training (World Health Organization, 2022). Likewise, while online and asynchronous training may be more logistically convenient for HCPs to attend, this can come at the cost of an impoverished learning environment compared to in-person training (Holford et al., 2024d).

A further consideration for how to field test ERI training was the need to tackle refutational skills. JITSUVAX WP2.3 found that HCPs who read about the ERI in written scenarios delivered in an online, asynchronous format, were able to pick up on affirmations and put this skill into practice, however this method of training did not significantly raise HCPs' use of refutations (Holford et al., 2024c). We also know of no other tested method for training people to refute misconceptions using evidence-based best practice. Given that refutational skills were also a critical training gap identified by HCPs in interviews from JITSUVAX WP1.3, it was important that HCPs received instruction on these skills directly from trainers during early-stage field testing.

One way to optimise delivery of communications training as an in-person session is to integrate it into existing programmes that HCPs already plan to attend as part of their existing medical education. For example, embedding communications training into medical school curricula or as part of an existing continuing medical education course could reduce the extra time and travel commitments needed compared to only attending a stand-alone workshop. However, provision also needs to be made for HCPs who do not have access to such regular training. For example, vaccination roles in the UK are carried out by a range of different HCPs (e.g., nurses, midwives,

pharmacists; UK Health Security Agency, 2022). Yet vaccine communication interventions have been disproportionately targeted at medical providers rather than the full range of HCPs involved in vaccination discussions (Lip et al., 2023). Furthermore, how HCPs are trained for their vaccination roles can vary depending on their local authorities; although the UK has a national standard for vaccination training that includes vaccine communication as a core competency, the standard is not mandatory (Public Health England, 2018). Indeed, consultations with stakeholders found that different regions operated different systems of vaccination-related training (including online-only programmes) and many regions lacked the capacity to incorporate vaccine communication elements in their programmes. This was corroborated by HCPs interviewed in JITSUVAX WP1.3, who reported never receiving training on how to discuss vaccination with patients and caregivers (Holford et al., 2024d). To broaden the scope of potential training provision, it was therefore important to evaluate how effectively ERI training could be delivered for HCPs under different delivery models.

Objectives of the study

The objective of this study was to investigate how the ERI could be effectively taught to HCPs in clinical settings, such that HCPs acquire skills in using the ERI and increase their confidence in communicating about vaccination. The study was also designed to consider issues around the feasibility and acceptability of implementing ERI training in different contexts and how to address these issues.

Methods

Ethics and scientific best practice

Before data collection, the study received approval by the University of Bristol School of Psychological Science Ethics committee (reference: 12008) and the UK Health Research Authority (reference: 318853) for research conducted in the UK. Research conducted in Germany received approval by the University of Erfurt Ethics committee (reference: 2023-25).

The study method and planned analyses were pre-registered for the randomised experiment that compared ERI training with conventional training within an existing immunisation training programme. These were documented on the Open Science Framework (OSF) prior to the start of data collection. Exploratory research that did not involve group comparisons (i.e., cases where participants only received ERI training with no comparable control group) was not pre-registered, but followed the same data collection protocols as the randomised experiment. Experimental materials, data and the code used to derive the reported analyses will be openly shared on JITSUVAX's OSF project repository (https://osf.io/h8sv2/) when manuscript(s) are submitted for peer review.

Study context

The study was conducted within the context of vaccine communication training provided for HCPs, during which ERI training was delivered under three different settings.

1. **Randomised experiment.** ERI training was embedded into an immunisation training course conducted by University Hospitals Bristol and Weston NHS Foundation Trust (UHBW) that constitutes essential training for HCPs in the Southwest England region with vaccination roles or who are intending to take up those roles. This full-day course, run quarterly, covered theoretical and practical aspects of childhood immunisation, with a 60 min module on communicating with patients and caregivers. A 60 min ERI training session was compared against the existing 60 min communication module in this setting, with data collection taking place before and after the module. Four sessions were run in this context.

2. **Short training.** ERI training was delivered as a stand-alone 90 min module (including time for data collection). These sessions were either organised on request by partner health organisations and authorities (four in-person sessions in the UK, one in-person session in Germany) or organised for the purposes of the research (one online session in the UK and two online sessions in Germany).

3. **Two-day workshop.** ERI training was delivered as a two-day in-person "train the trainers" workshop organised by the UK Health Security Agency (UKHSA) London and NHS England (NHSE) London. The objective of this session was to train health professionals who also had a training remit within their vaccination roles. Delivering ERI training in this setting allowed us to pilot this model of training with the aim of future capacity building for the health organisations and developing multipliers for the ERI approach. Two such sessions were conducted in the UK.

Training in the UK covered four different geographical regions (Southwest, West Midlands, Northwest, and London), allowing us to reach a greater diversity of participants, professions, and vaccination contexts than initially planned. Training in Germany was conducted for medical students from the north of Germany (Hamburg) and paediatricians from a central region (Hesse). Additionally, one online session was organised for interested medical students from various German universities.

All ERI training in the UK was delivered by at least one member of the JITSUVAX research team who had previously undergone Motivational Interviewing training and co-developed ERI training during a train the trainers workshop organised in February 2022 as part of JITSUVAX WP3.1, prior to the WP3.3 research study. ERI training in Germany was delivered by one member of the JITSUVAX research team who was instructed by another member who joined the train the trainers workshop in February 2022. Additionally, the German trainer observed two training sessions in the UK in September 2023.

In the UK, we conducted a process evaluation in parallel that involved (1) researcher observation of each of the training sessions and (2) follow-up interviews with participants and stakeholders in immunisation training.

Participants

Participants were recruited from among 165 HCPs (135 in the UK and 30 in Germany) registered to attend training across each of the three settings. Participation was voluntary and participants did not receive compensation for taking part in the study, except in the UK, where participants were offered a chance to win a £50 voucher if they completed each of the study follow-up questionnaires. Table 1 shows the breakdown of participants who completed each stage of the study and their socio-demographic characteristics.

Table 1. Breakdown of study participants in each study context and their characteristics

	Randomised experiment (UK only)			Short training		Two-day workshop	Total
	Control	ERI	Total	UK	Germany	(UK only)	
Number attended training, of which:	30	31	61	52	30	22	165
Consented	30	31	61	51	30	21	163
Completed pre-test	30	31	61	45^	26^	18^	146
Completed post-test*	26	29	55	48	24	19	140
Completed 1 follow up	20	21	41	20	-	9	70
Completed 2 follow ups	18	13	21	16	-	9	46
Profession							
Nurse	29	29	58	22	0	6	86
Midwife	0	0	0	0	0	9	9
Community health	0	0	0	21	0	0	21
Medical student	0	0	0	0	11	0	11
Physician specialist	0	0	0	0	14	0	14
Other roles/unknown	1	2	3	2	1	3	12
Age (in yrs) [1]							
Mean (SD)	36.63 (9.08)	39.00 (11.12)	37.84 (10.15)	45.76 (13.24)	-	49.67 (12.50)	42.43 (12.52)
Median	34	37	37	45	-	48.5	42
Range	24-57	24-66	24-66	22-68	-	27-71	22-71
Years of clinical experience (in yrs)** [1]							
Mean (SD)	11.08 (7.72)	13.69 (9.88)	12.41 (8.91)	21.39 (14.09)	-	22.44 (12.86)	16.40 (11.97)
Median	9.50	10	10	20	-	20	13.5
Range	1-25	1-38	1-38	0-42	-	6-50	0-50
Expertise with vaccine hesitant people [2]							
In a private environment	-	-	-	-	19	-	-
In a work-related environment	-	-	-	-	15	-	-
No expertise	-	-	-	-	4	-	-
Gender [1]							
Female	28	31	59	41	-	17	117
Male	2	0	2	4	-	1	7
Not reported	-	-	-	6	-	3	9

Ethnicity [1]							
White	29	29	58	29	-	9	96
Other ethnic groups	0	2	2	16	-	7	25
Prefer not to say/not reported	1	0	1	6	-	5	12
Vaccination role involves~: [1]							
Scheduling appointments	4	7	11	19	-	8	38
Prescribing vaccines	0	3	3	3	-	2	8
Administering vaccines	20	17	37	10	-	3	50
Answering questions about vaccines	0	1	1	6	-	2	9
Documenting vaccines	0	0	0	1	-	0	1
No vaccination role	6	3	9	6	-	3	18
Number vaccinated against influenza (at least once in past 3 years)	27	30	57	39	23	17	136

Note. Demographic information available only for participants who completed those fields. *Participants are recorded here as having completed post-test and follow ups if they provided at least one complete measure in these questionnaires. ^Some participants did not complete pre-test questionnaires but did post-test questionnaires. ~Multiple roles possible for each participant. [1] Variables measured only in the UK. [2] Variables measured only in Germany.

Design

The randomised experiment part of the study followed a parallel group design, in which participants were randomly allocated to the control (conventional communications training) or ERI group.

For the short training and two-day workshop part of the study, all participants received the ERI training. Thus, measures taken at multiple time points before and after the training were analysed in a within-subjects (repeated measures) design, while measures taken only after the training are analysed descriptively only.

Procedure

Figure 1 summarises the overall study procedures for the three different study groups. All participants read the online information sheet and consent form and gave consent by selecting a tickbox before they proceeded to complete the pre-test questionnaire online (which took approximately 3-5 minutes).

In the randomised experiment, participants were randomly assigned to their condition by the online survey software Qualtrics once they provided consent. However, on two occasions, the on-site researcher had to override this assignment for one randomly selected participant within the session to ensure a necessary number of trainees were allocated into each group to meet training requirements within those particular sessions. Participants proceeded to their regular immunisation training after the pre-test questionnaire and were only divided into control and ERI groups at the start of the communications module. This module was completed in different rooms for the two groups.

In the short training and two-day workshop sessions, participants proceeded to the ERI training immediately after the pre-test questionnaire.

All participants were given an online link to the post-test questionnaire at the end of their respective training, with 15 mins allocated during the training course or session to complete it. This questionnaire asked for their email address so that follow up questionnaires could be sent.

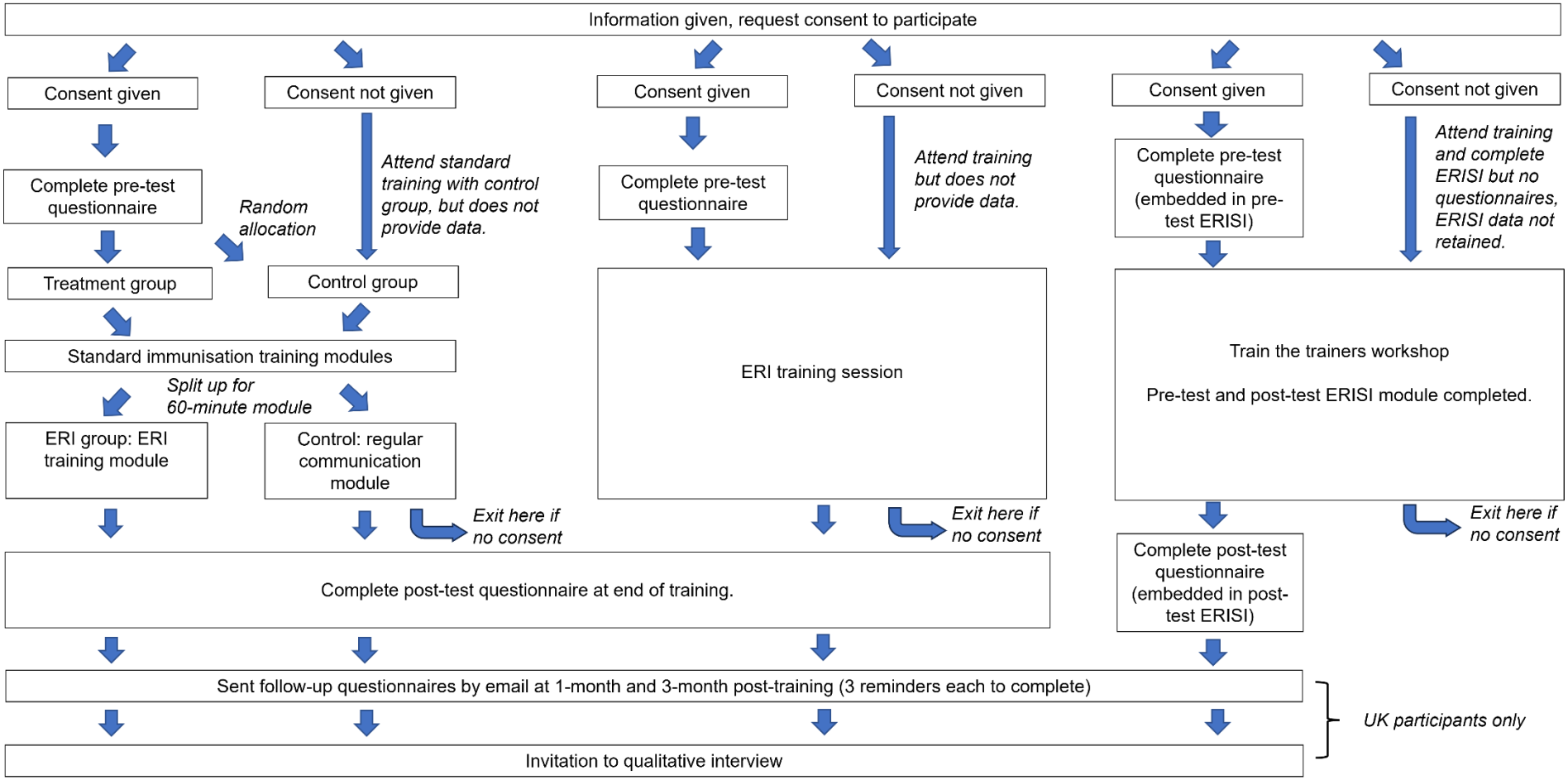
In the UK (but not Germany), follow-up questionnaires of approximately 5-10 min completion time were sent to participants by email with a link to complete the questionnaire online. Participants received these email links at two time points: one month and three months after the completion of their training session. For each follow-up questionnaire, participants were offered the chance to win a £50 shopping voucher. Fifteen of these vouchers were distributed randomly to participants who completed the follow-up questionnaires and entered the prize draw. Participants received three reminders to complete each follow-up questionnaire, once a week following each initial invitation with the follow-up questionnaire link.

