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Building HPV Vaccine Confidence with and for Healthcare Workers in Nigeria: A Co-Design Study

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Abstract

Background

Cervical cancer, primarily caused by human papillomavirus (HPV), is a global public health concern, particularly affecting women in low- and middle-income countries, including Nigeria. The HPV vaccine prevents cervical cancer, yet uptake remains low due to supply and confidence barriers. While vaccine confidence among women and girls, and their families has received wide attention, less attention has focused on healthcare workers (HCWs), despite their key role in improving uptake. Co-designing interventions with HCWs could yield better-tailored programs addressing context-specific communication and information needs. Here, we describe the co-design process with HCWs in Nigeria, the strategies and delivery mechanisms identified, and provide methodological reflections.

Methods

We conducted a co-design study guided by human-centred design and the Ideate, Design, Evaluate, and Share (IDEAS) framework, in Oyo and Jigawa states, Nigeria, between September 2024 and September 2025. Co-design participants included doctors, nurses, and community health extension workers, recruited using purposive and snowball sampling. Data were collected through participatory workshops using audio recordings, field notes, and visuals of co-produced materials, and analysed using content analysis, with findings iteratively refined and validated with participants across workshops.

Results

Through a series of five workshops and three rounds of sense checks involving 45 HCWs, participants identified gaps in access to HPV vaccine knowledge, difficulty addressing rumours, and a lack of confidence in counselling. In response, we jointly developed content for intervention approaches: in-person and digital. The in-person intervention is planned to be delivered in the health facility by a trained HPV champion. The digital intervention in planned to be delivered through WhatsApp. Both use four short educational videos, which were co-designed with the HCWs, to increase HCWs' knowledge and confidence in the HPV vaccine, covering: 1) general knowledge on cervical cancer, HPV, and HPV vaccine; 2) counselling parents on HPV vaccine, and 3) strategies for addressing rumours around the HPV vaccine.

Conclusion

The co-design study enabled successful development of co-designed videos, and in-person and digital intervention delivery strategies to strengthen HPV vaccine confidence among HCWs in Nigeria.

BACKGROUND

Cervical cancer, primarily caused by the human papillomavirus (HPV), remains a global public health concern with approximately 660,000 new cases and 350,000 deaths reported in 2022 [1, 2]. It is the fourth most common cancer in women globally, particularly affecting women in low- and middle-income countries (LMICs) where 94% of cervical cancer related deaths are reported. Africa, and Nigeria in particular, bear a high burden of cervical cancer with approximately 7,100 documented deaths in over 13,700 cases in 2022 [3–5].

The HPV vaccine effectively prevents cervical cancer, yet despite its proven effectiveness, the global uptake varies substantially from 5–90% [6]. Low uptake of the HPV vaccine is mainly seen in LMICs, including Nigeria, with key challenges including limited vaccine supply, misinformation, and persistent vaccine hesitancy leading to low demand [7–10]. The HPV vaccine was first introduced in 2006 and in Nigeria in 2023 with support from Gavi, WHO, UNICEF and the National Primary Health Care Development Agency, targeting girls aged 9–14 years through school-based and facility-based vaccination initiatives [11–13].

HPV vaccine confidence has been a challenge globally [14, 15]. Vaccine confidence refers to the level of trust in the effectiveness and safety of vaccines and the system that delivers them [16]. The antithetical concept, vaccine hesitancy exists along a continuum between full acceptance and complete refusal, describing individuals who are uncertain about receiving some or all recommended vaccines despite their availability [7, 17]. According to the WHO, vaccine hesitancy is one of the top 10 public health threats [18]. Globally, vaccine hesitancy is driven by distrust, and concerns about safety, effectiveness and necessity [19, 20]. The HPV vaccine has been surrounded by misinformation about adverse effects in countries like Denmark and Japan [21]. In Africa, including Nigeria, HPV vaccine hesitancy has been fuelled by misinformation and misconceptions about infertility and population control, religious and cultural concerns about adolescent promiscuity, and longstanding mistrust in vaccines stemming from previous health interventions such as the 1996 Pfizer Trovan trial in northern Nigeria and concerns during the COVID-19 vaccine rollout.[8, 20, 22, 23].

Healthcare workers (HCWs) remain the most trusted source of information about vaccines, they influence vaccine decision making and are key drivers behind vaccination success [16, 24, 25]. However, HCWs' HPV vaccine hesitancy has also been documented globally and in Nigeria [26, 27]. HPV vaccine hesitancy among HCWs has primarily been attributed to concerns over the risk of side effects, a general concern over new vaccines due to limited safety monitoring infrastructure, and distrust in public authorities [26, 28]. Moreover, HCWs training about HPV vaccination, including their ability to respond to rumours about the vaccine appears limited, arguably because of rapid scale up of HPV vaccination in Nigeria and many other low-income countries. Therefore, building HCW HPV vaccine confidence is needed to strengthen the community's confidence in the vaccine especially in contexts like Nigeria with a documented history of vaccine hesitancy and low HPV coverage [7, 29, 30]. Engaging HCWs through

participatory and collaborative methods allows for designing of interventions that are tailored to needs of HCWs [31].

Co-design is an iterative participatory process in which end-users and stakeholders collaboratively plan, develop, and refine public health interventions through structured stages [32]. It is grounded in principles of inclusiveness, iterative learning and shared decision-making with the aim to respond to context specific needs [33]. Co-design has been used for the development of several digital health innovations and immunisation programmes [33–35]. Few studies have systematically involved HCWs in developing interventions to address vaccine hesitancy amongst themselves and their peers. Therefore, we conducted a co-design study aiming to identify key contextual drivers of HPV vaccine hesitancy amongst HCWs in Nigeria and then co-develop concrete strategies to address them. In this paper, we describe the co-design process and how it led to the resulting strategies and delivery mechanisms, while also sharing methodological reflections.

