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Empowering Health Workers to Build Public Trust in Vaccination: Experience from the International Pediatric Association's Online Vaccine Trust Course, 2020–2021

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ABSTRACT

Background: The quality of interactions between health workers (HWs) and caregivers is key in vaccine acceptance. To optimize this, HWs need knowledge about best vaccine communication practices in person and on social media. Most pre-service curricula do not include such approaches. COVID-19 necessitated the International Pediatric Association (IPA) to shift from in-person train the trainer workshops to developing an online Vaccine Trust Course to address these gaps.

Method: The seven-module, 8-hour Vaccine Trust Course was offered online in seven languages and promoted globally. Course outcomes for participants between September 1, 2020 and September 30, 2021 were assessed using enrollment, participation, and completion data; pre-and post-training surveys of attitudes, knowledge, and practice skills; and follow-up practice surveys 3 months post course completion.

Results: Of the 4,926 participants across 137 countries who registered; 2,381 (48.3 %) started the course, with 1,217 (51.1 %) completing. The majority were 25 – 39 years (57 %), female (57 %), and in pediatrics (70 %); 31 % came from India. 62 % of completers rated course structure/design as excellent, 36 % as good. Over 80 % rated the content as the most valuable aspect. Three months post training, 61 % HWs reported increased empathy towards caregivers, confidence while counseling and increased vaccine acceptance

Abbreviations: HW, Health Worker; IPA, International Pediatric Association; WUENIC, WHO/UNICEF Estimates of National Immunization Coverage; EPI, Expanded Programme on Immunization; WHO, World Health Organization; AEFI, Adverse Events Following Immunization; IPC, Interpersonal Communication; SAGE, Strategic Advisory Group of Experts; UNICEF, United Nations Children's Fund; IVAC, International Vaccine Access Center; GHS, Global Health Strategies; GVAP, Global Vaccine Action Plan; SDG, Sustainable Developments Goal; ToT, Training of Trainers; PAG, Project Advisory Group; LMS, Learning Management System; SPSS, Statistical Package for Social Sciences.

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amongst their patients. 21 % identified the course as the only factor in these positive changes.

Conclusion: Shifting from face-to-face to online training due to the COVID-19 pandemic helped increase the global reach of HWs course engagement and uptake. Trained HWs reported increased empathy towards caregivers and confidence while counseling and increased patient vaccine acceptance.

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1. Introduction

Vaccination is one of the most cost-effective health interventions to prevent morbidity and mortality in both individuals and populations [1]. Despite great progress, in 2020 an estimated 23 million infants worldwide were not fully vaccinated with recommended vaccines [2]. WHO/UNICEF estimates of national immunization coverage (WUENIC) showed a continued decline in global vaccination in 2021 with 25 million children missing out on lifesaving vaccines, 2 million more than in 2020, and 6 million more than in 2019 [3,4]. The COVID-19 pandemic caused a decline in routine *EPI* (Expanded Programme on Immunization) immunization rates and an inequitable COVID-19 vaccine rollout exacerbated challenges of vaccine acceptance and demand globally [5].

Availability of vaccines and accessibility of immunization services are essential for vaccine uptake, as are awareness and acceptance of vaccines by communities and individuals. The reasons for people not being vaccinated vary significantly between communities and countries and may include lack of access to quality healthcare or vaccination services; conflict and displacement; traditional cultural beliefs; low disease salience; concerns about the efficacy or safety of vaccines; vaccine-related misinformation; and lack of trust in vaccines or the institutions which provide vaccination [6].

In 2019, before the COVID-19 pandemic hit, the World Health Organization (WHO) listed vaccine hesitancy – the reluctance or refusal to accept vaccination despite the availability of recommended vaccines – as one of the top 10 threats to global health [7].

1.1. Critical role of pediatricians and other health workers

Poor quality services of any type, including poor communication, can undermine acceptance of and demand for vaccination [8]. Healthcare worker (HWs) communication challenges can contribute to vaccine hesitancy or refusal. When reliable information about vaccines fails to reach communities, this makes room for unsubstantiated rumors and misinformation to spread rapidly. Such misinformation and disinformation about vaccines and vaccine preventable diseases can negatively impact vaccine acceptance and needs to be addressed in a measured and timely fashion following key principles of misinformation management [9,10]. At the patient level, HWs need to listen to their patient's vaccine concerns and address these knowledgeably.

Evidence shows that the quality of the interaction between frontline HWs and caregivers/patients about vaccination is a key factor in vaccine acceptance, helping to ensure completion of the vaccination schedule [11,12]. HWs are among the most influential sources of information and play a critical role in vaccination decisions. Good communication can motivate a hesitant caregiver/patient towards vaccine acceptance whereas poor communication contributes to vaccine refusal [13,14]. A HW recommendation remains the strongest predictor of vaccine uptake. However, many HWs report lack of training, resources, and structural levers in their practice preventing them from making a recommendation [15]. Physicians, nurses, pharmacists, midwives, community health workers, social workers, and community-based volunteers, who comprise the frontline of immunization programs, provide a cru-

cial bridge between the communities they serve and the immunization services they provide. HWs who routinely engage in positive and meaningful interpersonal communication with caregivers, patients, and community members such as eliciting and active listening to concerns, addressing them with appropriate language, demonstrating empathy, and respect for caregivers and patients can help build trusted relationships which may increase the likelihood that children as well as adolescents and adults will accept recommended vaccines on time [16–18].