At the end of the second follow-up questionnaire (i.e., after three months post-training), participants were debriefed and given links to a web resource that had been introduced during the training.

In the UK, participants were also invited after the second follow-up to take part in a video- or tele-conference interview of approximately 45 min to discuss their experiences of training. An interview invitation was also sent to (and accepted by) an immunisation training co-ordinator, as a stakeholder with insight on training considerations.

Figure 1

Study procedure



Materials

All materials were developed originally in English and translated into German for the study in Germany. Translation to German was done by a native German speaker and checked by a second native German speaker. The materials consisted of study questionnaires and ERI training materials.

Study questionnaires

Study questionnaires consisted of the pre-test, post-test, and follow-up questions. In addition, the two-day workshops included a pre- and post-training "Empathetic Refutational Interview Skills in Interviewing" (ERISI) questionnaire that was completed as part of the training exercises. Table 2 summarises the question types that were included in the study questionnaires, which are described in text below. The full wording of all questions and the means and reliability scores for responses are provided in the Appendix (Tables A1-A3).

Table 2.

Summary of questions in the study questionnaire and when they were administered

Question type	Description	No. of questions	Point of administration		
			Randomised experiment	Short session	Train the trainer
Flu vaccination status	Number of flu vaccines participant has had in past 3 years	1	Pre-test & follow-up		
Vaccine communication confidence	Participants state agreement with statements regarding their commitment to vaccinating patients and confidence in discussing vaccination with patients.	3	Pre-test, post-test, & follow-up		
Preparedness to refute vaccine misconceptions (non-ERISI)	Participants rate their preparedness to refute a hypothetical statement against vaccination from a patient.	6	Pre-test, post-test, & follow-up		Follow-up
ERI-related skills acquisition (non-ERISI)	Participants indicate their level of understanding of ERI-related skills.	6	Post-test and follow-up		Follow-up
Frequency of using ERI techniques	Participants indicate their frequency of using each ERI technique when speaking with individuals with immunisation concerns in the past 3 months.	6	Follow-up		
ERISI questions:					
Understanding of ERISI components	A set of questions testing participants' understanding of the four ERI components.	6	NA		Pre-test & post-test
Open-ended scenario case study question	Participants write a dialogue between themselves and a patient in a clinical case study.	1			
ERI skills acquisition	Participants rate their confidence in their understanding and preparedness to use ERI skills.	7			
Preparedness to refute vaccine misconceptions	Participants rate their preparedness to refute a hypothetical statement against vaccination from a patient.	11			
Evaluation questions					
Quantitative evaluations	Participants rate agreement with evaluative statements about the usefulness of the training.	6	Post-test		
Qualitative evaluations	Participants respond to yes/no question on usefulness and effectiveness of training, and elaborate on their answer in open-ended text feedback.	3	Post-test		
General feedback & improvement	Participants give open-ended feedback on the training and how it could be improved.	2	Post-test		
Retention & use of skills	Participants describe what they remember from the training, what skills they have used since, and (if yes) the frequency of use.	3	Follow-up		

Note. Follow-up questionnaires were only administered in the UK.

At pre-test, participants completed socio-demographic questions (reported in Table 1), followed by questions on their flu vaccination status, vaccine communication confidence, and perceived preparedness to refute vaccine misconceptions.

At post-test, participants completed questions evaluating the training session (ERI or control). These questions were used for the process evaluation. Participants then completed the questions on vaccine communication confidence and perceived preparedness to refute vaccine misconceptions, followed by questions on the acquisition of ERI-related skills. Participants in the two-day workshops completed a more comprehensive version of the perceived prepared to refute vaccine misconceptions and the acquisition of ERI-related skills questions that were administered within the ERISI.

At all follow-ups, participants completed the flu vaccination status questions, the questions on vaccine communication confidence and perceived preparedness to refute vaccine misconceptions, questions on the acquisition of ERI-related skills and whether they had used them in practice, and finally general questions about whether they had used what they had learned the training session in practice.

Flu vaccination status

Participants reported the number of flu vaccinations they had received in the last three years, with a multiple choice response scale (0, 1, 2, or 3).

Vaccine communication confidence

We used three items from the "proactive self-efficacy" section of the International Professionals Vaccine Confidence and Behaviours questionnaire (I-Pro-VC-Be; Garrison et al., 2023b) that was developed in WP1. These three items were selected because they specifically ask about HCPs' commitment and preparedness for engaging in vaccination discussions with hesitant patients (e.g., "I feel sufficiently trained on how to bring up the question of vaccines with hesitant patients.") Reliability of this measure was satisfactory (Cronbach's $\alpha > 0.60$ for all samples except follow-ups in the two-day workshop group[1]). We computed a mean vaccine communication confidence score per participant at each time point this measure was administered.

Perceived preparedness to refute vaccine misconceptions

We used six items from the difficulty to rebut anti-vaccination arguments questionnaire (Holford et al., 2024b) that was developed in WP1. This questionnaire presents each anti-vaccination argument to HCPs (e.g., "People are being offered too many vaccines nowadays, and this will overload their immune systems.") and asks them to rate how difficult each is to rebut. These six items were chosen to reflect the most common anti-vaccination arguments that would be encountered by HCPs. The wording of the question was adapted to reflect the training context, such that HCPs were asked *how prepared they felt to respond* rather than how difficult it would be. Reliability of this measure was satisfactory (Cronbach's $\alpha > 0.80$ for all samples). We computed a mean refutation preparedness score per participant at each time point this measure was administered.

ERI skills acquisition

Participants completed six questions asking for six skills/techniques introduced in the ERI (active listening, eliciting concerns with open-ended questions, understanding motivations for vaccine hesitancy, giving affirmations, tailoring refutations to vaccine misconceptions, and responding to immunisation concerns with facts), how well they understood that skill/technique. The response options were 1: I have not heard of it, 2: I have heard of it but do not understand it, 3: I understand it but have not used it, 4: I understand it and have used it but would like to become more

[1] Cronbach's α in this follow-up group may have been affected by the small sample ($n = 9$).

comfortable with it, 5: I understand it and am comfortable using it. Reliability of this measure was satisfactory (Cronbach's $\alpha > 0.80$ for all samples). We computed a mean skills acquisition score per participant at each time point this measure was administered.

In the follow-up questionnaires, after each of these skills acquisition questions, participants who had indicated having used the skill/technique were asked in addition to indicate the frequency with which they had used it within the last three months (following precedent in Reno et al., 2018). Participants had the option to indicate if they did not talk to any individuals with immunisation concerns, or provide one of the following frequencies: rarely/never (0-25%), sometimes (26-50%), often (51-75%), or most of the time (> 75%).

ERISI

The ERISI was developed based on the Motivational Interview Skills in Interviewing (MISI) questionnaire, which seeks to assess trainees' competence at the skills and techniques taught in that training (Gagneur et al., 2019). It consists of six sets of questions that assesses trainees understanding of the different components of the ERI and confidence in conducting an ERI:

(1) Understanding of attitude roots is assessed by a multiple-choice question asking trainees to select all the 11 correct attitude roots from a set of 17 possible responses.

(2) Understanding of the ERI procedure is assessed by two four-option multiple choice question asking trainees to correctly identify two key components in refuting false information, and the correct sequential order of the ERI steps.

(3) Understanding of attitude roots, affirmations, and refutations in practice are assessed by a set of scenario-based questions that asks trainees to identify and explain the attitude root for a patients' given concern and select an appropriate affirmation and an appropriate refutation.

(4) Skills in applying an ERI are assessed by a free-text question asking trainees to craft a dialogue between themselves and a patient with a given vaccination concern.

(5) Confidence in conducting an ERI is assessed by a series of seven questions where trainees self-report their confidence and preparedness to conduct the components of the ERI on a 1-10 rating scale (where higher ratings indicate greater confidence).

(6) Confidence in the refutation component is assessed by participants' rating of how prepared they feel to rebut 11 anti-vaccination arguments, representing each of the 11 attitude roots (i.e., the perceived preparedness questions).

For the scale measures in (5) and (6), reliability was satisfactory (Cronbach's $\alpha > 0.75$ at each time point). We computed a mean score per participant for these set of items at each time point the items were measured.

Participants in the two-day workshop completed the ERISI twice as assessment exercises within the workshop, and gave consent for their responses to be used in the research. Other pre-test and post-test questions used in the other sessions were included provided they did not duplicate the ERISI questions.

Post-test evaluation questions

Participants completed six multiple choice questions evaluating the vaccine communication session (ERI or control) on a 1-4 response scale (1: strongly disagree, 4: strongly agree). These questions targeted whether participants felt the session had addressed their worries, whether the content was informative, clear, and useful for their future clinical practice.

Participants then evaluated whether any elements of the session were useful, if their understanding had improved as a result, and whether there were specific elements of the session they would use in their future clinical practice. These questions were yes/no multiple choice questions, with open-ended text boxes below asking for elaboration. Participants were also invited to provide open-ended feedback on how the session could be improved, and any other feedback they wished to give.

Follow up evaluation questions

Participants were asked to describe what they remembered most from the training session, to indicate (yes/no) if they had used any elements in their clinical practice and, if yes, to describe these or, if no, explain why they had not. Finally, they reported how frequently they had used what they learned in the training session when speaking to individuals with immunisation concerns (response options: I did not talk to any individuals with immunisation concerns, rarely/never (0-25%), sometimes (26-50%), often (51-75%), or most of the time (> 75%).)

ERI training materials

Training materials for the ERI sessions were developed by the JITSUVAX research team building on key pieces of work conducted under JITSUVAX WP1 and WP2. Throughout these WPs, three key training materials were produced: (1) the jitsuvax.info web resource; (2) training slides suitable for the randomised experiment and short training sessions; (3) role play scenario exercises; (4) demonstration videos. Written and visual materials were reviewed by members of the JITSUVAX Clinical Advisory Group to ensure that the content and language were suitable and understandable for HCPs. Scripts for the demonstration videos were reviewed by an immunology expert and an expert in motivational interviewing to ensure that the content included was medically accurate and the communication style was appropriate. Three different videos were filmed for this study, featuring conversations discussing three different vaccines: the MMR vaccine, the HPV vaccine, and the whooping cough (pertussis) vaccine[2].

In February 2022, during a train the trainers workshop organised as part of WP3.1, attendees from the wider JITSUVAX team refined the training materials and co-developed an ERI facilitators' guide and training manual for conducting longer ERI training sessions. The ERISI was developed as part of this workshop. These materials were further refined by the research team to create final session slides and exercises for the two-day workshop in this study.

Screenshots and examples of the web resources, training slides for each session type, role play scenarios, and videos can be found in the Appendix. Full materials will be made available through the OSF and JITSUVAX website.

Results

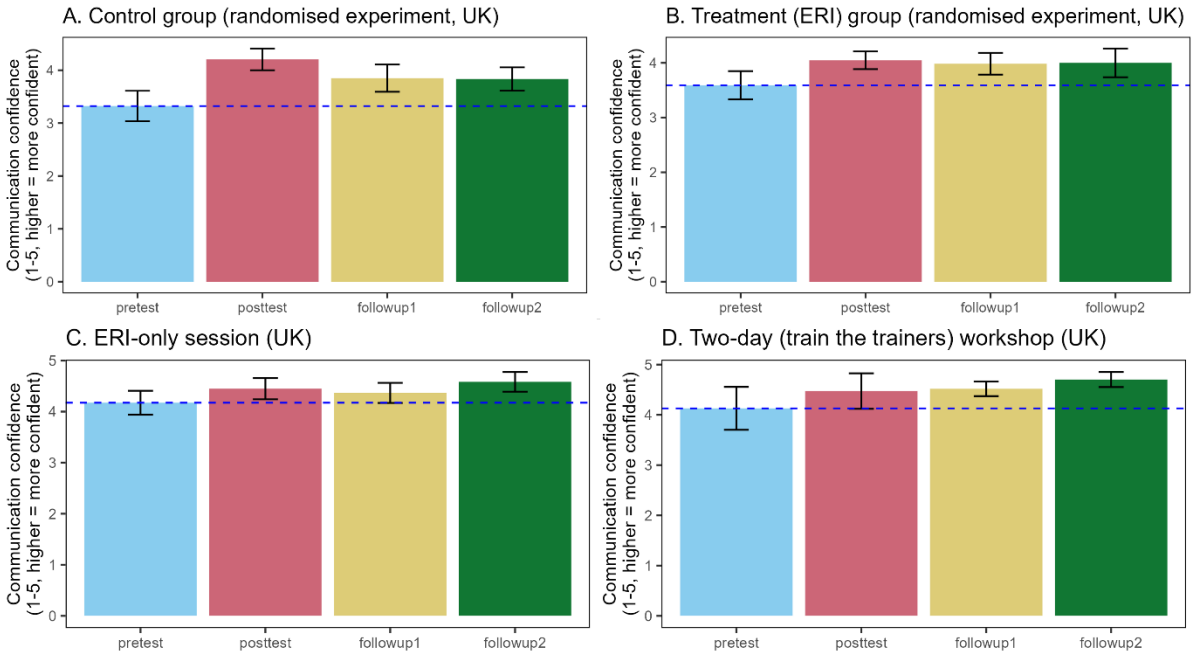
We present results by each of the key study measures. For each measure, we describe the analytical approach, followed by the results of the analyses for each of the study contexts.