METHODS

Study design and conceptual framework

We conducted a co-design study drawing on principles and tools from human centred design[36] as part of the wider HCW-Trust Project. Specifically, the co-design process was organised around the IDEAS framework, developed to guide the design of digital interventions through iterative, user-centred stages structured and consisting of ten phases (empathize, specify, ground, ideate, prototype, gather, build, pilot, evaluate, and share) [37]. Figure 1 describes the co-design process which consisted of a preparatory phase involving formative work (empathize, specify, ground), using systematic reviews [25, 37] and qualitative research [27] to identify the problem and draft solutions [26, 28, 38, 39]. The iterative co-design phase consisted the co-design workshops and iterative intervention development guided by five features of the framework (ground, ideate, prototype, gather, build), reported in this paper. A planned pilot trial will test the developed interventions [40]. We conducted five co-design workshops and two to three rounds of sense-checks conducted for the first three workshops with HCWs. The fourth workshop was a joint stakeholders' and the fifth co-design workshops with HCWs. (Fig. 1).

Alongside the IDEAS framework structuring the co-design process itself, we drew on the PROSECO framework (PROcesS Evaluation framework for CO-creation) [41], which examines co-design processes across five domains: Delivery, Participation, Experiential, Context, and Impact to guide our methodological reflection of the co-design process, presented in the discussion. The validated Pro-VC-Be (Professionals Vaccine Confidence and Behaviours)[42] tool was used to categorize the themes from the brainstorming session.

Context

This study took place in Oyo and Jigawa States, Nigeria. In 2025, Nigeria achieved 71% HPV vaccination coverage among girls aged 9–14 years within the first two years of the national HPV vaccination programme [43]. However, estimates of vaccination coverage have varied between and within States and been challenging to obtain.

Oyo state is located in southwestern Nigeria, where Yoruba is the dominant local language, and Jigawa state is in the northwestern region, where Hausa is predominantly spoken [44, 45] Although English is the official language of formal education, including medical, nursing, and community health training, HCWs often communicate with clients and patients in these dominant local languages. In January 2025, the HPV vaccine was integrated into the routine immunisation schedule and made available in selected primary healthcare (PHC) facilities in Jigawa and Oyo State for girls aged 9 years to receive for free during vaccination clinics and community outreach campaigns [10, 43, 46].

The co-design process

The co-design process (Fig. 1) consisted of a preparatory phase and an iterative co-design phase, in which workshops, sense checks with individual HCWs, and engagement with vaccine stakeholders built on one another and informed subsequent stages, resulting in the finalised co-designed intervention videos and their delivery strategies.

Preparatory phase

Before the co-design phase, the research team conducted several brainstorming sessions to generate ideas aligned with the study's theoretical framework and the formative findings [25, 27, 39, 40]. This process narrowed the project's initial broader focus on HCW confidence in new vaccines generally to a specific focus on HPV vaccine confidence. Guided by the Pro-VC-Be tool dimensions and formative research, we identified six priority behavioural domains and corresponding intervention topics to explore in the co-design workshops (Table 1). We also brainstormed potential delivery approaches for probing with HCWs, including audio, video, role-play-based activities, and WhatsApp-based formats; these initial ideas were subsequently refined through the co-design process.

Table 1
Behavioural domains and key intervention topics explored to co-design workshops

Dimensions of Pro VC Be tool	Main issues identified (guided by formative research)	Key intervention topics for co-design workshops
Perceived benefits of vaccination and cervical cancer risk	Limited understanding of HPV, link to cervical cancer, and the preventive role of HPV vaccine.	Increasing HCWs' knowledge on HPV, cervical cancer, and benefits of the HPV vaccine
Perceived risks of HPV vaccine	Concerns about infertility, side effects, HPV vaccine effectiveness, and rumours.	Addressing concerns that HPV vaccine causes infertility and strengthening confidence in vaccine safety and effectiveness.
Trust in authorities	Distrust in HPV vaccine and the vaccination programmes, government motives, and information sources.	Ensuring HCWs receive sufficient, transparent, and trustworthy information about the HPV vaccine.
Perceived constraints	HPV vaccine availability concerns and parents/caregiver uncertainty about vaccinating young girls.	Equipping HCWs to respond to common parent/caregiver concerns and questions.
Collective responsibility and complacency	Low awareness of the risk of cervical cancer and limited understanding of the importance of early HPV vaccination.	Increasing awareness of cervical cancer prevention and the benefit of early HPV vaccination.
Openness to patients	Difficulties discussing HPV vaccination and responding to parents who are hesitant.	Developing strategies for communicating with parents, responding to rumours, misinformation and conspiracy beliefs.

Participant recruitment

We recruited two different groups of HCWs to take part in the co-design process: a core co-design group, re-engaged at each workshop to maintain design consistency and a sense-check group, engaged for rapid feedback to ensure content and ideas made sense to HCWs beyond the core group. For both groups, we aimed to recruit diverse perspectives, with HCWs recruited from across different facility levels and professional roles (doctors, nurses and Community Health Extension Workers (CHEWs)) in each State (Table 1). Some participants were purposefully engaged as those who had previously participated in the formative stage interviews of the HCW-TRUST project[26, 28, 38, 39] .