Consistent with a large body of research, the WHO confirmed the important position of HWs as the cornerstone of public acceptance of vaccination [19]. One of the foundations of vaccination acceptance is public trust; this includes trust in vaccines, vaccine development, health systems, and government. However, HWs may underestimate their influence, have low perceived/actual self-efficacy to influence a decision, have insufficient time to discuss vaccination, and use prescriptive, factual language to address inquiries, which has been shown to have limited effectiveness in changing behavior [the so-called “Know-Do Gap”] [20–22].

An important underlying problem is that pediatricians and other HWs are often not trained in vaccine communication. They are uncertain about how to approach, determine, and then address specific concerns in a collaborative manner that would build trust to pass on appropriate messages to build confidence and identify strategies to address hesitancy. Oftentimes vaccine communication training was not part of their pre-service or their training curriculum [23–26].

These insights underpinned one of the recommendations from the WHO Strategic Advisory Group of Experts (SAGE) on immunization: The need to empower HWs to address vaccine hesitancy issues with patients and parents within the immunization program and beyond [27].

1.2. International Pediatric Association (IPA) Vaccine hesitancy Project – Phase I

The IPA is the only global body representing 164 professional societies of pediatricians from over 149 countries. The mission of the IPA is to work together to promote the physical, mental, and social health of children in order to achieve the highest standards of health for newborns, children, and adolescents in all countries of the world [28]. As noted above, routine childhood immunization is a critical element in the health and well-being of infants, children, and adolescents.

IPA launched the Vaccine Hesitancy Project in December 2018 with support from the United Nations Children's Fund (UNICEF), International Vaccine Access Center (IVAC), and Global Health Strategies (GHS) under the academic grants from Sanofi Vaccine Division and Serum Institute of India with the goal to reduce vaccine hesitancy in communities, disseminate information on the value of vaccination, increase demand for immunization, and to help reach the targets of the Global Vaccine Action Plan (GVAP) and the Sustainable Development Goals (SDGs). IPA organized the 1st International Training of Trainers (ToT) workshop on 14–16 December 2018 in New Delhi, India and the 2nd International ToT workshop on 16–17 March 2019 in Panama City, Panama.

The workshop in New Delhi attracted 83 participants, chairs, and faculty from 21 countries, and the workshop in Panama City had 62 participants, chairs, and faculty from 20 countries.

Through these workshops, IPA prepared a pool of Master Trainers who were designated to conduct a series of workshops on vaccine hesitancy in their respective countries. These trainers were encouraged to regularly share their knowledge and skills with each other and address vaccine hesitancy in their country and region.

1.3. IPA Vaccine Trust Project – Phase II

Following the success of this program, the project in 2019 was renamed the 'IPA Vaccine Trust Project' for the second phase, with the goal to raise resilient public trust in vaccination in countries around the world. In Phase II, IPA planned to conduct ToTs in seven regions of IPA - the United States and Canada, Latin America, Sub-Saharan Africa, Middle East and North Africa, Central Asia, Europe, and the Asia Pacific.

However, the COVID-19 pandemic intervened and stimulated development of a major adaptation to the training program. The IPA under the guidance of the Project Advisory Group (PAG) re-shaped the course curriculum and strategies in 2020, with the curriculum shifting from face-to-face training to a self-paced online course. The course was developed following pedagogical principles similar to a previous course developed for palliative care [29]. Content validity was established by triangulation with experts, guidelines from international agencies on immunization, feedback from beneficiaries, and from review of recent evidence. The free online course focused on vaccine hesitancy, communication skills, and advocacy tools and techniques, important areas for increasing vaccine acceptance [30].

IPA offered the free online training, the Vaccine Trust Course, on the IPA Learning Management System (LMS) in seven languages: English, Spanish, French, Portuguese, Turkish, Arabic, and Russian to HWs providing or promoting vaccines and immunization. This report describes the participation, effectiveness, relevance, value, and outcomes of the online Vaccine Trust Course over a 13-month period, September 1, 2020 and September 30, 2021.

2. Method

2.1. Participants

The online Vaccine Trust Course was promoted globally via the IPA's website, social media channels, member societies, partner organizations, and email listserv. The course was promoted primarily through IPA's networks, IPA national member associations, those who had registered and completed the Vaccine Trust Course to promote this with colleagues, and via emails, social media, and regular WhatsApp messages. A broader cadre of HWs including pediatricians, nurses, midwives, public health professionals, program managers, and other HWs were encouraged to enroll for the self-paced, 8-hour online course and complete the course within two weeks.