Vaccine communication confidence

We observed an overall increase in vaccine communication confidence between pre- and post-training (as measured by the average of three questionnaire items around commitment to vaccination and confidence in discussing vaccination), illustrated in Figure 2.

[2] A fourth video about the influenza vaccine was produced, but it was not completed in time to be used in the study.

Figure 2. Vaccine communication confidence measured at pre-test, post-test, and two follow-ups in each of the study groups in the UK.



Randomised experiment (60 min)

A pre-registered between-within mixed ANOVA with intervention condition (control, n = 26; or ERI, n = 28) as the between-subjects variable and timing (pre- or post-test) as the within-subjects variable found that both groups increased their communication confidence significantly after the training, $F(1, 52) = 45.68$, $p < .001$, $\eta^2_P = 0.47$ ($d = 0.90$). However, there was no main effect of nor an interaction with condition, $F(1, 52) = 0.01$, $p = .910$, $\eta^2_P < 0.01$; $F(1, 52) = 2.84$, $p = .098$, $\eta^2_P = 0.05$.

Across the follow-ups, changes in confidence over all time points remained significant, $F(3, 60) = 9.84$, $p < .001$, $\eta^2_P = 0.33$. There were no significant interaction with condition, $F(3, 60) = 2.49$, $p = .070$, $\eta^2_P = 0.11$. Pairwise t-tests showed that after the initial post-training increase, there was a significant drop in confidence between post-test and follow-up 1, $t(36) = 2.88$, $p = .020$, $d = -0.47$, that was also significant when comparing post-test and follow-up 2, $t(27) = 1.99$, $p = 3.07$, $d = 0.58$. There was no significant difference between follow-ups, $t(24) = 0.15$, $p = .880$, $d = 0.03$.

ERI-only session (90 min)

We conducted an exploratory analysis of the changes in vaccine communication confidence among the UK sample (the German sample only completed this measure at pre-test). A paired samples t-test found that trainees increased their communication confidence, but not significantly, $t(40) = 1.73$, $p = .092$, $d = 0.27$.

At the first follow-up, a one-way within-subjects ANOVA across the three time periods found significant changes in communication confidence, $F(2, 30) = 4.79$, $p = .016$, $\eta^2_P = 0.24$. However, the ANOVA across four time periods (both follow-ups) was not significant, $F(3, 30) = 0.77$, $p = .523$, $\eta^2_P = 0.07$. Follow-up comparisons between the different time periods were also not significant, with the largest difference being between pre-test and post-test.

Two-day workshop ("train the trainers")

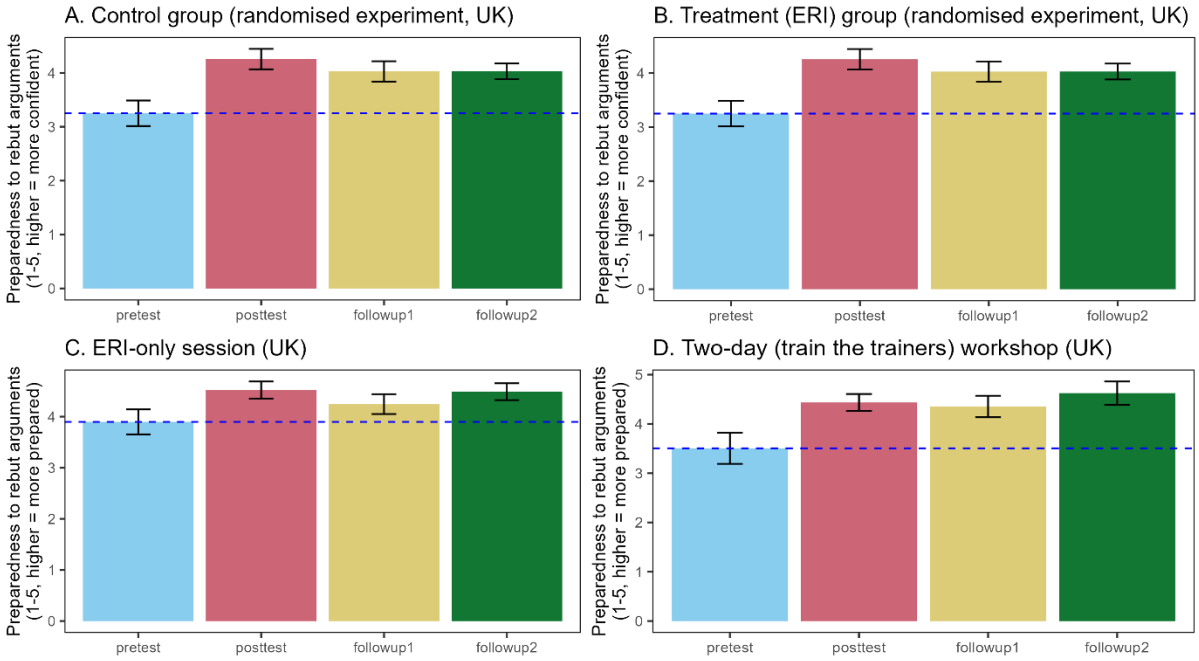
A paired samples t-test found that participants in this group increased their vaccine communication confidence, but the increase was only marginally significant, $t(15) = 2.11$, $p = .052$, $d = 0.53$. Given the small sample size for both follow-ups ($n = 9$), a detailed statistical analysis across the follow-up

data would not be informative[3]. However, the descriptive trend in Figure 2 (Panel D) shows that there was an increasing tendency following on from the training that did not revert with time.

Preparedness to rebut anti-vaccination arguments

We observed an overall increase in preparedness to rebut anti-vaccination arguments between pre- and post-training (as measured by the average of three questionnaire items around commitment to vaccination and confidence in discussing vaccination), illustrated in Figure 3.

Figure 3. Preparedness to rebut anti-vaccination arguments, measured at pre-test, post-test, and two follow-up time points for each study group in the UK.



Randomised experiment (60 min)

A between-within mixed ANOVA with intervention condition (control, n = 26; or ERI, n = 28) as the between-subjects variable and timing (pre- or post-test) as the within-subjects variable found that both groups increased their preparedness to rebut arguments significantly after the training, $F(1, 52) = 90.87$, $p < .001$, $\eta^2_P = 0.64$ ($d = 1.31$). However, there was no main effect of nor an interaction with condition, $F(1, 52) = 0.16$, $p = .689$, $\eta^2_P < 0.01$; $F(1, 52) = 0.18$, $p = .676$, $\eta^2_P < 0.01$.

Across the follow-ups, changes in preparedness to rebut arguments over all time points remained significant, $F(3, 60) = 32.08$, $p < .001$, $\eta^2_P = 0.61$. There was no significant interaction with condition, $F(3, 60) = 1.68$, $p = .179$, $\eta^2_P = 0.08$. Pairwise t-tests showed that preparedness at each follow-up remained significantly higher than pre-test levels (follow-up 1: $t(39) = 8.34$, $p < .001$, $d = 1.32$; follow-up 2: $t(30) = 5.87$, $p < .001$, $d = 1.05$), but with no significant differences between post-test and both follow-ups ($d = -0.19$ between post-test and follow-up 1, $d = -0.20$ between follow-ups).

ERI-only session (90 min)

We analysed the change in preparedness to rebut arguments before and after training on the full sample (UK and Germany, since both completed this measure pre- and post-test). An exploratory within-between ANOVA with timing of measure (pre- or post-test) as the within-subjects factor and country as the between-subjects factor found that participants increased their reported preparedness to rebut arguments significantly, $F(1, 58) = 28.88$, $p < .001$, $\eta^2_P = 0.33$ ($d = 0.79$). There

[3] Indeed, a one-way within-subjects ANOVA reports no significant effects across pre-test, post-test and follow up 1 ($F(2, 12) = 2.76$, $p = .103$) or all four time points up to follow up 2 ($F(3, 9) = 3.35$, $p = .069$).

was no main effect of nor interaction with country, $F(1, 58) = 2.85$, $p = .097$, $\eta^2_P = 0.05$; $F(1, 58) = 0.84$, $p = .363$, $\eta^2_P = 0.01$.

For the UK sample, from whom we collected follow-up data, a one-way within-subjects ANOVA found that changes in preparedness were significant across all four time periods, $F(3, 27) = 11.97$, $p < .001$, $\eta^2_P = 0.57$. Pairwise t-tests indicated that after the post-training improvement, there was a drop at the first follow-up, $t(16) = 3.00$, $p = .034$, $d = -0.73$, with preparedness to rebut arguments at follow-up 1 not significantly different from pre-test, $t(17) = 2.55$, $p = .062$, $d = 0.60$. However, at follow-up 2, the difference between post-test and this follow-up was not significant, $t(14) = 2.51$, $p = .062$, $d = -0.65$, and preparedness at follow up 2 was significantly higher than pre-test, $t(12) = 4.29$, $p = .005$, $d = 1.19$. (All *p*s adjusted for multiple comparisons.)

Two-day workshop ("train-the-trainers")

A paired samples t-test found that trainees increased their reported preparedness to rebut arguments significantly after training, $t(11) = 4.20$, $p = .001$, $d = 1.21$. In the small sample that completed follow ups ($n = 9$), we observed that average preparedness to rebut arguments was consistently higher than at pre-training. While a one-way ANOVA across all time points found no significant differences across times, $F(3, 9) = 3.35$, $p = .069$, $\eta^2_P = 0.53$, this likely reflects the underpowered sample size.

Vaccination status

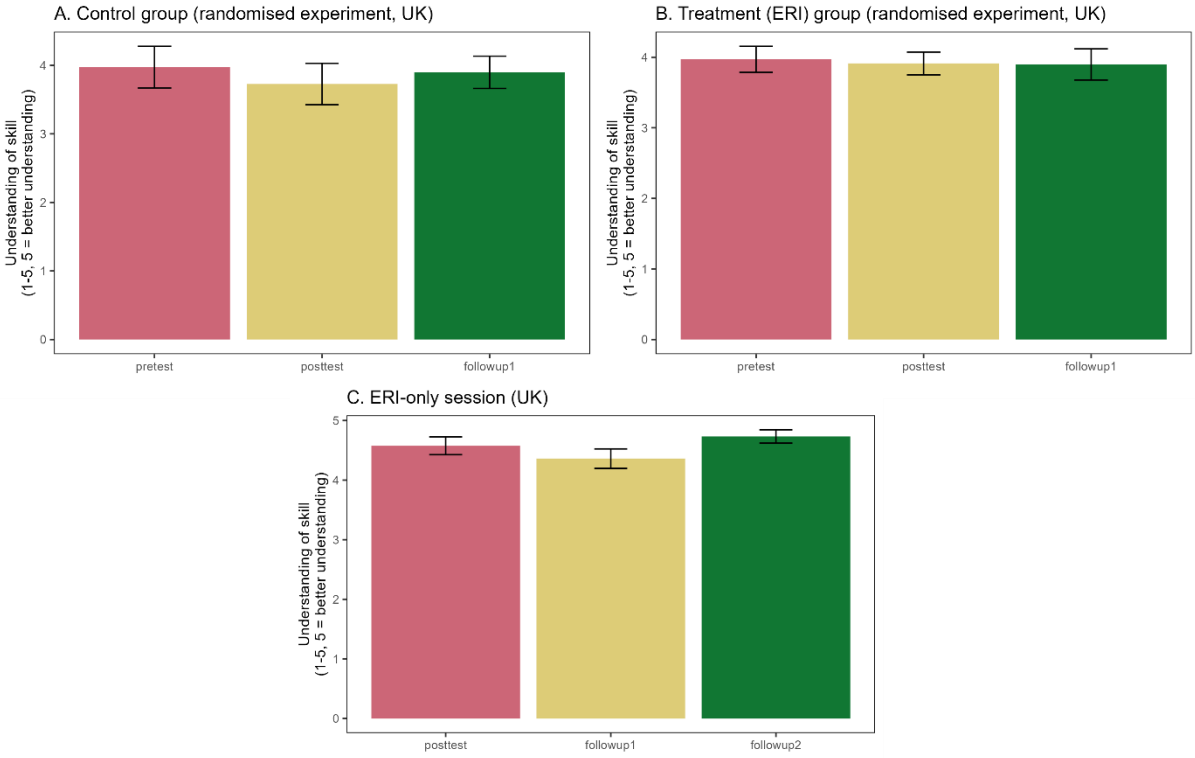
Vaccination status was measured at pre-test and at each of the follow-ups in the UK. We compared changes in number of flu vaccines participants' reported they had had using a two pre-registered between-within ANOVAs for the randomised experiment participants (with condition—control or treatment—as the between-subjects factor and timing as the within-subjects factor, comparing the pre-test and each follow-up in separate ANOVAs) and an exploratory within-subjects ANOVA (across the three time points) for the other groups.

None of the ANOVAs in the randomised experiment found any significant main effects nor interactions, all *p*s > .25. Nor were there any significant changes in participants' vaccination status between training and follow-ups in any of the study groups (90 min training: $F(2, 20) = 0.23$, $p = .795$, $\eta^2_P = 0.02$; two-day workshop: $F(2, 6) = 1.00$, $p = .422$, $\eta^2_P = 0.25$).