Core co-design group

The inclusion criteria required participants to be HCWs providing clinical and preventive services at primary, secondary, or tertiary facility levels, directly involved in vaccine administration, and have previously expressed concerns or questions about the HPV vaccine. Participants were contacted by

onsite visitation or telephone and informed about the project's purpose and the expectation of participating in four to six workshops over several months. Recruitment continued until 5–8 participants per state had agreed to take part, a range considered appropriate to ensure diverse HCW representation across facility levels while maintaining a group size conducive to active co-design engagement (Table 2).

Sense-check group

A sense-check group of two to three HCWs, not part of the core co-design workshops, provided external feedback on iteratively refined intervention materials. Different HCWs were recruited for each workshop's sense-check to ensure a wide range of perspectives. Inclusion criteria required HCWs who provided clinical and preventive services, administered vaccines, and had prior experience administering the HPV vaccine. Recruitment used a purposive and snowball approach. Some HCWs were identified through core group members who recommended colleagues with varying levels of HPV vaccine confidence (from highly confident to hesitant). In instances where this yielded insufficient numbers, participants from the formative HCW-Trust qualitative study were approached for referrals (Table 2).**Vaccine stakeholders**

We engaged vaccine stakeholders to review co-designed video content and to maintain engagement ahead of requesting use of the Primary Healthcare Board's logo and identifying facilities for the subsequent pilot trial. Vaccine stakeholders were purposively recruited from Oyo and Jigawa states Primary Healthcare Boards and invited to the vaccine stakeholders' debrief meeting and joint stakeholders' meeting. They included state immunisation officers, state cold chain officers, social media and community mobilisation officer/health educator, directors of planning, research and statistics, and directors of primary healthcare services.

Data Collection

Prior to data collection, facilitators (KOA in Oyo State and HU in Jigawa State) and notetakers in both states received training on the study's co-design approach, workshop guides (Supplementary Material 1a), and note-taking templates (Supplementary Material 1b). Facilitators on facilitation techniques and reflective note-making and notetakers on documenting workshop discussions and activities.

Data were collected through co-design workshops, sense-check discussions, stakeholders’ debriefing sessions, and joint stakeholders’ workshops. Co-design workshops, stakeholders’ debriefing sessions, and joint stakeholder workshops were held in person in a conducive environment to support comfortable engagement. In Oyo State, co-design workshops were conducted in hybrid format, as one participant joined remotely via Zoom due to distance from the venue and work requirements.

Co-design workshops were led by an English and Yoruba speaking researcher (KOA) in Oyo State and an English and Hausa speaking researcher (HU) in Jigawa State; participants were encouraged to use the language in which they felt most comfortable. Each workshop lasted 3–4 hours and followed a

structured workshop guide (Supplementary Material 1a). The fifth workshop included reflections, in which core group participants reflected on the co-design process and the interventions developed. Sessions were audio-recorded with prior consent, with notes taken by the two dedicated notetakers per state.

Sense-check discussions were conducted via WhatsApp calls and messages, following a structured sense-check guide (Supplementary Material 1a). Each participant completed a written review of the draft intervention ideas followed by a 20–30-minute follow-up call, led by the same language-matched researchers described above.

After each co-design workshop, the research team held internal debrief meetings to review facilitators' reflective notes, notetakers' workshop notes, and sense-check discussion notes. Multiple data sources were used to capture participants' contributions including audio recordings, photographs of flipcharts, and sticky notes from co-design workshop activities, notetakers' field notes, and facilitators' reflections.

Data analysis

We used a qualitative content analysis approach to analyse data from the co-design workshops and sense-check feedback [47]. We triangulated notetakers' notes, reflective notes, and pictures synthesising flipchart discussions. SHvW and KOA conducted the analysis[47] using Excel to identify recurring patterns and organise them into themes related to identifying and prioritising content and delivery strategies to strengthen HCWs' HPV vaccine confidence.

We then presented the key findings to the whole research team for input and discussion. The analysis was iterative and happened after every workshop to inform the content for the next workshop (Supplementary Material 1) and for the sense-checks (Supplementary Material 2) through a cyclical process of two to three rounds of discussion after each workshop. In line with this iterative co-design approach, we present the key contextual drivers of HPV vaccine hesitancy amongst HCWs, the resulting strategies and delivery mechanisms co-designed to address them, and methodological reflections on the process.

Ethics

The study was approved by the Oyo State Research Ethics Review Committee (ref: AD/13/479/362A), University of Ibadan/University College Hospital Ethics Committee (ref: UI/EC/23/308), Jigawa Ministry of Health (ref: MOH/PH/PHRAT/MN/23/003), Jigawa State Ethics Committee (ref: JGHREC/2023/151) and the Swedish Ethics Authority (Dnr: 2023-04772-01-471058). We followed the principles of the Helsinki Declaration. All participants gave their verbal and written informed consent. Through the consent process, participants agreed to the recording of the co-design workshops. To ensure ethical standards are upheld throughout data collection, all data collectors were trained on ethics and data protection using a general protocol and the facilitator guide. Training covered informed consent, cultural

sensitivity, confidentiality, and managing power dynamics. Participants were given transport fare, refreshment, and monetary compensation for their time.

Reflexivity

Our research team spanned public health, epidemiology, health systems research, implementation science, community and clinical medicine, qualitative research, and vaccine confidence research. From the formative assessment of the HCW-TRUST project, members' prior work on HPV vaccine research in Nigeria including engagement with HCWs, vaccine stakeholders, and the Oyo and Jigawa State Primary Healthcare boards supported rapport-building and contextual understanding, though the team remained aware that these prior assumptions could shape facilitation, interpretation, and decision-making.