3. Procedure

3.1. Teaching and learning methods (Training Model)

Course participants were given access to the online course through the IPA's LMS. The training modules and topics were designed and written by respective module faculty, experts, and advisors, with the curriculum adapted for an online format under

the guidance of the PAG and partner organizations (Appendix-II includes a list of the members of PAG and partner organizations). The online course comprised seven modules – Module 1 – Infodemiology, Module 2 – Behavioral Science behind Vaccine Acceptance Interventions, Module 3 – Interpersonal Communication, Module 4 – Social Media Engagement, Module 5 – Dealing with Vocal Vaccine Deniers, Module 6 – Interacting with Media, and Module 7 – Building Vaccine Value – Advocacy & Messaging to Effect Change. However, participants were able to pick modules in order of their choice. The course objectives were delivered through video lectures aided by the pre-reads (i.e., key readings and resources), interactive exercises, and quizzes. As the online program was originally developed in English, the pre-reads except the original articles, video lectures and quizzes were translated into Spanish, French, Portuguese, Turkish, Arabic, and Russian and exercise videos were given subtitles in these languages. The online course is not certified for continuing medical education (CME) credit. However, after completion of all seven modules and the feedback surveys participants were awarded with an IPA Vaccine Trust Course Level-1 certificate by International Pediatric Association, 122 years old only global body representing 164 professional societies of pediatricians from 149 countries.

3.2. Course structure

Course participants were required to complete pre-training and post-training surveys to capture baseline and post-training attitudes towards vaccines and the role of HWs in supporting vaccine acceptance and uptake (affective domain). Following completion of the pre-training survey, participants were required to complete six components of each module in a given sequence to mark the module complete – pre-test, pre-reads, video lecture, exercises, post-test (cognitive domain), and module evaluation survey. Upon completion of all seven modules and the post-training survey, participants were required to complete the course evaluation that captured participants' feedback and perception of the course materials and contents, level of acceptance, and suggestions to improve the course. A 3-month follow-up survey (psychomotor domain) was conducted for participants who successfully completed the course to capture the change and application of course content in their practice. The follow-up surveys were administered with Google Form and were sent to the registered e-mail addresses of the participants. To be eligible for the follow-up survey, the participant had to have completed 3 months since finishing the course with surveys being sent between December 1, 2020 – September 30, 2021. Thus, those who completed the modules after June 2021 i.e., between July and end of September 2021 did not receive the follow up survey.

3.3. Data analysis

Training and evaluation reports including pre-and post-training surveys and tests; enrollment, participation and completion data; and follow-up surveys of participants who completed the course from September 1, 2020 to September 30, 2021 were analyzed using SPSS software version 24.0. Description of categorical variables – including gender, age group, cadre of health workers, and country was done using frequency and percentage. The opinions of participants related to course contents and delivery and their attitude were collected using a Likert scale of five categories and analyzed using percentages.

4. Results

4.1. Participation and completion rates

A total of 4,926 participants across 137 countries registered for the online Vaccine Trust Course from September 2020 to September 2021 (13 months). Of these, 2,381 (48 %) individuals started the course. Of 2,381 active participants, 72 % completed the first module (Infodemiology), 62 % completed the second module (Behavioral Science Behind Vaccine Acceptance Interventions), 57 % completed the third module (Interpersonal Communication), 56 % completed the fourth module (Social Media Engagement), 55 % completed the fifth module (Dealing with Vocal Vaccine Deniers), 54 % completed the sixth module (Interacting with Media), and 54 % completed the seventh module (Building Vaccine Value – Advocacy and Messaging). 1,217 participants (51.1 %) from 91 countries over those who started the course (2,381) successfully completed all seven modules by the end of September 2021. Of these 1217 participants, 69 % took the modules in English, 11 % in Turkish, 8 % in Spanish, 7 % in Russian, 3 % in French, 1 % in Portuguese, and 1 % in Arabic.

4.2. Demographic details

The majority (57 %, 690) of the 1,217 participants were 25–39 years, female (57 %, 689) and pediatricians (70 %, 857). These participants were registered across 91 countries, the majority (64 %) were from India, Turkey, Indonesia, Nepal, and Kenya. Appendix-I includes a list of the 91 countries and language wise course enrolments (Table 1).

On reviewing the data from pediatricians' responses compared to other HWs data for the affective, cognitive, and psychomotor domains, no major differences were noted and hence findings are aggregated and not presented by participant background.

4.3. Pre- and Post-Training survey findings (Affective domain of Learning)

Participants' attitudes were assessed under nine items pre and post training (Table 2). A high percentage had positive attitudes in the pre-survey e.g., 97 % agreeing or strongly agreeing with the statement noting the important role HWs have in educating parents about the importance of immunization with less than a

Table 1
Characteristics of participants who completed the online Vaccine Trust Course between September 1, 2020 to September 30, 2021.