Communication skills

We measured participants' self-rated understanding of six communication skills related to the ERI only at post-test and in the UK follow-ups for the groups that received the randomised experiment session and the 90 min ERI-only session. While we had pre-registered analyses for the randomised experiment that analysed each skill individually, the pattern of results were broadly similar and the rating of skills were highly intercorrelated (Cronbach's alpha = 0.79-0.97 across samples). We therefore summarise results for average ratings across all six skills. We observed that these ratings remained at similar levels in the longer term (see Figure 4).

Figure 4. Self-rated understanding of ERI-related communication skills at post-test and two follow-up time points for the randomised experiment and short ERI session groups in the UK.



Randomised experiment (60 min)

A between-within ANOVA including condition (control or treatment) as the between-subjects factor and all three time points as the within-subjects factor found no significant drop in rated skills understanding over time, $F(2, 38) = 0.42$, $p = .662$, $\eta^2_P = 0.01$. There was no significant interaction with condition, $F(2, 38) = 0.34$, $p = .713$, $\eta^2_P = 0.01$.

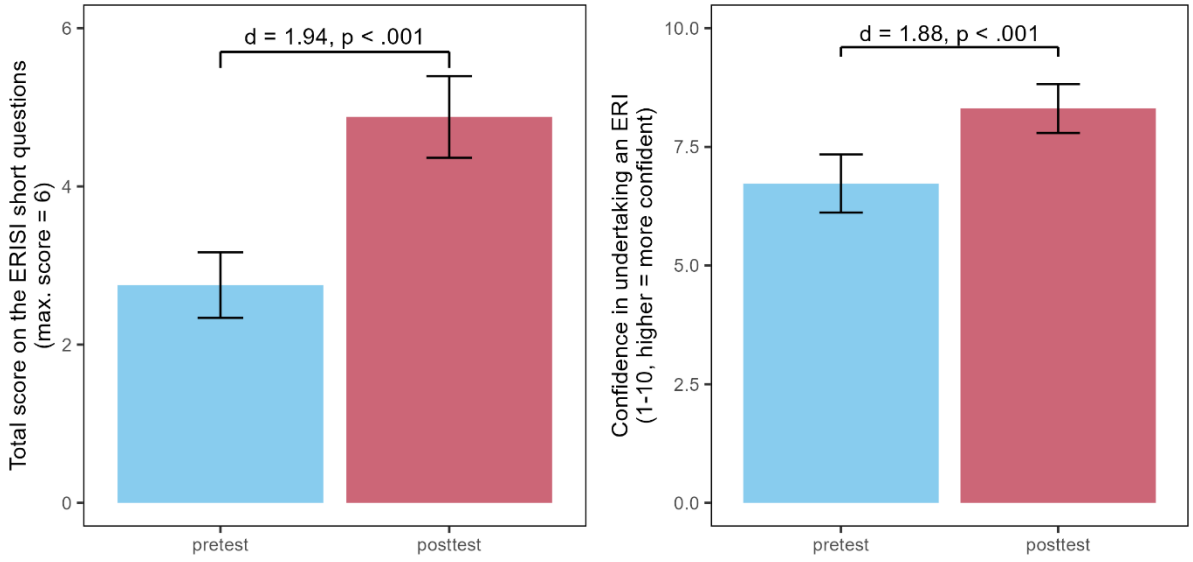
ERI-only session (90 min)

We conducted a within-subjects ANOVA across the three time points (post-test and both follow-ups), which found no significant drop in rated skills understanding over time, $F(2, 18) = 2.68$, $p = .096$, $\eta^2_P = 0.23$.

Two-day workshop ("train the trainers")

Communication skills for the two-day workshop group were measured pre- and post-training using the ERISI, which comprised a skills element testing understanding and application ERI knowledge and techniques, and a confidence element gauging preparedness and confidence to use the ERI. As shown in Figure 5, paired samples t-test showed that participants' score on the skills element of the ERISI increased significantly after the training, $t(11) = 6.73$, $p < .001$, $d = 1.94$. We averaged participants' ratings for the confidence in conducting an ERI (Cronbach's α pre-test = 0.95; post-test = 0.97) and similarly, these also increased significantly after training, $t(11) = 6.51$, $p < .001$, $d = 1.88$.

Figure 5. Changes in ERISI scores between pre- and post-test for the two-day workshop group.



In the post-training follow-ups, due to time constraints, we did not collect data using the ERISI again, but asked participants to rate their understanding of ERI-related skills (identical to the follow-ups for the other study groups). Participants' ratings for these skills were high on average: 4.29/5 (*SD* = 0.35) at follow up 1 and 4.52/5 (*SD* = 0.66) at follow-up 2. These ratings are comparable to the ratings of average confidence in undertaking the ERI observed at post-test (*M* = 8.31 out of 10, *SD* = 1.20).

Process evaluation

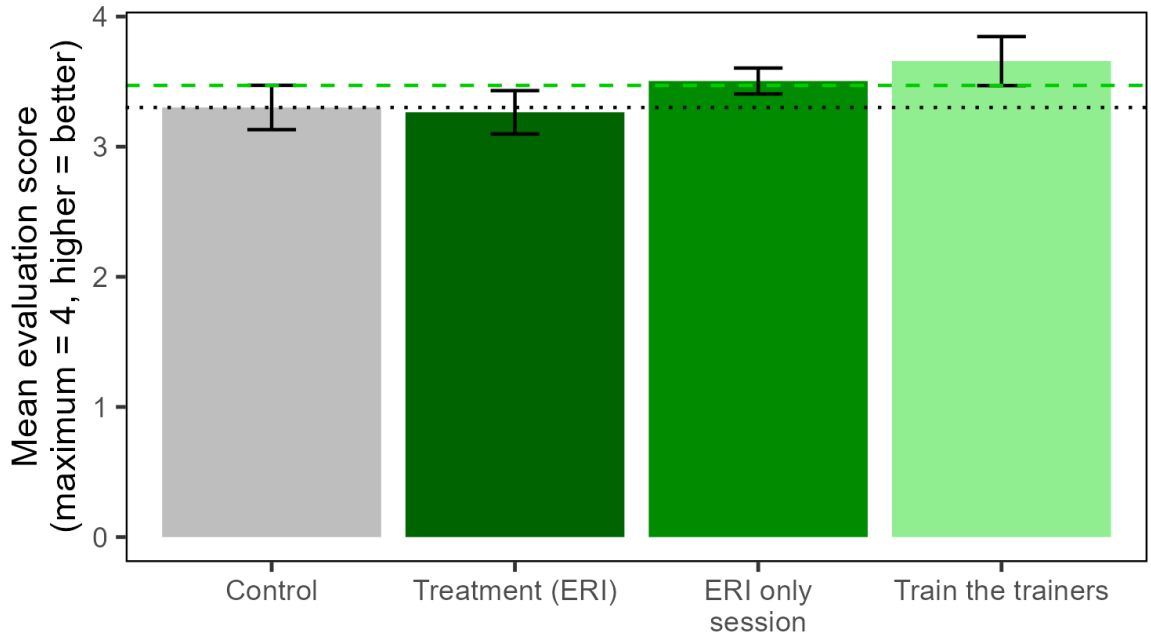
Questionnaire evaluations

We collected quantitative and qualitative feedback from participants during the post-test questionnaire as part of our process evaluation, to ascertain acceptability and feasibility of the ERI training.

Quantitative evaluation ratings

Evaluation ratings of the ERI-based sessions (randomised experiment, short session, and two-day workshop) were on average 3.30/4 (*SD* = 0.42). Figure 6 illustrates the average ratings for each of the different ERI sessions relative to ratings for the control group.

Figure 6. Average evaluation ratings of the different vaccine communication sessions run in WP3.3



Note. The green dashed line shows the average rating across all ERI-based sessions. The black dotted line indicates the average rating for the control group from the randomised experiment, who received an existing communication module.

Qualitative questionnaire feedback

We collected feedback from the open-ended questions in the post-test and follow-up questionaries, with 110 participants who received some kind of ERI training session leaving one or more comments in these questions. We summarise here the overarching and most frequent themes from these comments.

Useful elements of the ERI workshops

In total, 89 participants mentioned concrete elements of the workshops that they perceived as useful. Most respondents (*n* = 26) highlighted the ERI technique and its components. For example:

> "*Good tactic to avoid contradicting hesitant people too strongly but can bring them down to a common denominator*". [German participant, 90 min ERI-only session]

Moreover, the role play was largely well received (*n* = 23):

> *"It was useful to practice the techniques in a relaxed environment. It helped show how they can be used in practice just by changing your conversation approach slightly."* [UK participant, treatment (ERI) session]

Additionally, the concept and the metaphor of the attitude roots was mentioned frequently and seemed to appeal to participants (*n* = 19):

> "G*reat use of the tree to show how deep rooted the causes of being afraid of vaccines can be.*" [UK participant, 90 min ERI-only session]

Many participants emphasised that the workshop gave a framework and a clear structure for conversations with vaccine hesitant patients (*n* = 17). A few comments also mentioned the use of concrete examples (*n* = 16), providing room for discussions (*n* = 10) and showing the jitsuvax.info website (*n* = 3) as useful elements of the training.

Improved understanding due to the workshop

We had 69 responses about how the workshop improved understanding. The majority of these (*n* = 36) said that the workshop showed them clear steps and gave them inspiration for vaccination-related conversations.

> *"It was helpful to have a structure of how to form a supportive conversation and avoid combative conversation - one person's opinion vs the other's"* [UK participant, treatment (ERI) session]

Moreover, several participants stated that the workshop inspired them to be more open and empathetic towards others' viewpoints (*n* = 13).

> *"I felt it improved my understanding of the importance of affirming people's concerns so they feel heard before launching straight into a conversation about vaccines."* [UK participant, 90 min ERI-only session]

Participants reported a better understanding of the reasons for vaccine hesitancy (*n* = 13).

> "*Helped to think about WHY people may be hesitant and use that to help us reach an understanding together."* [UK participant, 90 min ERI-only session]

Intention to use workshop elements in clinical practice

We analysed 86 responses for participants' intention to use elements in clinical practice. A majority intended to use the ERI and its steps in their practice (*n* = 35).

> *"I will try to use the techniques discussed in practice as I think they provide an effective way to manage tricky conversations"* [UK participant, treatment (ERI) session]

Participants specifically planned to use affirmations (*n* = 23), address people's underlying attitude roots (*n* = 15), ask more open questions in the future (*n* = 12) and a few intended to make use of the *jitsuvax.info* website (*n* = 8).

> *"Using affirmation, empathy & open-ended questions in conversations with parents regarding vaccines."* [UK participant, 90 min ERI-only session]

Opportunities to improve the workshop

Thirty-six participants left suggestions for how the workshop could be improved. These answers were rather diverse, but many in the shorter sessions suggested that it could have been longer (*n* = 9).

> *"Could be slightly longer session, as there is a lot of information. I would have liked to discuss further about the psychology of the relationship and discussing such a personal matter."* [UK participant, 90 min ERI-only session]

Mostly, participants felt they would have benefited from receiving more (best practice) examples (*n* = 8), having more time for group discussions (*n*= 4) and increasing the ratio of practice exercises to theory (*n* = 3).

> *"It would be helpful to have an example scenario, about how to engage with people who follow conspiracy theories. The example on the PowerPoint about a mum fearing vaccines overwhelming her child's immune system was helpful - it would be good to have a similar example concerning conspiracy theories."* [UK participant, treatment (ERI) session]

General feedback

Forty-five participants gave general feedback, including comments that the session was useful (*n* = 25) and expressions of gratitude for the opportunity (*n* = 7). There was praise especially for the teaching (*n* = 5) and the organisation (*n* = 5), but also the examples provided (*n* = 4) and the interactive aspects of the session (*n* = 4).

> *"Really well organised training sess[ion]. Both trainers engaging and stimulated group discussion. Felt opinions and answers were valued."* [UK participant, two-day workshop]

The perception of the training sessions as a good opportunity to learn and practice new skills and perspectives was exemplified by this comment:

> "*Really useful- a totally protected space to really look at this topic and because it was so focussed it had a clear message*." [UK participant, 90 min ERI-only session]

Single participants expressed doubt about whether they might be able to apply the skills in their daily practice and suggested that a better balance of occupations invited to the session might be beneficial. Additionally, one participant from a two-day workshop felt the new terminology introduced during the training would take some effort to internalise and put into practice.

Follow-up questions: Take-aways from the workshop

Participants completing the two follow-up questionnaires provided open-ended feedback on what they remembered most from the workshop and which elements they had implemented in their practice since the workshop. In total, we were able to analyse comments on these questions from 40 participants at the first follow up and 20 participants at the second follow-up.

The ERI technique and components (n_{t1} = 11; n_{t2} = 7), the different attitude roots (n_{t1} = 9; n_{t2} = 7), and the role play experience (n_{t1} = 13; n_{t2} = 3) were among the elements participants remembered best.

> *"Remembering every patient is an individual, with an individual response, which requires an individual conversation."* [UK participant, treatment (ERI) session]

Several participants reported that since the workshop, they had applied the ERI in patient education (n_{t1} = 6; n_{t2} = 6), identified patients' attitude roots through active listening (n_{t1} = 9; n_{t2} = 7) and open-ended questions (n_{t1} = 4; n_{t2} = 1), and positively affirmed patients' individual concerns (n_{t1} = 6; n_{t2} = 5).