Oyo and Jigawa based members brought insider knowledge of their respective local language, culture, and health system, while being outsiders to the other state given the distinct sociocultural and religious contexts of southwestern versus northern Nigeria. Stockholm-based members held an outsider, comparative position relative to both sites. During internal debrief meetings, Oyo and Jigawa based members each contributed site-specific context.

To minimise bias, facilitators used structured guides and activities and engaged in reflective practice after each workshop through debrief notes and team meetings. These reflections addressed participant interactions, power relations, group dynamics, and how researchers' perspectives may have shaped discussions and interpretation around HPV vaccine confidence, health system trust, and community perceptions.

We also maintained awareness of the hierarchy and power structures within the Nigerian healthcare system, working to foster an inclusive, participatory environment where all participants could contribute and facilitators ensured dominant voices did not overshadow quieter ones, while respecting cultural norms throughout the workshops.

Trustworthiness

We considered the four standard qualitative trustworthiness strategies: credibility, dependability, confirmability, and transferability [48]. Credibility was enhanced by recruiting HCWs across primary, secondary, and tertiary facilities and triangulating facilitators' reflections, note-takers' notes, and pictures of flipcharts. The iterative co-design process let participants review, refine, and validate intervention content across sessions. Dependability was supported by structured workshop guides, consistent facilitation, and documented methodological decisions. Confirmability was addressed through regular debriefing with reflections on biases, intervention ideas, and positionality. Transferability was improved by providing detailed descriptions of study context, participant characteristics, and recruitment methods, applicable to similar settings.

FINDINGS

The core co-design group comprised seven participants in Oyo and eight in Jigawa. One participant from Jigawa state dropped out after the first workshop, while one participant from Oyo state dropped out after the third workshop. Overall, 17 HCWs took part in the sense-checks (Table 2). All participants had prior HPV vaccination and recommendation experience.

Table 2
Co-design participants

Core group		**Oyo**	**Jigawa**
		(N = 7)	**(N = 8)**
Gender	Female	6	5
	Male	1	3
Profession	Doctors	3	3
	Nurses	3	2
	CHEWs	1	3
Facility	Primary	2	2
	Secondary	3	2
	Tertiary	2	4
Sense-check		**(N = 8)**	**(N = 9)**
Gender	Female	6	5
	Male	2	4
Profession	Doctors	1	3
	Nurses	3	3
	CHEWs	4	3
Facility	Primary	5	5
	Secondary	2	2
	Tertiary	1	2
Joint workshop with vaccine stakeholders for content review		**(N = 7)**	**(N = 8)**
Gender	Female	2	2
	Male	3	4
Profession	Doctors	2	4
	Nurses	2	2
	Health educator	1	0
Facility	Primary	5	6
	Secondary	0	0
	Tertiary	0	0

Iterative co-design process: Workshops 1–3

We conducted five co-design workshops in parallel in each of the study states with HCWs in the core group and sense-checks. This included five iterative phases (Fig. 2).

Workshop 1: Discussing concerns & questions about HPV vaccine

During the discovery phase in workshop 1 (supplementary material 1) we explored and discussed key areas that could increase HCWs knowledge and skills to strengthen their confidence in the HPV vaccine (Table 3). HCWs discussed their understanding of HPV and the HPV vaccine and reflected on their experiences communicating with parents and community members about vaccination. Participants were familiar with the HPV vaccine and many reported receiving little or no formal training on HPV vaccines and vaccination and expressed the need for more detailed information to equip them to recommend HPV vaccine. Common concerns raised included questions about HPV vaccine safety and misconceptions that the HPV vaccine could cause infertility.

HCWs highlighted misinformation and inadequate access to comprehensive information as major barriers to vaccine confidence among themselves. When asked to prioritise content for a potential intervention, participants consistently identified the relationship between the HPV vaccine, HPV and cervical cancer, HPV vaccine safety and effectiveness, and fertility rumours, as key topics that should be addressed. Participants indicated a preference for short, engaging, and easily accessible learning formats, favouring WhatsApp-based materials, video or audio messages, and practical demonstrations that could fit within routine work schedules.

Workshop 2: Co-developing intervention content

The second workshop focused on exploring what information should be included in the intervention and how this information should be presented. HCWs emphasised their need for clear explanations about HPV transmission, cervical cancer prevention, HPV vaccine safety, side effects, and effectiveness. Also, addressing HPV vaccine infertility rumours as one of the most persistent concerns raised by parents. Participants highlighted the importance of having sufficient and clear information about how that improves their confidence communicate and respond confidently to questions and concerns about the vaccine. Role-play scenarios and real-life examples were suggested as useful approaches for demonstrating effective communication techniques. Participants also recommended incorporating information from credible sources, including local experts and locally relevant evidence, to strengthen trust in the intervention.

When discussing delivery approaches, participants noted advantages and disadvantages of different formats. Face-to-face training was perceived as interactive and engaging but recognised that attendance

could be an issue due to feasibility of gathering all HCWs together considering the resources, and competing work demands at the health facilities. WhatsApp-based videos were viewed as convenient, flexible, and capable of reaching larger numbers of healthcare workers.