	N = 1217	%
Gender		
Male	528	43 %
Female	689	57 %
Age		
18 – 24	41	3 %
25 – 39	690	57 %
40 – 60	411	34 %
greater than 60	75	6 %
Designation		
Pediatrician	857	70.4 %
Nurse	65	5.3 %
Public Health Professional	61	5.0 %
Program Manager	19	1.6 %
Midwives	2	0.2 %
Assistant of Physician	3	0.2 %
Other Healthcare Professionals	79	6.5 %
Other Health Worker	12	1.0 %
Other	94	7.7 %
Student (Medical, Nursing, and Other)	25	2.1 %

1 % shift post-training, 96.4 % (p > 0.05). In contrast, there was a positive shift in the sense of competence in ability to respond to misinformation circulated on social media with an evidence-based approach; up from 80 % pre to 94 % post (p < 0.01).

4.4. Module-specific Pre- and Post-Test findings (Cognitive domain of Learning)

The change in knowledge at the module level was evaluated using pre-and post-test survey questions following the completion of each module. Those participants who completed both pre-and post-test forms were analyzed, with the number varying between different modules (Fig. 1). The change in the knowledge score for each of the seven modules is summarized in Fig. 1. All modules showed statistically significant improvement in the score, particu-

Table 2
Pre- and post-training survey findings.

Rating	Pre-training (N = 1217) n (%)	Post-training (N = 1217) n (%)	p-value
Health workers have an important role in educating parents about the importance of childhood vaccination			0.03
Agree	1181 (97.0)	1174 (96.4)	
Neutral	1 (0.1)	2 (0.2)	
Disagree	35 (2.9)	41 (3.4)	
As a health worker, I believe my conversations with my patients can really make their opinion about vaccination more positive			0.29
Agree	1176 (96.6)	1185 (97.4)	
Neutral	8 (0.7)	7 (0.6)	
Disagree	33 (2.7)	25 (2.0)	
As a health worker, I believe that my strong recommendation for a vaccination will impact a patient's decision on whether or not to vaccinate			<0.001
Agree	1140 (93.6)	1162 (95.5)	
Neutral	41 (3.4)	26 (2.1)	
Disagree	36 (3.0)	29 (2.4)	
I feel competent to discuss vaccination with vaccine-hesitant patients			<0.001
Agree	1048 (86.1)	1167 (95.8)	
Neutral	126 (10.4)	25 (2.1)	
Disagree	43 (3.5)	25 (2.1)	
The large amount of information available, some accurate and some not, makes it harder for people to find trustworthy sources and reliable guidance when needed			0.78
Agree	1148 (94.4)	1157 (95.1)	
Neutral	38 (3.1)	29 (2.4)	
Disagree	31 (2.5)	31 (2.5)	
I feel competent to respond to misinformation circulated on social media with an evidence-based approach			<0.001
Agree	977 (80.3)	1146 (94.2)	
Neutral	149 (12.2)	51 (4.2)	
Disagree	91 (7.5)	20 (1.6)	
I feel it is important for healthcare workers to counter misinformation, by actively engaging on social media and presenting facts, as well as reliable and trustworthy information about vaccines			<0.001
Agree	1113 (91.4)	1171 (96.2)	
Neutral	75 (6.2)	24 (2.0)	
Disagree	29 (2.4)	22 (1.8)	
Increasing the amount of pro-vaccination content in media of all types may be of value over the longer term			<0.001
Agree	1102 (90.5)	1155 (94.9)	
Neutral	79 (6.5)	37 (3.0)	
Disagree	36 (3.0)	25 (2.1)	
As a health worker, I believe that I am responsible for advocating the benefit of vaccines to influence policy change and/or build an enabling environment with stakeholders to increase vaccine confidence			0.002
Agree	1167 (95.9)	1177 (96.7)	
Neutral	31 (2.5)	19 (1.6)	
Disagree	19 (1.6)	21 (1.7)	