> *"I am not in a clinical setting but have utilised Jitsuvax resources in training and have disseminated to those in vaccination roles."* [UK participant, two-day workshop]

Training observations

All UK sessions involving the ERI (treatment group in the randomised experiment, ERI-only session, and train the trainer) were attended by a research observer, who completed an observation schedule to assess the fidelity of module delivery and whether the planned learning outcomes for the training had been met (see Appendix).

Overall, observers found the ERI sessions to be of high quality and faithful to the conception of the ERI and its foundations in attitude root theory and empathetic communication. There was evidence that learning outcomes were being met, as trainees could relate specific examples from their practice to the attitude roots and ERI skills introduced. Module fidelity was good as all trainers managed to cover all planned content aspects (e.g., presentation of attitude root and ERI, use of jitsuvax.info website, video demonstration, and role plays) and give sufficient time for trainees to complete exercises and engage in discussion around them. Most trainees showed good engagement throughout the module, though this was notably lower in the randomised experiment group. Group discussions in all sessions were participatory and facilitators did a good job of probing where necessary, and drawing in discussions to keep to time. Keeping discussions on track was noted as a greater challenge in the ERI-only and train the trainer sessions, where discussions were often more organic and spontaneous than in the randomised experiment ERI session.

Two challenges in content delivery and exercise engagement were observed specific to the shorter sessions (60 min treatment session and 90 min ERI-only session). First, although the trainers always went through the website and encouraged trainees to follow along, the quick pace of the presentation did not allow for detailed exploration of the website content within it. Most trainees

did not engage with the QR code given. Second, trainees had a tendency in role play to jump quickly to refutations and facts provision despite showing greater agreement with the elicitation and affirmation steps when they were explained. This was the case even when trainers instructed trainees to focus on the elicit and affirm steps of the ERI in the first role play.

These challenges might be a function of logistical difficulties and the necessity of fitting content into a short time frame. In the randomised experiment ERI sessions, timing was extremely tight and subject to last minute timing changes due to co-ordination problems with the overall training programme. As the module was scheduled last in the training (15:45-16:45) and was sometimes impacted by late running of other earlier modules. Trainees were often also tired by the end of the day and the role play exercises could be disrupted by trainees taking toilet breaks mid-exercise, or trainees leaving before the end of the session (e.g., to catch public transport). A few trainees were also unwilling to take part in a role play.

In the 90 min ERI-only session, extra time was built in to allow for pre- and post-test measures to be completed within the scheduled time. In practice, not all trainees completed pre-test measures due to late arrivals and trainers had to adapt session timings to lateness. Three of the ERI-only sessions were delivered online (though only the one in the UK was formally observed). There were minor technical issues that were smoothly overcome, however for the role play exercises, it was observed that trainees required more time to access links and documents and thus timing for these sessions should ideally be increased to account for this. Role play online was also difficult to monitor as it was not possible to enter online breakout rooms without being disruptive to the pairs in them.

The two-day workshops were conducted at a slower pace, allowing for more time for content delivery and a range of exercises to consolidate learning. This was observed to be well-received by trainees, with the experiential exercises around attitude roots and refutational learning highlighted as two particularly effective components. There was also more scope for exploring the website as part of the exercises and repeating it several times to allow trainees to familiarise themselves with it throughout the day. Observers noted much praise from trainees for the website when they had this opportunity to engage with it.

In these two-day workshops, trainers spent more time with trainees discussing the elicitation and affirmation steps and increased their awareness of the correction reflex. However, this might have come at the expense of less time spent on tailored refutations. The refutation step was noted to be difficult for trainees to grasp. Observers suggested further breaking down refutation techniques to help.

Observers noted that the group size of 6-20 was ideal, and should not extend beyond this range due to the participatory nature of the exercises and discussions. Observers provided more suggestions for improvements, which will be implemented in future rounds of training.

Qualitative interviews

We conducted nine interviews among participants in the UK, with representation from trainees in each of the three study groups, as well as a stakeholder in immunisation training. This allowed us to gather qualitative insights from the experiences of participants in each of the training settings as well as the perspectives of key informants regarding the delivery aspects of immunisation training.

Table 3. Characteristics of interviewees

Characteristic	**Number (total *n* = 9)**
Number who participated in training, of which:	8
Randomised experiment, control session	2
Randomised experiment, treatment (ERI) session	2

ERI-only short session	3
Two-day workshop	1
Number with HCP training/education roles	2
Median age	47
Median years of clinical experience	20
Number of females	9
Professional background:	
Nursing (primary care)	2
Nursing (secondary care)	5
Midwifery/maternity services	2

Our analysis of the qualitative interviews with trainees and training stakeholders focused on three main themes: (1) trainees' experiences of and feedback on the training they had attended; (2) post-training, what trainees remembered from the training and how they applied this in their practice; (3) interviewees' perspectives on the expectations and considerations around delivering vaccine communications training.

Experiences and feedback from trainees

Interviewees who had attended ERI sessions had positive feedback about the delivery of those sessions. They reported that the training was useful and provided value for them. Those who were more experienced felt that the training reinforced good practice and helped them consolidate their knowledge.

> *"It's always good to have that consolidation, and it's always good to have that reminder … sometimes if a difficult conversation is thrown on you and you weren't expecting it, then that training because it's fresh in my mind now, I would like to think I would do it more naturally."* [P01, trainee in treatment (ERI) session]

The experience of the ERI sessions was also positive, with interviewees saying they enjoyed it and found it easy to understand. Specific elements credited for this were that the ERI presentation had clear slides with good graphics, included a good amount of detail within the given time, and the overall session was structured in a way that balanced theory and the overall model with practical exercises. There was also praise for resources shared, including the jitsuvax.info website.

> *"I think [there] was a good amount of detail. If you do too much, you can switch off a bit, but I think [the presentation] was just the right amount, and then [the session] went into practical – trying it out – and then went back to the model again – so I think that's a nice balance."* [P08, trainee in 90 min ERI-only session]

All interviewed trainees agreed that the timing of the session they had attended was just right.

> *"The model – the participation – and I think the presenters – and the timing of it was good. I can't remember how long it was, but it definitely felt the right length. It didn't go on! I think the length was good."* [P08, trainee in 90 min ERI-only session]

At the same time, interviewees felt they would have liked time to cover attitude roots and different forms of patient arguments in detail. Interviewees acknowledged that realistically, the session timing allowed for an outline of the content rather than in-depth details. They felt that it was good to have further resources so they could consult these after training.

> *"A limitation was that I think it was only about an hour long. To get all that information in is challenging. … I guess there could have been more information about the background of*

what those roots are and how you then deal with those more specifically." [P10, trainee in treatment (ERI) session]

One interviewee suggested that sessions could be followed by refresher courses

"You could have then a follow up on Teams [video conferencing], on how you found it and other things you need help with to be able to implement it more into your practice." [P10, trainee in treatment (ERI) session]

The value of having a framework to structure the session was highlighted by interviewees from the ERI sessions. They felt that they had an intuitive understanding that the ERI steps were beneficial, but the framework helped to articulate why those steps were necessary for better communication.

"[The] session was really good to try and explore those themes, which I think we all know are there, but we weren't able to put them down so concisely … to put it in such a simple format was really helpful … nurses are doing this every day, but to actually have it put down on paper, I think is really helpful." [P06, trainee in 90 min ERI-only session]

Despite many of the steps being intuitive and already practised by most trainees, the trainees felt the ERI model was novel and had additional value to previous communication training they had attended.

"I think it's a really good framework and I think it does build on motivational interviewing. It takes it a step further." [P07, trainee in two-day workshop]

The presentation about attitude roots and how it informed the communication framework was highlighted as an interesting new aspect for interviewees.

"I like the fact that you used a very clear model, and then it wasn't just reiterating the same…discussions about difficult conversations. It was quite refreshing to see a different model. It felt like there's some slightly new things to add to sort of repertoire." [P08, trainee in 90 min ERI-only session]

In addition, the role play scenarios were seen as unexpectedly useful and effective. This was a surprise for several interviewees because they held negative perceptions of role play in general.

"I thought the role play was really useful. And I really hate things like that, but I did think it was really useful. I find it really embarrassing. But I actually thought for that it was very good." [P01, trainee in treatment (ERI) session]

Not all interviewees found it easy to engage with hesitant patients' perspectives in the role play, describing it as an unnatural position for them to take. However, they also felt that challenging themselves to take on that perspective was useful in reinforcing the message of listening and accepting how patients were feeling.

"I think all of us were slightly more anxious – sort of like, 'Ooh, we've gotta do this!' – but it was very good. because we'd just talked about different ways of doing it, it was good to then directly go and try it out, rather than take the theory away to practise… consolidate the theory a bit, rather than go away and thinking, 'What was it again?!'" [P08, trainee in 90 min ERI-only session]

Interviewees reflected that the ERI role play was effective compared to their previous experiences of role play because it was structured, with clear tasks that avoided uncertainty about what trainees were supposed to do. They also felt that the exercise was conducted in a supportive fashion in small groups that did not feel too pressurising.

> *"Often, what I find in group-work situations is you get given a task and half the people don't understand what you're supposed to do so they sit there and are a bit vacant…and then it's not useful because half the people don't get it. But [in this training] it was quite obvious what we were supposed to do, how we were supposed to approach it. And it was short enough that you could do it."* [P09, trainee in 90 min ERI-only session]

This was in contrast to the control sessions, where trainees underwent a similar scenario-based exercise and discussed responses to patient concerns. We interviewed two trainees who had attended one of these sessions. One interviewee felt the control session provided new background knowledge and that it was a good reminder for them to apply communication skills they had already acquired through previous experience in the context of vaccination.

> *"Advanced communications is a lot of my job anyway. …I guess that's what the [session] is for, is just re-looking at the whole spectrum of vaccinating, and going, 'Well what are your gaps in your knowledge and your experience?'"* [P03, trainee in control session]

The other interviewee described the session as an unpleasant challenge and felt the session did not provide enough practical guidance, and expressed doubt that they were any more confident. This appeared to stem from a feeling of being judged by peers during the practical exercise, uncertainties about the assigned task, and the need for more structured and relevant training materials.

> *"You're trying to think on the spot in a scenario where you don't know anybody and you don't know the group that you're working with either. It just doesn't feel normal, I can't transfer it over to what I would do in an actual situation. … I didn't really come away from it thinking, 'Oh, now I know how to handle that situation better.'"* [P02, trainee in control session]

This need for a structured and supportive training atmosphere was mentioned by other interviewees as well, who felt that this was present in the ERI session they attended, allowing them to tackle challenging tasks in the training exercises and push through the discomfort of practising new skills.

> *"It was relaxed enough for us not to be so stressed, we felt we could try it out and we could give honest feedback, and it didn't feel that we were being judged by the researchers or the presenters if we just fluffed it a bit."* [P08, trainee in 90 min ERI-only session]

All training sessions (including the control) involved discussion time, which was valued by the trainees as an opportunity to learn from each other, as long as it was well-structured with effective management of the training group to keep discussions on topic.

> *"There were sort of things raised that each of us hadn't really thought of and stuff. But, 'cause it was a smallish group, it wasn't like you were going round a million people*." [P09, trainee in 90 min ERI-only session]

Trainees felt that they gained exposure to other practitioners' diverse experiences through discussions, as well as a sense of solidarity knowing that their peers went through similar experiences in vaccine discussions with patients. They also spoke of the networking benefits from being able to meet other HCPs doing related work.

> *"There were lots of people there that we met and we've exchanged ideas. So I think a network as with lots of things in healthcare is so beneficial and hopefully that will just grow."* [P07, trainee in two-day workshop]

Interviewees had a few constructive ideas on improvements that could be trialled for training. These included re-naming the ERI and its steps to be less wordy, including live demonstrations of ERI

interactions, and having bespoke training that drew on practice-level data in their own regions to better tailor discussions around attitude roots and argument themes.

Memory and applications of training

Interviewees' memories of the sessions and which components stood out to them varied. Those who had attended the ERI-only session and the two-day workshops were able to describe the session contents in greater detail, but interviewees who had been part of the randomised experiment (and thus had either the control or the ERI module at the end of their training day) had less detailed content memory.

Interviewees who had attended the control session could describe the structure of the session but not details of the scenario exercises. One of them mainly highlighted their negative memories of a stressful training challenge that they felt they failed.

> *"We had to think of the answers in a pressured situation, in front of a load of other people, when we don't normally do it anyway … I don't mind small groupwork, but that sort of having to perform in front of a group of people and being caught unawares, it's so, it's not like reality is it?"* [P02, trainee in control session]

The other described the set-up of the exercise and that it was a useful and realistic challenge.

> *"I quite liked that way of working, and it was quite nice that we only got part of the scenario and not the full story. Because in reality that's what you would have, you never get the full situation, you know this patient is coming in for this, but you generally won't know any background about that family unless there's anything particularly highlighted."* [P03, trainee in control session]

Interviewees who had attended ERI sessions were able to recall parts of the framework, though they often used their own words to describe the principles instead of remembering the name of each step. For example, interviewees described "asking what their concerns were, listening to their concerns" (elicit concerns), "resonating with people" (affirmation), "refuting that information, and then replacing that with something more positive" (tailored refutation) and being "knowledgeable" (factual information"). The attitude roots and how they motivated vaccination concerns had stuck out for most trainees, as they were able to describe this part of the training in good detail.

> *"The idea of the different roots of where information comes from, and talking about vaccination in a way where people are able to be receptive to that information and not feeling like they're just having their viewpoint counted so that they then put up that barrier, that wall*." [P09, trainee in 90 min ERI-only session]

The jitsuvax.info website used during the training stood out for some trainees, who also described returning to it after the training and being motivated to find out more about after getting the context and outline of attitude roots and the ERI in training.