Workshop 3: Presenting findings between States

In Workshop 3, we exchanged findings between Oyo and Jigawa states to explore comparability of findings across states. We found similar concerns across Oyo and Jigawa regarding inadequate training, persistent rumours especially infertility, and poor cold chain systems. The findings were comparable for proposed content for intervention development however the preferred modes of delivery differed. Oyo state participants emphasised in-person training as the most effective solution. Participants in Oyo state focused on trust and credibility, calling for structured training models and certification, and collaboration with professional bodies. They prioritized getting local experts and consultants (preferably female, African/Nigerian) to debunk rumours about HPV vaccine. While Jigawa participants felt the mode of delivery should be social media platform as it will reach more HCWs alongside creative tools such as posters, videos, and appointing an HPV champion in the health facilities. Participants in both states were open to the other's ideas rather than defensive of their own. Their concerns and ideas were similar and overlapping, hence, they saw the delivery approaches as complementary, and the discussion moved toward combining both approaches, building credibility while expanding reach through digital and in-person delivery.

Once we identified the main content areas (Table 3) and modes of delivery through short videos (Table 3), a content creator was employed to create the co-design videos in collaboration with the research team. Following the third co-design workshop, a debriefing session was held with vaccine stakeholders in each state with representatives from the Oyo and Jigawa states Primary Healthcare Boards, to review the co-designed videos.

Co-designed content and delivery strategies

During the co-design workshops, participants raised several practical concerns that they felt should be addressed to support HPV vaccine delivery (Table 3), including clearer information on why different HPV vaccines exist, how the vaccine was tested in children, and storage/cold-chain reliability, alongside guidance on responding to persistent rumours around infertility, population control, and vaccine safety. Participants also emphasised the need for accessible, continuous training and support, including digital platforms, mentorship, expert input and simple tools such as role-plays or posters. This is illustrated in Tables 3 and 4.

Table 3
Co-designed content material

Theme	Questions and concerns expressed by participants
HPV Vaccine Training Needs	• Insufficient information and materials addressing common concerns on HPV vaccine • Lack of access to materials for all HCWs (not only selected individuals) • Link between HPV and cervical cancer
Vaccine Choice & Availability	• Why there are different HPV vaccines? • Why is the bivalent HPV vaccine given? • Why are HPV vaccines are not produced in Nigeria • What is the assurance of suitability for Nigerian populations (genetics, long-term side effects)
Tolerance & Safety	• Has the vaccine been tested in children? • Is it tested the same way as in adults? • How was it tested?
Cold Chain & Storage	• Is the vaccine properly stored?
Rumours & Misinformation	• No evidence to debunk Infertility/population-control rumours • How to address rumours as HCWs • Where the vaccine is available
Communication Skills	• How to counsel parents • How to respond to concerns about the HPV vaccine • No confidence to recommend the HPV vaccine

Table 4
Suggested content and delivery modes

Suggested delivery modes	Suggested approaches and contents	Selected?	Rationale for deciding to proceed
Digital and In-Person Delivery Options	• HPV related information platform • Continuous training opportunities • Mentor-based training • HPV champions • Newsletter signup • Short informational videos with quizzes	Yes	Participants from both states believed that both in-person and digital modes of delivery were effective for information dissemination and confidence building.
Short Online Training	• Completion certificate • Video modules focusing on key topics	No	Not proceeded with due to the high requirement of developing and maintaining a dedicated website/platform for HCWs to access materials and issue certificates; these high cost and resources requirements were not immediately feasible for implementation
Interview-based Materials	• Interviews with local experts (Nigeria/Tanzania) on vaccine availability and choice • Interviews with women who had vaccinated their children • Interviews with experts on vaccine tolerance	Partially Yes	We interviewed local experts talking about HPV vaccine availability, choice and tolerance in the general knowledge videos. Interviews with women who had vaccinated their children were not included because the HPV vaccine was just officially introduced to Nigeria in 2023 making it difficult to find such women.
Role-play Activities	• HCW–parent role-play on addressing rumours • HCW–parent role-play on counselling for HPV vaccination	Yes	Role play was adapted into video format and chosen for demonstrating communication because participants felt it best modelled realistic HCW–parent interactions while addressing rumours and counselling.
Social Messaging / Reinforcement	• Example/peer messages in groups • Embedded conversation cues within digital channels and platforms	Yes	Adapted for the digital delivery via WhatsApp as HCWs already had groups for communication, hence adapting that approach appeared realistic and feasible

Prototyping the intervention

The content ideas include having information on general knowledge on cervical cancer, HPV, and HPV vaccine; counselling parents on HPV vaccine, strategies for addressing rumours around the HPV vaccine (Table 3). In terms of mode of delivery, we decided on developing short videos covering the latter content and developing these to be delivered through either an in-person intervention, or a digital intervention via WhatsApp.

Four short videos speaking to the three intervention needs were created with the support of a video maker. Two videos were developed for the counselling topic, to show examples of good and bad counselling techniques. The scripts were developed with guidance from WHO materials, training materials from UNICEF and NPHCDA [49–51]. For the strategies to address rumours script, it was further guided using the Empathetic Refutational Interview (ERI) approach [52]. The scripts were also reviewed by experts in the HPV vaccination research field, Paediatric/Adolescent Health consultant and by a social media and health communications expert from the state PHC Board.

Following an iterative and detailed review of scripts, the four videos were shot in parallel in Oyo and Jigawa states in Yoruba and Hausa languages, respectively (Table 5). Each general knowledge video had 2 actors: an interviewer and a trusted expert involved in HPV vaccination delivery in Nigeria, addressing rumours video: a nurse, a mother, father, and their adolescent daughter. 3 actors for counselling video: a nurse, a mother, and her adolescent daughter. We then developed the two interventions delivery modes.