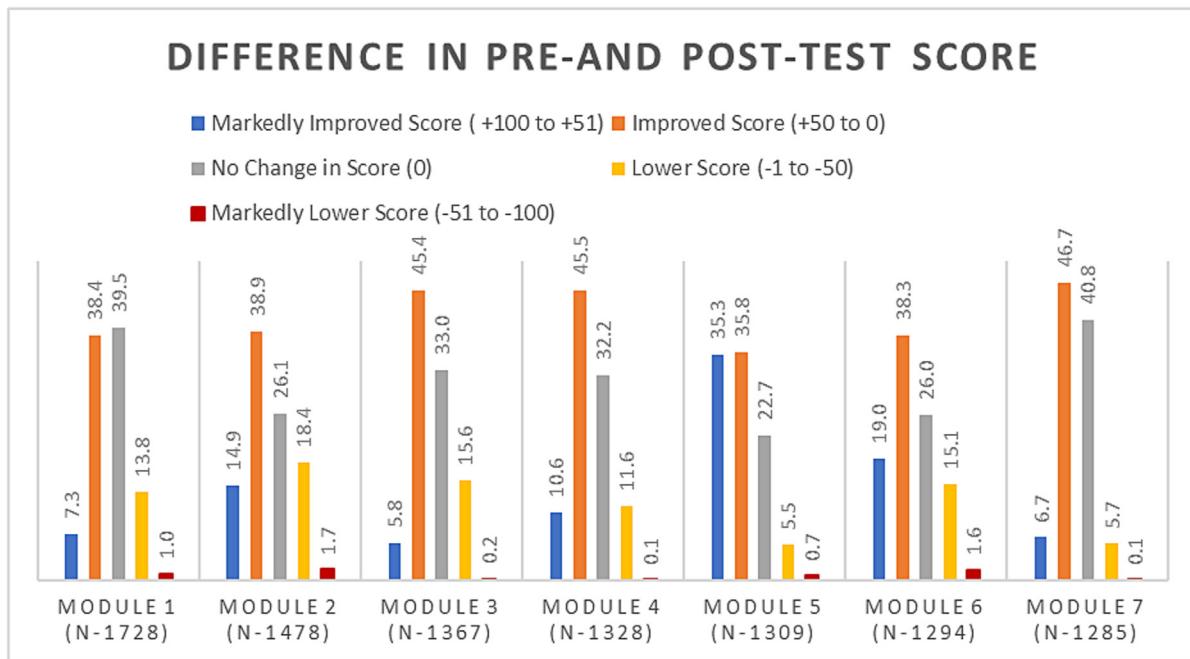


Fig. 1. Pre- and post-test scores^{1,2} (Module-wise knowledge test). ¹The total score was fixed as 100 for all seven modules i.e. If there are 5 questions in a module, then each carry 20 marks. The score change was measured as Post-Test Score –[minus] Pre-Test Score. ²Module 1 – Infodemiology, Module 2 – Behavioral Science behind Vaccine Acceptance Interventions, Module 3 – Interpersonal Communication, Module 4 – Social Media Engagement, Module 5 – Dealing with Vocal Vaccine Deniers, Module 6 – Interacting with Media, and Module 7 – Building Vaccine Value – Advocacy & Messaging to Effect Change.

larly in Module 5 (Dealing with Vocal Vaccine Deniers) with highest percentage of improvement in score.

4.5. Participants' feedback on course

Table 3 summarizes the feedback received from participants for each module in terms of satisfaction, content, and delivery. Most participants were satisfied with all modules under the five feedback domains. More than 55 % of course completers rated that the structure and content of the course was excellent; with less than 6 % rating it as poor. While feedback on the structure and content was largely positive, Module 2 (Behavioral Science behind Vaccine Acceptance Interventions) received lower ratings (i.e., 49 % reported average).

More than 60 % of participants indicated that the level of all seven modules' content was 'just about right', but almost one-third (29 %) felt that it was too advanced. Module 3 (Interpersonal communication) received the high scores consistently across the five areas covering content, satisfaction, and delivery.

A high proportion of the participants indicated that the online Vaccine Trust Course had met their professional educational needs; with strongly agree or agree rating across all seven modules at just over 90 % (range 84 % to 93 %). Similarly, a large majority (81 %) felt that the course duration was 'just about right'. Almost all (99 %) participants that completed the course indicated that they were either extremely satisfied or satisfied with the e-learning platform that was used by the course and many commented on the usefulness of the e-learning tool guide and tutorial video in supporting their access to the course.

Participants identified several particularly helpful aspects of the training: content (i.e., videos, exercises, testing, reading materials), course design and methodology, quality of the speakers, course accessibility, and course timeliness. The course content was considered one of the most valuable aspects of the course by more than 80 % of the trainees. When asked about the least favourable features, 20 % of trainees noted they had had issues with the

videos; either they found them too long or inaccessible (sometimes due to country bans on software) and for some, the reading materials (original articles in English and other readings in all seven languages) were either too long or difficult to download. Comments indicated that more examples would be helpful. Nearly 18 % of course completers believed the least favorable features were related to the course structure/design, namely: course duration too long; insufficient time to complete the course; lack of personal interaction; and too many surveys. About one in 20 participants noted that they experienced language comprehension issues, including several who remarked about the quality of the translations in Russian, Spanish, and French; a lack of translated reading materials, videos, or course guidance; and in some cases, issues understanding Indian accents or comprehending written English.

Table 4 summarizes participants' suggestions to improve the course and preference for future courses. The findings showed that 40 % of participants would prefer a similar course online and 18 % face-to-face with almost 39 % neutral (i.e., no model preference). Responses captured conveyed that nearly 25 % preferred improvements in terms of course structure (more interactive sessions, fewer surveys), 30 % wanted fewer pre-reads and video lectures (shorter videos lectures and reading materials), 9 % highlighted need for improved language interpretation (better translation quality, subtitles in videos), and 20 % wanted other content to be developed and included (refresher courses, real life scenarios, case studies) in future courses. Suggested topics for inclusion in future courses cited by participants were Adverse Effects Following Immunization (AEFI) Reporting and Management, Risk Communication, Vaccine Hesitancy, Adult and Childhood Immunization.