> *"I wanted then for myself to go back through the JITSUVAX website and read a lot more of the specific counter examples to things and information."* [P09, trainee in 90 min ERI-only session]

However, other interviewees remembered this less clearly and had not visited the site after the training.

> *"I can't remember whether they did point us to the Jitsuvax website that goes through each of those roots. I can't remember whether they did highlight that or not."* [P10, trainee in treatment (ERI) session]

Overall, the ERI session interviewees felt that the training had utility and relevance to their clinical practice and were able to describe how they had put to use the ERI approach in practice. Several gave examples of interactions where they had implemented some aspects of the ERI framework, with successful outcomes.

> *"I have used it, and I guess the bits I would have used would be the listening, and the feeding back accurate information about things…somebody did have an MMR [vaccination] as well, which was quite good."* [P08, trainee in 90 min ERI-only session]

One interviewee noted that they would need more practice to successfully use the ERI techniques, but described reflecting on how they could have used it better after specific interactions.

> *"I guess if I'd used the conversation technique… I didn't do enough of the 'I recognise that you're well-educated and you're understanding and you're seeking all the information you can'. Yeah, I think the technique could have worked more."* [P10, trainee in treatment (ERI) session]

Interviewees also described interactions with patients in which they encountered arguments against vaccines that had be discussed during the training sessions. One reflected that training on the communication approach was useful for helping to avoid confrontations and intended to put it into practice, but had reservations about whether the outcomes would be better.

> *"I certainly would always go through a more step-by-step approach and listen, and things like that, and try and do it as gently as I can. But I don't know if [I'd] have been any more successful [with the patient]."* [P01, trainee in treatment (ERI) session]

Interviewees from the control group spoke mainly about applying their own previous experiences and general vaccine knowledge when it came to communicating with patients, rather than anything learned from the session.

> *"There are lots of communication tools and study sessions out there, but I guess a lot of it comes with experience, and practice really."* [P03, trainee in control session]

Interviewees who attended the short ERI session and two-day workshops mentioned that in addition to using the approach themselves, they had also signposted other colleagues to the ERI resources shared, including the jitsuvax.info website.

> *"I came out thinking, 'Wow, this is great website,' and had a read through and I've disseminated it. … I've sort of suggested to my colleagues who do this work as well, 'Why don't you utilise this website?'"* [P06, trainee in 90 min ERI-only session]

One interviewee felt that in addition to the website, simpler guides that they could share with busy HCP colleagues would have been helpful. They had concerns that their busier colleagues would not have time to consult the website or would find the approach of exploring patients' motivations difficult during pressured clinical situations.

> *"I guess [what would help is] a sort of quick-reading resource. What the JITSUVAX website has [is] a sort of easy-access resource, but when you work in clinic you can't always just quickly look on that."* [P10, trainee in treatment (ERI) session]

Interviewees also reported recommending the training to their other colleagues, some of whom did indeed attend sessions organised subsequent to this study.

> *"I will certainly recommend it and I'll maybe get our actual [vaccination outreach] callers doing [the training]."* [P08, trainee in 90 min ERI-only session]

Some felt that the ERI training had wider relevance than just immunisations, and thought this could be useful to communicate to other colleagues.

> *"I mean, you could use the techniques for stuff like people who are declining blood transfusion, people who were declining screening tests. People who are declining any sort of course of clinical decision-making that wouldn't necessarily be what you're advising, but, specifically, where they're making those decisions not based on best information."* [P09, trainee in 90 min ERI-only session]

The interviewee who had attended the two-day workshop were planning to run their own training using materials that had been shared. One interviewee on the short ERI-only session had been consulted by managers to run training, but felt that the session they had attended was not sufficient to have confidence to train others about the ERI.

> *"I think the two hour [training] was good, but I don't know if it's enough to equip me to confidently speak eloquently about it."* [P06, trainee in 90 min ERI-only session]

Perspectives on delivering vaccine communication training

Several of our interviewees had experiences with immunisation training and education and were able to share key considerations around organising and delivering training, and how they felt these applied to the delivery of ERI training.

Most interviewees agreed that the face-to-face format of the training was beneficial, especially when the goal was to impart communication skills.

> *"I don't think that session would be as effective online, because you could watch the videos and do that, but you wouldn't get the interaction. However much some people will ask questions when they're online, I feel you get less participation from people."* [P01, trainee in treatment (ERI) session]

One interviewee had twenty years' experience as an HCP immunisations education lead and shared that there was a strong demand from staff to have training conducted face-to-face, especially if it involved childhood immunisations.

> *"What has become more apparent over the last three or four years, is that staff and other organisations don't necessarily feel very confident in just having online training, particularly with a paediatric client base… they don't feel confident with just looking at something online, they want to have something more face-to-face and discussionary."* [P05, immunisation training stakeholder]

One interviewee was concerned about accessibility and reach of the training content if sessions were in-person only and expressed the opinion that because the ERI approach and jitsuvax.info website were highly beneficial, they needed to be disseminated more widely to larger groups of trainees.

> "*The training needs to be online … Not so many little spaces for a few. … And you do I across the [region], you're trying to get 100 people in one session."* [P06, trainee in 90 min ERI-only session]

One interviewee felt that this was a case of communicating clearly the goals and target audience for the training, so that potential trainees could decide whether the session was right for them.

> *"I think that maybe, if it was being rolled out more widely, then I think that really hammering home, 'The reason this can't be online is because of the sort of training and what you're*

being trained to do is very much about interpersonal things that you can't achieve.'" [P09, trainee in 90 min ERI-only session]

Face-to-face training also presented logistical challenges around acquiring physical space for training and getting managerial buy-in to release staff to attend. Some interviewees felt that training needed to be more of a priority on the agenda of managers, as there was good value in training that gave tools for HCPs to exhibit behaviours they had been told to achieve.

"Actually getting the support and buy-in from the senior management teams in the adult side, in order to see this is important - a priority, and to release their staff, I think is the tricky bit." [P05, immunisation training stakeholder]

This value was not always appreciated by colleagues, some of whom might be overconfident in their own skills.

"I think because it's so intuitive, there's a risk of thinking that it's very basic… Like I think lots of people will be like, yes, I do that anyway. But actually they think they do that anyway, but they probably don't." [P07, trainee in two-day workshop]

Interviewees suggested some creative ways to blend learning formats to adapt to HCPs' busy schedules, such that training could be implemented with a mix of online and face-to-face components that might reduce the in-person time commitment involved.

"*I think mixed blended learning works much better, so whether that's scenario-based, whether that's within a face-to-face training session, whether that's providing some other tools… I was just thinking about the various videos, and interactive things that we can do online so much more now. I think those are very useful, but I don't think they stand alone. I think they have to be part of a whole package."* [P05, immunisation training stakeholder]

It was also suggested that being able to deliver training as part of a larger programme of work could help to address the issue of staff time being hard to find.

"I know there's people that have conferences and nurses can go, and they can, but I think if you go to a conference, you're ticking loads of boxes, you've got a conference about lots of other things." [P06, trainee in 90 min ERI-only session]

However, organising larger training programmes presented its own challenges to co-ordinate and sustain and tended to be less frequently run.

"So [the training programme] doesn't run in the adult [immunisations] side in the same way … trying to re-establish and get the same commitment and the same kind of delivery in the adult side … they are struggling to be able to mirror that." [P05, immunisation training stakeholder]

Crucially, interviewees identified that training should be accessible not just to HCPs but also ancillary staff and those from community and public health organisations who were also involved in frontline vaccination outreach and communication.

"[The training] could be really helpful for those, yes, the people that are vaccinating, but it might be really helpful for those people that are really good at having conversations with the community, and are actually working in the community. So like voluntary aid organisations, or faith leaders that are keen to support." [P06, trainee in 90 min ERI-only session]

An important consideration for interviewees who ran their own training was the standard of training and whether it resulted in improved skills and confidence for trainees.

> *"You can obviously have the evaluation of we've trained this many people in this amount of time, but a bit of a survey pre and post can be quite helpful in, you know, showing that they've actually learned something."* [P07, trainee in two-day workshop]

One interviewee who co-ordinated an immunisation training programme had faced in finding the right trainers, which in some cases meant having the right expertise but also the ability to pitch training content at the right level for the target audience.

> *"I needed to look at where are my experts, who can I have that supports this? … Who was there within the research that can provide some of that expertise? … [Having] a nurse by background, talking to other nurses, that does help with understanding the language and the level at which you want to aim your programme."* [P05, immunisation training stakeholder]

This interviewee also identified a lack of expertise around vaccine communications.

> *"The communications, and talking about the myths that are surrounding vaccinations, being able to communicate and reassure parents and carers who may have hesitancy, I think that's the other bit that we want to develop*." [P05, immunisation training stakeholder]

This was also reflected by a general feeling that this type of training was rare and often not sustained due to piecemeal funding.

> "*I feel like you see a lot of these things, working in healthcare, these initiatives and priorities that get money, and then it works really well for a bit and then unfortunately 'cause the funding drops off. So I guess it's seeing how things can be as sustainable as possible despite funding."* [P07, trainee in two-day workshop]

Discussion

Our objective in this study was to pilot the teaching of the ERI to HCPs in clinical training settings. We conducted field tests in three different training settings: (1) a short (60min) ERI module embedded within a full-day immunisation training course (which was compared to an existing vaccine communication module of the same length); (2) a short (90min) ERI module delivered as a stand-alone workshop, run in two different countries (UK and Germany) and formats (in person and online); (3) a two-day "train the trainers" ERI workshop. This allowed us to pilot and obtain feedback on the effectiveness and feasibility of ERI training across a range of settings in which training for HCPs takes place.

We obtained quantitative measures of participants' self-reported vaccine communication confidence, skills acquisition, and training evaluation, alongside open-ended feedback about the training session, qualitative interviews with trainees and stakeholders, and observations by on-site researchers of the training delivery. These measures provided a broader picture of the effectiveness and feasibility of ERI training implementation for HCPs.

Overall, our quantitative measures showed that participants generally improved their vaccine communication confidence after attending training—this was the case across all training attended (including the control module), though in many cases, a significant improvement was hard to detect due to a high baseline level of self-reported confidence, especially from participants with more clinical experience. Increases in preparedness to rebut anti-vaccination arguments was striking, with this measure seeing the most improvement post-training. Among participants who completed follow-up surveys, self-reported confidence and preparedness stayed high, suggesting that the training's beneficial effects stayed high over the three month follow-up period.

Although we saw similar beneficial effects in both randomised experiment groups (ERI module and control module), we note that the control group involved a long-standing programme that had been running for 15 years and regularly benefited from course participants, including senior HCPs who came prepared to impart their knowledge and experience to junior colleagues during the module. Furthermore, participants may have completed the questionnaire measures taking into consideration their takeaways from the entire day of vaccine-related training (which included practical administration and vaccine knowledge modules, not just a communication element). In that regard, it was promising to see that delivering the ERI module in isolation also produced significant improvements particularly in preparedness to rebut anti-vaccination arguments. In other words, even though HCPs in these sessions did not have additional teaching on vaccination facts, they still improved their skills and confidence and retained this over the three months of the follow-up.

Qualitative insights gathered from open-ended feedback and in-depth interviews suggested areas where the ERI modules might still be an improvement on the control. Themes found in the open-ended comments and in the interviews were quite similar. In particular, participants mentioned the interactive nature of the training (particularly role play), novelty of attitude roots, and benefits of a structured framework as key elements that stood out positively. We thus believe the interviews broadly represented the views of most participants in the respective sessions.

The structured framework of the ERI is especially important as we observed from the qualitative data that HCPs bring their existing experience and knowledge into their training; indeed in the control sessions, activities and discussions were typically reliant on the contributions of experienced HCPs within the group. The quality of a session would thus depend on the expertise of the trainees, which is a risky education strategy. Furthermore, probing the experiences of HCPs who attended the control session revealed their tendency to fall back on previous experiences and activities outside of the training to inform their levels of confidence and preparedness, as opposed to specific elements of the training that helped them build confidence (as was the case among ERI trainee interviewees).

Beyond providing a structure for the learning of communication skills, the ERI also offers novel theoretical aspects grounded in psychological theory, specifically attitude root theory and refutational learning theory. The concept of attitude roots appeared to resonate well with trainees, however we observed less engagement with and retention of the refutation aspect of training. This is consistent with previous findings in WP2.3, where HCPs who read exemplars of the ERI (vs. a factual control) were more likely to subsequently describe using affirmation in responses to hypothetical patients, but they picked up refutations to a lesser extent (Holford et al., 2024c). Improvements to training could thus be made by breaking down the tailored refutation process further into examples of specific refutation techniques and allowing more time for trainees to practise these specific skills (Hefter et al., 2022).

In terms of how training is delivered, the ability to interact with peers and put skills into practice (e.g., through role play) was widely highlighted by our trainees as critical for effective learning. Although we observed that a few trainees were resistant or wary about role play, the majority overcame this and reflected that it was helpful. To maximise the value of interactive practice exercises, conducting the sessions in person was perceived by trainees and observers to be optimal. It might also be beneficial to time communication exercises to be earlier in a session (especially when embedded in a longer course where trainees may experience fatigue from earlier training modules). The scaffolding of exercises within the ERI framework also appeared to be positive, as a way to balance having trainees challenge themselves while providing them with a supportive environment to guard against the fear of failure.

Next steps

Qualitative feedback from the questionnaires, interviews, and training observations provided recommendations for improvement, which are currently being implemented. After the conclusion of the study, two partner organisations (UHBW and UKHSA) have requested continuing ERI training for staff members. This has afforded the opportunity to continue field testing improvements to the training and receive feedback on these as part of JITSUVAX WP4. In particular, the train the trainers model will be tested to develop a wider pool of trainers who have the confidence and skills to make bespoke adjustments for their local contexts.