Table 5
Content for short videos

Video	Theme	Category	Content (General Overview)	Approach
Video 1	General knowledge	Cervical cancer	Understanding of cervical cancer, its burden, and prevention	Expert interview (Doctor + interviewer)
		HPV (Human Papillomavirus)	General information about HPV, how it spreads, and its link to cervical cancer	
		HPV vaccine	Overview of the HPV vaccine, types, its use, benefits, and where it is available in Nigeria	
Video 2	Strategies to address rumours	Common rumours and myths	Common misconceptions about the HPV vaccine in communities	Role play (HCW + parents + child)
		Addressing misinformation	Approaches to debunking rumours, correcting false information and providing accurate, trustworthy information guided by ERI approach	
Video 3	Counselling	Poor counselling	Examples of ineffective counselling and communication between healthcare workers and parents	Role play (HCW + parent + child) comparison
Video 4		Good counselling	Examples of effective counselling and communication using key principles of effective and informative counselling	

Feedback on intervention

Workshop 4 (Joint stakeholders' workshop)

We presented the co-designed videos and delivery approaches to the core group co-design participants, 1 sense-check participant and vaccine stakeholders together at the joint stakeholders' workshop in each state. We received feedback on the content, suggested edits to the videos, and were advised to reshoot them. The feedback is described in Table 6.

Table 6
Feedback from joint stakeholders' meetings

Video	Key Strengths	Main Issues Raised	Recommended Improvements
Video 1: General knowledge on cervical cancer, HPV and HPV vaccine	• Clear overview of cervical cancer, prevention, and vaccine. • Good Yoruba and Hausa delivery and explanation of terms.	• Language concerns (e.g., "saying the vaccine was introduced and has been given in America"). • Not stated that vaccine is free. • Target audience unclear. • Lack of clarity on male vaccination.	• Replace "America with overseas" • Replace sensitive terms; translate "high risk." • State clearly that vaccine is safe and free. • Include male interviewer; add cultural sensitivity. • Clarify male vaccination plans
Video 2: Addressing rumours	• Strong targeting of public audience. • Good flow of information.	• Use of "sexually active" considered culturally inappropriate. • Mention of fainting may cause fear. • Lack of explanation on what to do after adverse effects. • Limited engagement with the girl. • No discussion on disconnects between menstrual cycle and HPV vaccine	• Replace sensitive terms with culturally acceptable phrasing. • Avoid rare side effects like fainting; use "dizziness." • Explain steps to take after adverse effects. • Engage the girl directly (ask name, check understanding). • Explain how the HPV vaccine does not interfere with the menstrual cycle.
Video 3: Poor counselling	• None highlighted; video intentionally demonstrates poor practice.		
Video 4: Good counselling	• Strong rapport and eye contact. • Effective fear appeal for cancer prevention. • Clear explanation of benefits vs risks. • Encourages questions; creates safe atmosphere.	• HCW did not stand to welcome clients. • Slight gap in persuasion during greeting.	• Improve welcoming etiquette (stand, offer seat). • Maintain strong counselling structure.

Video	Key Strengths	Main Issues Raised	Recommended Improvements
General Responses	• Videos mostly clear and culturally relatable. • Improved confidence in recommending the vaccine. • Learning objectives and concluding call-to-action messages to improve clarity and audience engagement across all the videos.	• Some cultural mismatches noted.	• Ensure cultural alignment across all scripts and visuals.

Workshop 5: Finalising interventions and feedback on co-design process

After we revised the scripts to address feedback and reshot all videos, they were shown to the core group co-design participants, and they had no further corrections. The videos had the research partner logos, the HCW-TRUST project logo, the Oyo and Jigawa States Primary Healthcare Boards on the cover pages and end screens to show credibility. In addition, the videos had learning objectives as the introductory and “call to action phrases” as concluding messages.

During the fifth workshop, we asked the core group participants to reflect on the co-design process and the interventions that had been developed. The HCWs responded that being involved in the co-design process increased their sense of ownership and allowed them to contribute perspectives that might otherwise have been overlooked. Participants appreciated the opportunity to discuss their experiences, share challenges, and collaboratively develop solutions.

Participants felt that the final short videos reflected the issues they had identified throughout the workshops, particularly the need to address misinformation, improve knowledge, and support effective communication with parents. Several participants reported that the videos increased their confidence in discussing HPV vaccination and responding to concerns.

Overall, participants considered the co-designed intervention acceptable, relevant, and responsive to their needs (Appendix 1). They anticipated that the intervention could strengthen healthcare workers' confidence in recommending the HPV vaccine.

Co-designed content, delivery modes and interventions

In a final phase we developed the intervention strategy in collaboration with members of the core group, expert consultants and the research team. The co-design process resulted in development of two

interventions: an in-person facility-based approach and a digital WhatsApp-based approach both using the co-designed short videos (Table 6). The in-person component centred on a trained HPV champion within each facility who would use short videos to guide structured group discussions, encourage reflection and peer learning. The digital component applied the same video content within flexible WhatsApp groups, enabling asynchronous engagement supported by guiding questions, prompts and input from HCWs. Both interventions incorporated the same set of short educational videos: general knowledge, addressing rumours, and examples of "good" and "poor" counselling (Table 7).