4.6. 3-Month Follow-up survey findings (Psychomotor domain of Learning)

Of the 852 participants eligible to receive the follow-up survey-three months after completing the course to assess self-reported changes in participants' behaviors/practice, 358 (42 %) filled out

Table 3
Satisfaction, content, and delivery from modular feedback survey¹.

Rating	Module-1 (N = 1724) n (%)	Module-2 (N = 1475) n (%)	Module-3 (N = 1364) n (%)	Module-4 (N = 1327) n (%)	Module-5 (N = 1308) n (%)	Module-6 (N = 1292) N (%)	Module-7 (N = 1284) N (%)
1. The extent of meeting the learning objectives							
Completely	1395 (80.9)	908 (61.5)	1109(81.3)	1133(85.4)	1030(78.7)	953 (73.8)	1088(84.7)
Partially	324 (18.8)	544 (36.9)	251 (18.4)	189 (14.2)	267 (20.4)	317 (24.5)	194 (15.1)
Not at all	5 (0.3)	23 (1.6)	4 (0.3)	5 (0.4)	11 (0.9)	22 (1.7)	2 (0.2)
2. The structure and content							
Excellent	922 (53.5)	577 (39.1)	822 (60.3)	827 (62.3)	769 (58.8)	707 (54.7)	774 (60.3)
Good	749 (43.4)	156 (10.6)	476 (34.9)	459 (34.6)	466 (35.6)	507 (39.2)	465 (36.2)
Average	51 (3.0)	722 (48.9)	57 (4.2)	40 (3.0)	71 (5.4)	67 (5.2)	44 (3.4)
Poor	2 (0.1)	20 (1.4)	9 (0.6)	1 (0.1)	2 (0.2)	11 (0.9)	1 (0.1)
3. The organization of video lecture							
Excellent	998 (57.9)	664 (45.0)	728 (53.4)	889 (67.0)	769 (58.8)	691 (53.5)	760 (59.2)
Good	669 (38.8)	637 (43.2)	552 (40.5)	395 (29.8)	468 (35.8)	522 (40.4)	472 (36.8)
Average	53 (3.1)	154 (10.4)	78 (5.7)	41 (3.1)	63 (4.8)	70 (5.4)	49 (3.8)
Poor	4 (0.2)	20 (1.4)	6 (0.4)	2 (0.1)	8 (0.6)	9 (0.7)	3 (0.2)
4.The level of the materials used							
Too Advanced	426 (24.7)	442 (29.9)	286 (21.0)	311 (23.5)	379 (28.9)	342 (26.5)	333 (25.9)
Advanced	54 (3.1)	60 (4.1)	51 (3.7)	47 (3.5)	36 (2.8)	51 (4.0)	49 (3.8)
Just about Right	1164(67.5)	886 (60.1)	952 (69.8)	900 (67.8)	849 (64.9)	843 (65.2)	854 (66.5)
Simple	2 (0.1)	7 (0.5)	5 (0.4)	3 (0.2)	2 (0.2)	4 (0.3)	3 (0.2)
Too Simple	78 (4.6)	80 (5.4)	70 (5.1)	66 (5.0)	42 (3.2)	52 (4.0)	45 (3.6)
5.Achieving the professional educational needs							
Strongly Agree	510 (29.6)	319 (21.6)	440 (32.2)	471 (35.5)	414 (31.6)	370 (28.6)	413 (32.2)
Agree	1058 (61.4)	923 (62.6)	830 (60.9)	746 (56.2)	774 (59.2)	776 (60.1)	768 (59.8)
Neutral	77 (4.5)	146 (9.9)	49 (3.6)	59 (4.5)	71 (5.4)	98 (7.6)	66 (5.1)
Disagree	16 (0.9)	41 (2.8)	10 (0.7)	12 (0.9)	14 (1.1)	23 (1.8)	13 (1.0)
Strongly Disagree	63 (3.6)	46 (3.1)	35 (2.6)	39 (2.9)	35 (2.7)	25 (1.9)	24 (1.9)

¹ Module 1 – Infodemiology, Module 2 – Behavioral Science behind Vaccine Acceptance Interventions, Module 3 – Interpersonal Communication, Module 4 – Social Media Engagement, Module 5 – Dealing with Vocal Vaccine Deniers, Module 6 – Interacting with Media, and Module 7 – Building Vaccine Value – Advocacy & Messaging to Effect Change.

Table 4
Feedback on improvement and preferences for future courses.