The results of this study will feed into introductory guidance and a facilitator's guide to ERI training, which will be produced for WP4. A planned meeting with all JITSUVAX nodes involved in field tests for WP3 will be organised as part of this work to consolidate learning from across the various field tests.

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Appendix

Questionnaire wording

Table A1. Exact wording and response options for all questions used in the pre-test, post-test, and follow-up questionnaires

	Question	Response options
Vaccination status	How many times have you been vaccinated against influenza during the last three years?	0, 1, 2, 3
Vaccine communication confidence	I am actively involved in ensuring that my patients are vaccinated. I feel comfortable discussing vaccines with my patients who are highly hesitant about vaccination. I feel sufficiently trained on how to bring up the question of vaccines with hesitant patients.	1: strongly disagree, 2: somewhat disagree, 3: undecided, 4: somewhat agree, 5: strongly agree
Preparedness to refute vaccine misconceptions (non-ERISI)	Please indicate how prepared you feel to respond to the individual who said this: [individual items presented below with this question] Medical authorities are overreacting, with vaccines being recommended for every minor illness now. People are being offered too many vaccines nowadays, and this will overload their immune systems. Instead of vaccines, people should improve environmental factors like good hygiene, healthy lifestyles, and protective measures against the disease. I worry about experiencing side effects from the vaccine. Vaccines should not be administered to vulnerable people, such as pregnant women, young children or patients with allergies. Negative experiences and testimonies of injuries by patients should be prioritised when deciding whether or not to accept vaccination.	1: very unprepared, 2: rather unprepared, 3: undecided, 4: rather prepared, 5: very prepared
Understanding of ERI-related skills	Please rate how well you understand the following communication skill/technique: [individual items presented below with this question] Eliciting concerns with open-ended questions Understanding motivations for vaccine hesitancy Giving affirmations Tailoring refutations to vaccine misconceptions Responding to immunisation concerns with facts	1: I have not heard of it; 2: I have heard of it but do not understand it; 3: I understand it but have not used it; 4: I understand it and have used it but would like to become more comfortable with it; 5: I understand it and am comfortable using it

Quantitative evaluation	The group session was useful preparation to deal with individuals' concerns about immunisation. The group session exercise did not adequately address my worries about responding to individuals' vaccine concerns. [reverse coded] The content for the group session was informative. The communication approach discussed in the group session had clear steps for me to follow. I plan to use the communication approach from the group session in my future clinical practice. I did not find the group session helpful to understand individuals' concerns. [reverse coded]	1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree
Qualitative evaluation	Did you find any elements of the group session useful?	Yes / no
	If yes, please provide further information below	Open-ended text
	If no, please describe what we could do to make the group session useful	Open-ended text
	Did you feel you that you improved understanding as a result of the group session?	Yes / no
	If yes, please provide further information below	Open-ended text
	If no, please could you describe what we could do to improve understanding during the group session.	Open-ended text
	Are there any elements of the group session that you will use in your future clinical practice?	Yes / no
	If yes, please describe below	Open-ended text
	If no, please could you explain why?	Open-ended text
	Are there any other ways that the group session could be improved? If yes, please provide details below.	Open-ended text
	Do you have any feedback for the group session? Please write it in the box below.	Open-ended text
Frequency of use of ERI-related skills	In the past 3 months, how frequently have you used this skill/technique when you talk to individuals with immunisation concerns? [question accompanied each skill in *Understanding of ERI-related skills* if participant rated the skill at 4 or 5]	1: I did not talk to any individuals with immunisation concerns; 2: Rarely/Never (0-25%); 3: Sometimes (26-50%); 4: Often (51-75%); 5: Most of the time (> 75%)
Memory and application of training	What do you remember most from the session?	Open-ended text
	Are there any elements of the session that you have used in your clinical practice?	Yes / no
	[If yes] Please describe below.	Open-ended text
	[If no] Please could you explain why not.	Open-ended text
	In the past 3 months, how frequently have you used what you learned during the group session when you talk to individuals with immunisation concerns?	1: I did not talk to any individuals with immunisation concerns; 2: Rarely/Never (0-25%); 3: Sometimes (26-50%); 4: Often (51-75%); 5: Most of the time (> 75%)

Table A2. Exact wording and response options for the ERISI (used in the two-day "train the trainer" workshops)

Question	Response options
People's opinions about vaccines are influenced by distinct psychological constructs, known as "attitude roots." Among the candidate roots presented below, select all those that you believe are relevant to people's opinions about vaccines.	*[Multiple selections possible]* 1: Extroversion; 2: Fear and phobias*; 3: Social identity; 4: Conspiracist ideation*; 5: Epistemic relativism*; 6: Distrust*; 7: Worldview and politics*; 8: Perceived self-interest*; 9: Openness to experience; 10: Religious concerns*; 11: Unwarranted beliefs*; 12: Locus of control; 13: Moral concerns*; 14: Ethnicity; 15: Distorted risk perception*; 16: Reactance*; 17: Crystallised intelligence
In your opinion, what are the two key components in refuting false information?	1. Explain why the misconception is wrong and provide a plausible alternative.* 2. Give factual evidence and check for understanding. 3. Forewarn about misinformation and provide plausible facts. 4. Emphasise that the misinformation is wrong and check there is no misunderstanding.
Select the usual sequential order of the Empathetic Refutational Interview.	1. Elicit concerns, Affirm, Provide facts, Tailored refutation 2. Provide facts, Tailored refutation, Affirm, Elicit concerns 3. Elicit concerns, Affirm, Tailored refutation, Provide facts* 4. Tailored refutation, Affirm, Provide facts, Elicit concerns
The following questions pertain to the use of empathetic refutational interview (ERI). ERI was designed as an approach for healthcare professionals to communicate effectively with patients who are vaccine hesitant and whose hesitancy is expressed, at least in part, by belief in misinformation. The ERI has two goals: on the one hand, to empower people to make informed decisions about vaccinations and, on the other hand, to protect people from misinformation that infringes on their right to be properly informed about vaccinations. On a scale of 1 to 10, indicate the level that best reflects your perception of your confidence or ability for each of the following:	
1. How do you rate your confidence level to include ERI in your professional context?	1 – Low to 10 – High
2. To which extent is it easy for you to discuss with a patient reporting misconceptions about immunisation?	
3. To which extent do you feel confident in affirming such a patient?	
4. To which extent do you feel confident in offering a tailored refutation to the patient's concerns?	
5. To which extent do you feel confident in eliciting a patient's concerns?	
6. To which extent do you feel confident in providing factual information in a comprehensive format to patients?	
7. To which extent do you feel prepared to conduct an ERI?	

Note. Correct answers are marked with *.

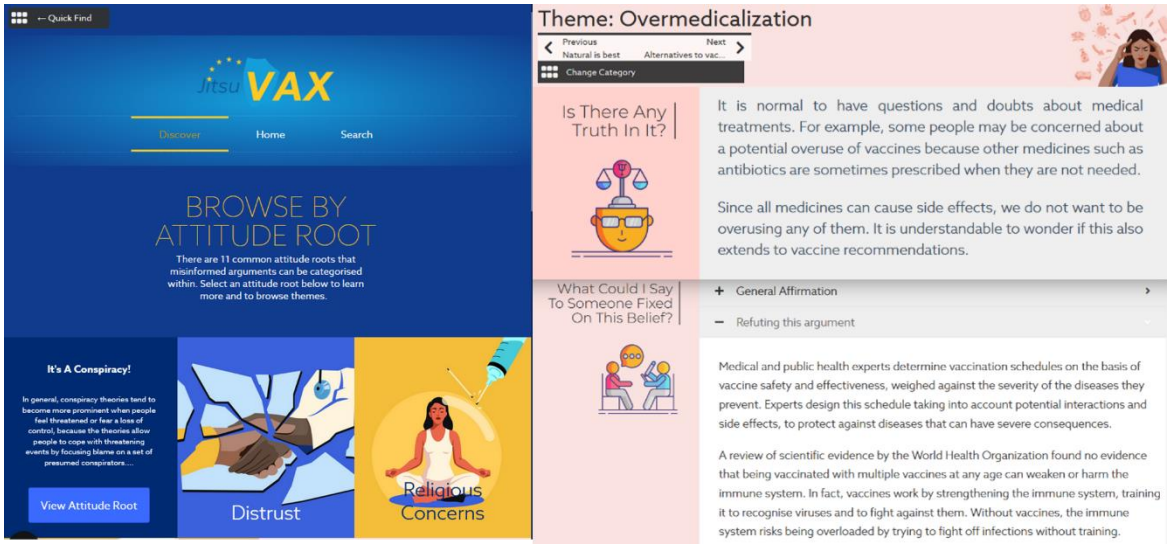
Table A3. Mean scores and reliability (Cronbach's alpha) per study context for questionnaire measures

Questionnaire measure	Mean (SD)				Cronbach's alpha			
	Pre-test	Post-test	Follow-up 1^	Follow-up 2^	Pre-test	Post-test	Follow-up 1^	Follow-up 2^
Vaccine communication confidence (maximum score = 5)								
Randomised experiment	3.46 (0.77)	4.12 (0.52)	3.91 (0.64)	3.90 (0.67)	0.63	0.80	0.69	0.83
Short session*	3.87 (0.89)	4.45 (0.76)	4.37 (0.72)	4.58 (0.70)	0.68	0.75	0.75	0.66
Two-day workshop	4.12 (1.00)	4.47 (0.83)	4.52 (0.34)	4.70 (0.35)	0.80	0.92	0.45	0.55
Refutation preparedness (maximum score = 5)								
Randomised experiment	3.25 (0.68)	4.21 (0.46)	4.10 (0.50)	4.08 (0.50)	0.87	0.86	0.83	0.88
Short session	3.78 (0.85)	4.38 (0.63)	4.24 (0.71)	4.49 (0.60)	0.91	0.90	0.88	0.96
Two-day workshop ~	3.51 (0.74)	4.44 (0.40)	4.35 (0.51)	4.63 (0.55)	0.92	0.86	0.82	0.96
ERI skills acquisition (maximum score = 5 except two-day workshop pre/post test = 10)								
Randomised experiment	-	3.97 (0.69)	3.83 (0.67)	3.90 (0.63)	-	0.85	0.86	0.87
Short session	-	4.44 (0.53)	4.36 (0.41)	4.73 (0.41)	-	0.88	0.92	0.94
Two-day workshop ~	6.73 (8.31)~	8.31 (1.20)~	4.29 (0.35)	4.52 (0.66)	0.95	0.97	0.79	0.96
Quantitative evaluation (maximum score = 4)								
Randomised experiment	-	3.28 (0.43)	-	-	-	0.84	-	-
Short session	-	3.50 (0.42)	-	-	-	0.82	-	-
Two-day workshop	-	3.66 (0.39)	-	-	-	0.53	-	-

Note. – indicates the measure was not administered at that time point. * Post-test data on vaccine communication confidence in the short test excludes German participants for whom the measure was not administered again at post-test. ^ Follow-up questionnaires were only administered in the UK. ~The ERISI version of these items was used for pre- and post-test only in the two-day workshop.

Training materials

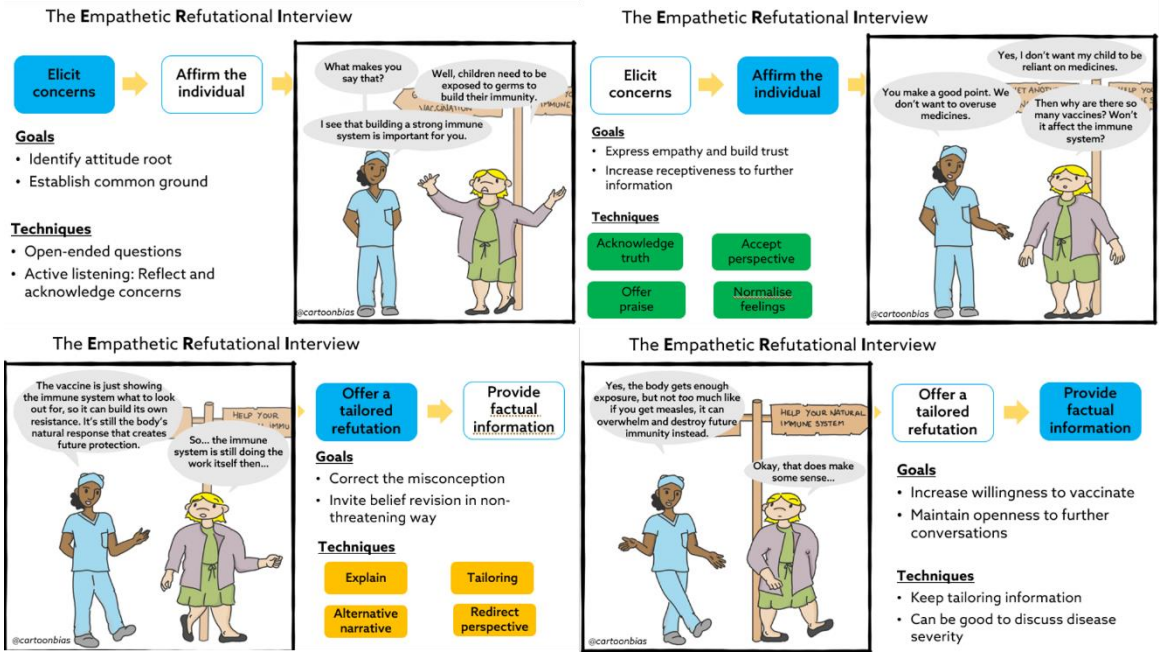
Figure A1. Screenshots of the jitsuvax.info website introducing attitude roots, affirmations, and tailored refutations.