Table 7

Co-designed content, delivery modes and intervention

Intervention Arm	Mode of Delivery	Participants/Health facility	Description	Video contents developed
In-person	In-person in the primary healthcare facility	Primary healthcare workers- Nurses, midwives, community health workers in	• Each facility will have one HPV champion in each In-person arm facility who will be trained by the HCW-TRUST team. • The intervention includes four videos to be shown period: one video to be watched each in months 1 and 2 and two counselling videos in month 3 (good and bad examples) • After watching each video, the HPV champions will facilitate discussions and reflections among other HCWs • A supervisor from the HCW-TRUST team in each state conducts monthly facility support visits and completes a structured in-person monitoring form.	• Video 1: General knowledge of cervical cancer, HPV and HPV vaccine. • Video 2: Strategies for addressing rumours about the HPV vaccines • Videos 3 & 4: Counselling videos illustrating good and poor counselling practices with learning objectives • All videos include introductory and closing messages for HCWs.
Digital	WhatsApp	Primary healthcare workers- Nurses, midwives, community health workers.	• In each state, one WhatsApp community with 2 groups each will be created- one for nurses/midwives and one group for community health workers (CHEWs and CHO) • The same four videos will be shared once every month for 3 months, spaced 7–10 days apart. • Month 1: videos will be posted without guided conversations • Month 2: videos will be accompanied by pre-developed guiding questions by a digital arm	• Video1: General knowledge of cervical cancer, HPV and HPV vaccine. • Video 2: Strategies for addressing rumours about the HPV vaccines • Videos 3 & 4: Counselling videos illustrating good and poor counselling practices with

Intervention Arm	Mode of Delivery	Participants/Health facility	Description	Video contents developed
			manager who is part of the HCW-TRUST team. • Month 3: video will be posted alongside engagement from a mystery participant (a nurse from the research team who have been added to groups from the onset to act like she is one of the participants. Quiet in months 1 and 2) who stimulate discussion with comments and questions. • The digital arm manager in each state will document engagement and discussion using conversation and responses using a structured monitoring form.	learning objectives • All videos include introductory and closing messages for HCWs.

DISCUSSION

We aimed to identify and co-design concrete strategies for building HPV vaccine confidence among Nigerian HCWs. Here, we describe the strategies and delivery mechanisms identified and provide methodological reflections of the co-design process, using the PROSECO framework [53]. We use the framework to reflect on how the intervention was developed, who was involved, how participants experienced the process, the contextual factors shaping decisions, and the resulting outputs.

Delivery

The delivery domain concerns how the co-design process was organised, facilitated, and implemented [53]. The structured, iterative IDEAS process guided us from identifying concerns and barriers to HPV vaccine recommendation toward developing and refining intervention components, with content evolving in response to participants' feedback rather than being predetermined by researchers. This flexibility extended to a hybrid session, where a participant unable to attend in person due to distance joined online via Zoom and still contributed meaningfully, demonstrating the adaptability of co-design approaches in resource-constrained settings.

Participation

The participation domain focuses on who was involved and how their perspectives were incorporated [53]. Participation was central to our study, with HCWs actively engaged throughout, identifying barriers,

prioritising content, and refining communication and delivery strategies, while vaccine stakeholders played a more consultative role, reviewing and validating what HCWs had generated. A Terms of Reference, opportunities to seek clarification, and modest remuneration for time and transport likely supported this engagement by clarifying expectations and reducing practical barriers.

Our previous study found that HCWs wanted more HPV vaccine information; co-design discussions revealed this was not simply a general knowledge gap. Rather, HCWs needed specific, contextually grounded information, including whether the vaccine had been tested in Nigeria and how to respond to community rumours. This aligns with evidence that HCW vaccine confidence is shaped not only by knowledge but by confidence in communication and context-specific uncertainty [24, 54, 55], suggesting that improving HCW recommendation behaviour requires interventions that go beyond general information provision toward practical, context-specific communication support.

Meaningful participation required more than attendance, it required a safe space for dialogue, negotiation, and shared decision-making, consistent with participatory research principles[56]. Participation was also plausibly shaped by professional cadres and hierarchies, individual personality and differences in communication confidence. Although overall engagement was high, this variation suggests equitable participation requires intentional facilitation strategies to encourage contributions from HCWs of lower cadres.

Experiential

This domain examines how participants experienced the process itself [53]. High engagement and willingness to contribute reflected a positive overall experience. Participants valued a clear, well-structured opportunity to contribute directly to intervention development, describing it as peer exchange and shared learning rather than one-directional consultation. This suggests co-design workshops created a safe space for HCWs to voice vaccine-related concerns, including misinformation, caregiver concerns, and their own uncertainty about the vaccine, that are often unaddressed in routine training. This positive experience likely contributed to the depth of participants' contributions, reinforcing evidence that participatory approaches strengthen ownership and acceptability of the resulting intervention [57].

Context

The context domain relates to the broader social, cultural, economic, and political factors that create the system which can influence the success or failure of the co-creation methods used[53]. Context shaped both the process and the resulting interventions. Participants raised concerns specific to the Nigerian setting, including fertility-related rumours, mistrust of the vaccine, uneven access to credible training, and uncertainty about local testing, mirroring evidence that vaccine confidence is shaped by sociocultural, historical, and health-system factors [24, 28]. All participants emphasised the importance of training on addressing rumours and counselling parents, echoing evidence on the value of such training for equipping HCWs to recommend and administer vaccines [28, 49–51, 58, 59]. The

interventions also reflect the reality that health communication in Nigeria is largely delivered in local languages, directly informing development of the videos in Yoruba and Hausa.

The most analytically interesting contextual finding, however, is that Oyo and Jigawa HCWs, despite raising largely the same underlying concerns, proposed different solutions: Oyo participants converged on a credibility solution (a verifiable local expert, certification, professional endorsement), while Jigawa participants converged on a reach solution (social media, posters, a facility-based champion). When each state's findings were presented to the other in Workshop 3, participants did not defend their original position; they recognised the other's approach as addressing the same problem from a different angle, and discussion moved toward combining both. This divergence plausibly reflects both the documented north-south disparity in Nigerian vaccine confidence and more concrete local factors, Jigawa's greater geographic dispersal favouring broad-reach approaches, and Oyo's dense, interconnected urban setting favouring individual credibility and certification, though we offer this as an interpretation for future research rather than an established finding. What the study does establish is methodological: state-level divergence need not be averaged away or resolved by researchers choosing a winner. A single structured moment of cross-state exchange converted an apparent disagreement into a design both states arrived at with reasoning they had heard and accepted.