Feedback component	Count	%
Preference of mode of similar course in future (N = 1206)		
Both online and physical setting	21	1.7
Neutral	465	38.5
Online	482	40.1
Physical setting	221	18.3
Irrelevant responses	17	1.4
Things to improve about the course (Multiple Response) (N = 1206)		
Accessibility	73	6.1
Content	244	20.2
Course structure/ methodology	293	24.3
Language & interpretation	110	9.1
Pre reads and video lectures	356	29.5
Promotion	8	0.7
Technical issues	30	2.5
None	273	22.6
Inclusion of topics into the future course (N = 1050)		
AEFI reporting and management	32	3.1
Risk communication	24	2.3
Specific content and exercises	224	21.3
Vaccine hesitancy – Antivaccine complaints, cultural competence, religious hesitancy, debunking myths	80	7.6
Adult and childhood immunization	208	19.8
None	482	45.9

the assessment. Importantly, 90 % (322) of these respondents reported a positive change in their approach when dealing with caregivers, patients, and others and attributed this to the training. Of note, 19 % (68) reported observing an increase in vaccine acceptance and vaccine uptake among patients/parents/families because of change in their approach and 8 % (28) reported that they were now more proactive in promoting vaccination and in addressing

vocal vaccine deniers. More than two-thirds (81 %, 89) had already held conversations with patients and/or caregivers related to vaccine hesitancy and advocated for key individuals or institutions to promote the value of vaccines (81 %, 290). A similar proportion (79 %, 280) claimed to have dealt with vocal vaccine deniers using the techniques outlined in Module 5 (Dealing with Vocal Vaccine Deniers). Fewer respondents (67 %, 241) reported having used social media to promote evidence-based strategies for inoculating people against vaccine misinformation. Almost two-thirds (67 %, 230) indicated that they had responded effectively to media requests, while almost one-half (49 %, 177) had engaged proactively with journalists.

The responses to open ended questions supported these reported quantitative results. The analysis of participants' examples of changes in practice indicated that most (90 %; 324) provided examples of how they used effective techniques outlined in the modules in their communication skills, claiming to have applied the knowledge and/or skills from the course in their conversations with others, both general interactions and more formal advice. Regarding the quality of their conversations, participants emphasized that they now had greater patience and were better at listening to the concerns of patients, caregivers, and families and responding to these with evidence. Others examples of how knowledge and skills from the course have been applied in HWs' practices included in counseling patients; teaching/lecturing; and input into national/organizational/institutional strategies or protocols that promote vaccines.

Overall, one in five (21 %; 75) claimed that the online Vaccine Trust Course was the only major factor contributing to their reported changes in their approach to communicating about vaccines and immunization. However, 90 % (328) referred to a combination of factors contributing to a change: online Vaccine Trust

Course, increased media coverage of vaccines in the wake of the COVID-19 pandemic; knowledge and influence of colleagues; and information received from employers. Increased media coverage of vaccines in the wake of the COVID-19 pandemic was the second most cited factor that contributed to a change in practices, after the IPA Vaccine Trust online course.

5. Discussion

This study assessed uptake, effectiveness, relevance, and value and practice outcomes of the 1,217 participants from 91 countries who completed all seven modules of the free online IPA Vaccine Trust Course via IPA LMS (<https://ipa-world.org/ipalmsv1/index.php>) which aimed to increase vaccine communication and advocacy skillsets of HWs. Of these 1,217 participants, almost one-third (n = 358) also responded to the follow-up survey 3 months after course completion. The online Vaccine Trust Course targeted a wide range of the health workforce whose roles include providing and promoting vaccines and immunization. Consistent with previous studies [31], this comprehensively designed free online learning program that was easily accessible (and using multiple platforms) appeared to be an effective method to enhance the confidence, knowledge, and skills of health workforce at broader scale and in a short timeframe. In particular, after having completed the online Vaccine Trust Course, eligible 3-month follow-up survey respondents showed improvements in knowledge and skills in the majority of the course topic areas – most notably in relation to interpersonal communication and dealing with vocal vaccine deniers. Overall, while attitudes such as the importance of HWs roles in educating caregivers/patients about the value of vaccination did not shift much, this was because 95 % of the participants who had completed the program had started with this positive attitude, there was a statistically significant improvement in their sense of competence in ability to respond to misinformation circulated on social media with an evidence-based approach (80 % pre to 94 % post). Eligible 3-month follow-up survey respondents also reported improvements in their communication skills, specifically the quality of conversations with patients and their families and one in five also observed increased uptake of vaccines among patients and families as a result of their application of the course content within three months of their completing the course. Most 3-month follow-up survey respondents attributed this change to the course as well with or without other factors such as increased media coverage of vaccines in the wake of the COVID-19 pandemic; knowledge and influence of colleagues; and/or information received from employers. Participants also noted greater uptake of vaccines reported by their colleagues in terms of changes that took place post-training.