Note. The website is publicly available at https://jitsuvax.info.

Figure A2. Screenshots of a demonstration video showing captioned scenes for the four steps of the ERI.

Figure A3. Screenshots of training slides that give an overview of the ERI and the attitude root theory that underpins it.



Process evaluation materials

Observation schedules

Observation schedule for short ERI sessions (60min & 90min)

Date:	**Location of session:**	**Time started:**	**Time finished:**
Overview of training session logistics: *(e.g. space session delivered, who delivered the session, how were participants seated, how many attendees).*			
Criteria	**Extent met ***	**Descriptive account** *(summarise observational evidence to support the extent to which the criteria has been met)*	
** Score on Likert scale: 1=Criteria not covered; 2=Criteria poorly covered; 3=Average: 4; Criteria covered well; 5=Criteria extensively covered*			
Evidence for learning outcome being met			
Knowledge about motivating factors for vaccination concerns		*e.g. Did participants engage well in the exercise about attitude roots?*	
Communication skills tailored to addressing a range of vaccination concerns and motivators		*e.g. Did participants demonstrate these skills during the exercises?*	
Skills to effectively refute vaccine-related misconceptions in a sensitive way		*e.g. Did participants discuss these skills during the wrap up?*	
Awareness of tools and resources to help with vaccine communications		*e.g. Did participants note down the tools and resources?*	
Delivery of module as intended (fidelity)			
1. *Opening presentation/ demonstration of technique*			
- Attitude roots and empathetic refutation		*e.g. Did participants require clarification about the content presented?*	
- Using the jitsuvax.info website to look up attitude roots, affirmations, and tailored refutations		*e.g. Technical issues? Ease of navigation of website.*	
- Demonstrate interaction in a 5min video		*e.g. How did participants respond to the films?*	
2. Role plays			
-To what extent were participants able to use ERI in practice		*e.g. Were all participants able to use key steps*	
-Timings		*e.g. Did all participants have time to practice each role?*	
3. Wrap up			
Group conversation		*e.g. How well did the facilitator appear to elicit and respond to feedback*	
Reiterate key steps of ERI		*e.g. How was this provided*	
Where to find help and information, including other videos		*e.g. Did participants find the additional information sources useful?*	
Adaptions and contextual observations that may affect implementation:			
Questions from participants during the session *(note: include number of questions asked during session, as well as content)* (a) Number of questions: _____ (b) Details of questions:			

Observation schedule for two-day workshop

Date:	**Location of session:**	**Time started:**	**Time finished:**
Overview of training session logistics: *(e.g. space session delivered, who delivered the session, how were participants seated, how many attendees).*			
Criteria	**Extent met ***	**Descriptive account** *(summarise observational evidence to support the extent to which the criteria has been met)*	
** Score on Likert scale: 1=Criteria not covered; 2=Criteria poorly covered; 3=Average: 4; Criteria covered well; 5=Criteria extensively covered*			
Delivery of module as intended (fidelity)			
1. ERI module presentations *e.g. Was the demonstration of the website clear? Did participants require clarification about the content presented?*			
Eliciting concerns & attitude roots			
Affirmation			
Tailored refutations, refutational learning, and providing facts			
2. ERI learning exercises *e.g. Did participants engage well in the exercise?*			
Exercise on open-ended questions (elicit concerns)			
Exercise on attitude roots			
Exercise on developing affirmations			
Exercise on refutational learning			
Exercise on creating refutations			
Exercise on presenting complex information			
3. The ERI in practice *e.g. How did participants respond to the films? Did all participants have time to practice each role in the role play? How well did the facilitator(s) appear to elicit and respond to feedback?*			
ERI video demonstration			
Role play			
Group discussions			
Evidence for learning outcome being met			
1. Understanding of background *e.g. Did participants discuss these components of the ERI in discussion time? Did participants show an understanding of the terminology and processes when discussing them?*			
Knowledge about attitude roots (i.e., motivating factors for vaccination concerns)			
Scientific rationale for affirmation, tailored refutation, and facts			
2. Demonstration of skills *e.g. To what extent were participants able to use ERI in practice? Were participants able to use Jitsuvax website to look up attitude roots, affirmations, and tailored refutations?*			
Eliciting concerns			
Affirmation			
Tailored refutation			
Facts provision			

Awareness of tools and resources to help with vaccine communications		
3. Application of learning to own training plans *e.g. Were participants able to adapt ERI exercises for own use? What adaptations did they bring up during the group discussion?*		
Group discussions		
Plenary session on training plans		
Adaptions and contextual observations that may affect implementation:		
Questions from participants during the session *(note: include number of questions asked during session, as well as content)* (a) Number of questions: _____ (b) Details of questions:		

Interview topic guides

Topic guide for interviews with short session training participants

SECTION 1: Experiences of the training

I'd like to ask you about your experience of the immunisation training course that you attended on [date].

1. Could you describe your participation in the course?
- Why did you sign up for the course?
- What components of the course stood out to you?
- How did you feel when undergoing the training?

I'd like to focus now on the groupwork session of the training *[interviewer can describe the session so that the participant knows they are talking about the intervention]*.

2. What was your overall impression of this part of the training?
    - Where there any parts that were helpful?
    - Where there any parts that you did not find helpful?
    - What would be the most important thing to change?

Detailed questions about training session: [Use 2a-2c if participant was in intervention; 2d if participant was in control condition]

2a. What can you remember from the opening presentation of the training?

- Explanation of attitudinal roots
- Demonstration of JitsuVax website
- Explanation of empathetic refutational technique
- Video demonstrating empathetic refutational technique

- Were these elements helpful or not?
- Was the information presented easy to understand or not?
- Was there enough detail provided by the trainers?
- Was the length of time spent on each element sufficient or not?
- Have you used the JitsuVax website since the training?

2b. What can you remember from the role play exercise in the training?

- How helpful was it to practice the empathetic refutational technique with your colleagues?
- To what extent did you find it easy to deliver the empathetic refutational technique in a role play situation? What was easy or difficult about this?
- Are there any alternative ways that the role play could have been carried out as part of the training? (e.g. demonstrated by trainer with attendees)

2c. What can you remember from the wrap up section of the training?

- To what extent was it helpful to hear about your colleagues experiences of practicing the empathetic refutational technique?

2d. What can you remember from the scenario-based exercise in the training?

Any other feedback on the training:

3a. To what extent do you feel that communication with patients related to vaccinations was addressed during this training?

3b. To what extent did you feel prepared to interact with and discuss vaccination with patients after this training?

3c. What do you think could be done to improve the training?

- Should it be more/less detailed?
- Should it be more/less interactive?
- Overall length of time: more/less?
- Should it have used a different exercise?
- Were the examples and role play scenarios relevant to you?
- Delivery model (e.g. online)

SECTION 2: Factors influencing effectiveness of intervention

I'd like to talk about patient interactions you have had since the training that involve the topic of immunisation. *[Interviewer should highlight that this line of questioning should not identify an individual patient, but focus on the content of the interaction and the HCP's approach to it.]*

1. Since you had training, have you interacted with patients where you discussed their doubts and/or concerns about vaccination?

- If yes, can you describe the doubts raised by this patient?
- How did you respond to these doubts?
- How easy or difficult was it to continue this interaction with this patient?
- How did you feel during this interaction?
- Did the immunisation training help you in responding to this patient?
- Have you used any specific recommendations from the training in your interaction with this patient?
    - Why/why not?

2. Could you tell me about any barriers you experience when it comes to discussion vaccinations with patient?

- What makes it difficult to have these conversations? *[interviewer can be aware of the possibility that lack of time, communication modalities are factors and prompt if necessary]*
- Are there any skills you feel would facilitate the conversations?
- What tools would be helpful to you in having these discussions?

[OPTIONAL SECTION] Understanding questionnaire responses

If time permits, interviewer may show some of the HCP post-test and follow up Questionnaires and ask participant to explain thought processes for their answers to the questions.

Topic guide for interviews with two-day workshop participants

SECTION 1: Experiences of the training

I'd like to ask you about your experience of the "train the trainers" workshop that you attended in October.

1. Could you describe your participation in the workshop?

- Why did you sign up for the workshop?
- What components of the workshop stood out to you?
- How did you feel when undergoing the training?

I'd like to focus now on the content of the training workshop and the empathetic refutational interview ("ERI") approach taught *[interviewer can describe the session so that the participant knows they are talking about the intervention]*.

2. What was your overall impression of the ERI training?

- Were there any parts of the ERI approach that were helpful?
- Were there any parts of the ERI approach that you did not find helpful?

2a. Can you describe specific exercises that you did during the workshop on the different ERI components?

Reminders for interviewer for what ERI activities there were:

- *Understanding attitude roots*
- *Eliciting concerns*
- *Affirmation*
- *Tailored refutation*
- *Providing facts*
- *Overall: role play and video demonstrations*

- Were these exercises helpful or not?
- Was the information presented easy to understand or not?
- Was there enough detail provided by the trainers?
- Was the length of time spent on each element of the ERI sufficient or not?
- Are there any alternative ways that you thought the training exercises could be carried out, or improved?
- Have you used any of these exercises since the training?

2b. During the workshop, there was some time spent on designing your own training plan. Can you describe what you remember from this part of the workshop?

- Was it helpful or not to have this time set aside for planning training?
- What support did the trainers give to help you plan your own training?
- How prepared did you feel to deliver training at the end of the workshop?
- Are there alternative exercises you would have liked that would have improved this section of the workshop?
- What considerations did you have when designing training ? Were these addressed in the workshop?

2c. What do you think could be done to improve the workshop overall?

- Should it be more/less detailed?
- Should it be more/less interactive?
- Overall length of time: more/less?
- Should it have used different exercises?
- Were the video examples and role play scenarios relevant to you?
- Delivery model (e.g. online)

SECTION 2: Perspectives on vaccine communication training

I'd like to talk to you about your experience with training courses related to vaccine communication that you have conducted, commissioned, or overseen in the last 3 months.

3a. Could you describe this training?

- What was the focus of the training?
- Who/what organisations did you work with for this training?
- How often did you conduct the training?
- How long was the training?

3b. What did you cover in the training?

- What content did you include?
- Are there any specific exercises you used?
- Did you include any content from the workshop in your training?
- Is there anything you would change after having delivered the training?

3c. How did you feel the training was received by your trainees?

- What feedback did you receive from trainees?
- Were there any staff members who were resistant to the training offered? What are your thoughts on this?
- Were there any immediate outcomes, e.g., in trainees' confidence?
- Were there any longer-term outcomes you have observed (e.g., vaccine uptake in your region)?

3d. Could you tell me about any barriers you experience when it comes to designing/delivering/ commissioning training?

- What makes it difficult to implement certain aspects of the training?
- What tools would be helpful to you to overcome these barriers?

SECTION 3: Factors influencing effectiveness of intervention

I'd like to talk about patient interactions you have had since the training that involve the topic of immunisation. *[Interviewer should highlight that this line of questioning should not identify an individual patient, but focus on the content of the interaction and the HCP's approach to it.]*

4a. Since you had training, have you interacted with patients where you discussed their doubts and/or concerns about vaccination?

- If yes, can you describe the doubts raised by this patient?
- How did you respond to these doubts?
- How easy or difficult was it to continue this interaction with this patient?
- How did you feel during this interaction?

- Did the immunisation training help you in responding to this patient?
- Have you used any specific recommendations from the training in your interaction with this patient?
    - Why/why not?

4b. Could you tell me about any barriers you experience when it comes to discussion vaccinations with patient?

- What makes it difficult to have these conversations? *[interviewer can be aware of the possibility that lack of time, communication modalities are factors and prompt if necessary]*
- Are there any skills you feel would facilitate the conversations?
- What tools would be helpful to you in having these discussions?

SECTION 4: General Questions

1. Can I confirm with you your socio-demographic and professional characteristics?

a) Gender, ethnicity, age
b) Region of the country where you work
c) Specialty (if any)
d) Work functions/duties, length of service
e) Vaccination statuses (are you up to date for flu and Covid?)

2. Do you have any additional thoughts/questions/concerns that you would like to add before we conclude?

Topic guide for interviews with training stakeholders

SECTION 1: Perspectives on immunisation training

I'd like to talk to you about your experience with immunisation training courses that conduct/commission/oversee.

1. Could you describe your role in immunisation training?
   - Can you describe any modules that you teach?
   - Who/what organisations do you work with for this training?
   - How often do you conduct training?
   - What are some considerations you have when designing training?

2. What is your impression of immunisation training?
   - What do you like about it?
   - What do you not like about it?
   - What would be the most important thing to change?
   - To what extent do you feel that communication with patients related to vaccinations is addressed during this training?

3. What do you think could be done to improve immunisation training?
   - Are there any components missing?
   - Can it be more targeted, and to which groups?

4. Could you tell me about any barriers you experience when it comes to designing/delivering/ commissioning training?
   - What makes it difficult to implement certain aspects of the training?
   - What tools would be helpful to you to overcome these barriers?

SECTION 2: General Questions

1. Confirm with participant their socio-demographic and professional characteristics

f) Gender, ethnicity, age, number of children
g) Region of the country where you work
h) Specialty (if any)
i) Work functions/duties, length of service
j) Vaccination statuses [based on current vaccination recommendations for HCPs at the time]

2. Do you have any additional thoughts/questions/concerns that you would like to add before we conclude?