Similar immediate post-training findings have been reported with other immunization competency-based education programs for physicians and pharmacists [32–36]. The pharmacy programs used integrated blended delivery modes but all lacked later studies that assessed impact after a lag period following the course in contrast to this current study. Marcum et al. assessed the impact of a national immunization training certificate program on the perceived knowledge, skills and attitudes of pharmacy students toward pharmacy-based immunizations [37]. The results of that study showed an increase in knowledge and skills improvement but not much change in attitude. As with our study, there was a high percentage of positive attitudes pre-training so only a 1 % change in attitude was seen. This may reflect on who amongst these health care professionals chooses to take such programs i.e., those already motivated to improve their vaccine knowledge and skills. Another study conducted among medical interns on immunization showed that knowledge was improved at the end

of study; however, it was not translated into practical skills [32]. The current IPA Vaccine Trust Course study suggested that practical skills did improve at the end of the follow-up assessment and resulted in self-reported immunization practice changes 3 months later. This difference may reflect content differences and/or motivation or other differences. Sarnquist, Clea, et al. suggested need of focusing on communication strategies and vaccine-related information for expanding resident educational programs for residents [41]. While the results of this study have shown to have positive outcomes in participants post 3-month follow-up after training in regards to dealing with patients/caregiver using effective communication strategies, participants' suggestions on inclusion of additional domains i.e., AEFI, reporting and management, risk communication, adult and childhood immunization should be considered by the authors while developing or shaping existing educational curriculum for health workforce involved in immunization.

The COVID-19 pandemic highlighted the significance of immunization competencies among HWs [38]. With the development of COVID-19 vaccines, physicians and other HWs need to be comfortable in counseling patients and reducing vaccine hesitancy among the eligible beneficiaries. Given the difference in mortality across high income countries with high COVID-19 vaccine uptake versus those with lower vaccine acceptance, the importance of taking all steps shown to be effective in increasing uptake including better counseling by HWs has become even more clear [39,40].

5.1. Strengths and limitations

The present study has several strengths. The study curriculum was developed by an expert faculty and followed adult pedagogical principles. Secondly, the overall course covered a wide range of topics on behavioral aspects behind vaccine hesitancy, effective communication skills, and immunization advocacy using various tools. All areas have been shown to be helpful in increasing vaccine acceptance. Thirdly, evaluations were carried out at regular intervals that assessed three domains of learning (attitude, knowledge, and skills), and especially the skill domain three months after the training. Finally, the online course benefitted a wider and larger scale of HWs across the globe in a shorter timeframe and at less cost than could have been accomplished with an in-person program.

In terms of limitations, the data may not be representative of overall HW populations involved in immunization in different countries. Given the high positive attitude towards the statement that HWs are important in educating parents about the importance of immunization on the pre course assessment, those participating were already primed to benefit from the opportunity to learn more about being effective in this role. “Nay sayers” appear not to have participated to any great extent and/or may not have completed the course. Hence the analysis is focused on the perspectives/opinions of, and outcomes for, the course graduates only. Secondly, only those who completed the course were fully surveyed. Hence the reasons for poor course uptake and/or truncated use of the course materials could not be identified. Finally, the reports of increased vaccine uptake and changes in attitudes of caregivers/patients were based on data self-reported by course participants. There was no independent objective review to document if there was actual increased coverage.

While the course did attract a wide range of HWs from different disciplines and from many countries (91) and was taken up in a number of languages, it is not clear from this assessment whether the number of non-pediatrician participants can be substantially increased. Perhaps a broader partnership can be developed to let other non-physician HWs become more aware of this free online course e.g., international nursing, pharmacists' associations, and

other international medical specialty areas such as family medicine. To make the course more attractive to non-English speakers, the translation issues need to be further addressed as suggested by participants. For many HWs and for many countries' immunization programs, the value added of the course being free and online cannot be over emphasized. There were no travel expenses to participate in the course and it could be done at time best suited to the participant and altogether only took eight hours over a two-week period.

6. Conclusion

This study provides empirical evidence that HWs who completed all seven modules of a free online modular program that focused on knowledge, communication skills, and advocacy concerning vaccine acceptance became more empathetic towards caregivers and more confident while counseling caregivers because of their improved communication skills. This led to self-reported practice changes and a perceived increase in vaccine uptake among their patients and caregivers noted three months post training. The shift to an online mode of training from face-to-face training due to the COVID-19 pandemic situation helped expand the reach, diversity, and number of HW participants. This online training reached a broader and wider audience in a shorter timeframe globally, than would have been possible with in-person training workshops. The in-person IPA courses never would have attracted participants from 91 countries nor over 1200 in a 13-month time period. Furthermore, as with the participants, the online course made more optimal use of experts' time delivering the modules by saving travel time and costs. The initial findings of this project and anecdotal evidence from the external engagement of trained HWs point to a strong need for the course content specifically to support HWs' communications skills on vaccines and immunization. With routine immunization rates declining worldwide, interventions to address vaccine acceptance and misinformation are crucial to improving public health.

Data availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper: [Walter A Orenstein is an uncompensated member of the Moderna Scientific Advisory Board. Tina D Purnat is staff of the World Health Organization, is alone responsible for the views expressed in this article, and does not represent the views of the organization.].

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Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2022.11.061>.

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