Impact

The impact domain relates to the extent to which the co-creation process used achieved one or more desired outcomes and its overall effect, encompassing components such as capacity building, empowerment, reach, and personal change [53]. The co-design process generated several outcomes. It translated HCWs' concerns into tailored digital and in-person interventions aimed at strengthening their HPV vaccine knowledge and confidence. Several participants described the process as changing their own confidence directly, reporting that they had personally been uncertain about the vaccine beforehand and left able to recommend it, including to their own families, an unplanned effect worth accounting for when interpreting confidence outcomes among facilitators and champions in the pilot phase. The process also fostered a sense of ownership among HCWs, including through the state-level disagreement discussed above, which was worked through collaboratively rather than resolved unilaterally.

Our study also contributes to the growing evidence on co-design in low- and middle-income countries, where existing literature remains concentrated in high-income settings [60]. Engaging HCWs, rather than only community members or patients, as co-designers of interventions aimed at their own vaccine confidence remains rare in this literature. Although this study produced two distinctly tailored interventions, it did not itself assess their feasibility, acceptability, or effectiveness; these questions will be explored using a pilot trial and definitive RCT [40].

Strengths and limitations

A key strength was adapting the IDEAS framework, which fit the co-design process into the overall HCW-TRUST project and linked it clearly to the formative assessment and the future pilot phase. To the best of our knowledge, this study is novel and first in including HCWs across professions, cadres, and all three levels of healthcare, fully involving them in co-designing a vaccine confidence intervention, adding to the limited existing literature on HCWs' own vaccine confidence. Including local and state vaccine stakeholders in reviewing and refining the videos strengthened contextual relevance and fostered a sense of ownership.

Some limitations should be considered. Snowball sampling may have introduced bias, as HCWs likely suggested colleagues with similar experiences and close facility ties. In the hybrid Oyo session, the participant joining online was sometimes affected by poor internet signal; we managed the situation by having him post suggestions in the chat box, which the facilitator relayed to other participants. Finally, this study was conducted only in south-western (Oyo) and north-western (Jigawa) Nigeria, which may not fully capture the diversity of perspectives across all regional healthcare contexts.

CONCLUSION

We described a co-design process, guided by the IDEAS framework, to develop concrete strategies for building HPV vaccine confidence among Nigerian HCWs. Through this process, we developed co-designed videos and two tailored interventions, in-person and digital, intended to strengthen HCWs' trust in the HPV vaccine and support their recommendation of it; whether they achieve this remains to be tested in the planned pilot and cluster RCT. Our strategy was novel in engaging HCWs, rather than only community members or patients, as co-designers of interventions aimed at their own vaccine confidence, developed and delivered in Yoruba and Hausa, with vaccine stakeholders engaged separately to review and endorse the resulting strategies, moving beyond community HPV vaccine uptake alone toward strengthening the confidence and recommendation behaviour of the HCWs who shape that uptake directly.

Beyond these specific outputs, our findings point to a broader methodological lesson: state-level differences in HCW priorities need not be resolved by researchers choosing between them. A structured moment of cross-state exchange, in which each group's reasoning was made visible to the other, converted an apparent disagreement into a design both states endorsed, suggesting co-design has value as a method for health service delivery and health system strengthening more broadly, not only for developing intervention content itself. Further research, including the planned pilot trial, will assess the feasibility, acceptability, and effectiveness of the co-designed interventions in strengthening HCWs' HPV vaccine confidence and recommendation behaviour.

Abbreviations

HPV Human Papillomavirus

LMICs Low- and Middle-Income Countries

WHO World Health Organization

HCW(s) Healthcare Worker(s)

IDEAS Integrate/Ideate, Design, Evaluate, and Share (framework)

PROSECO PROcesS Evaluation framework for CO-creation

Pro-VC-Be Professionals Vaccine Confidence and Behaviours (tool)

PHC Primary Healthcare

CHEW(s) Community Health Extension Worker(s)

CHO Community Health Officer

Gavi The Vaccine Alliance

ERI Empathetic Refutational Interview

RCT Randomised Controlled Trial

Declarations

Ethics approval and consent to participate

The study was approved by the Oyo State Research Ethics Review Committee (ref: AD/13/479/362A), the University of Ibadan/University College Hospital Ethics Committee (ref: UI/EC/23/308), the Jigawa Ministry of Health (ref: MOH/PH/PHRAT/MN/23/003), the Jigawa State Ethics Committee (ref: JGHREC/2023/151), and the Swedish Ethics Authority (Dnr: 2023-04772-01-471058). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication

All participants gave their written informed consent, including consent for publication.

Competing interests

The authors declare no competing interests.

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Author Contribution

KOA contributed to the conceptualization and design of the co-design process, participated in its implementation and data collection, analysed and interpreted the findings, and led the writing of the manuscript. AAB and AGF contributed to the design and oversight of the co-design process, interpretation of the findings of the manuscript. HU contributed to the implementation of the co-design process and data collection. AB and JS supported the implementation of the co-design process. CK and CH contributed to supervision, study design, and interpretation of the findings. All authors reviewed and approved the final manuscript. SHvW conceptualized and oversaw the overall study.

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Data Availability

Data is available upon reasonable request from the corresponding author.

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Figures

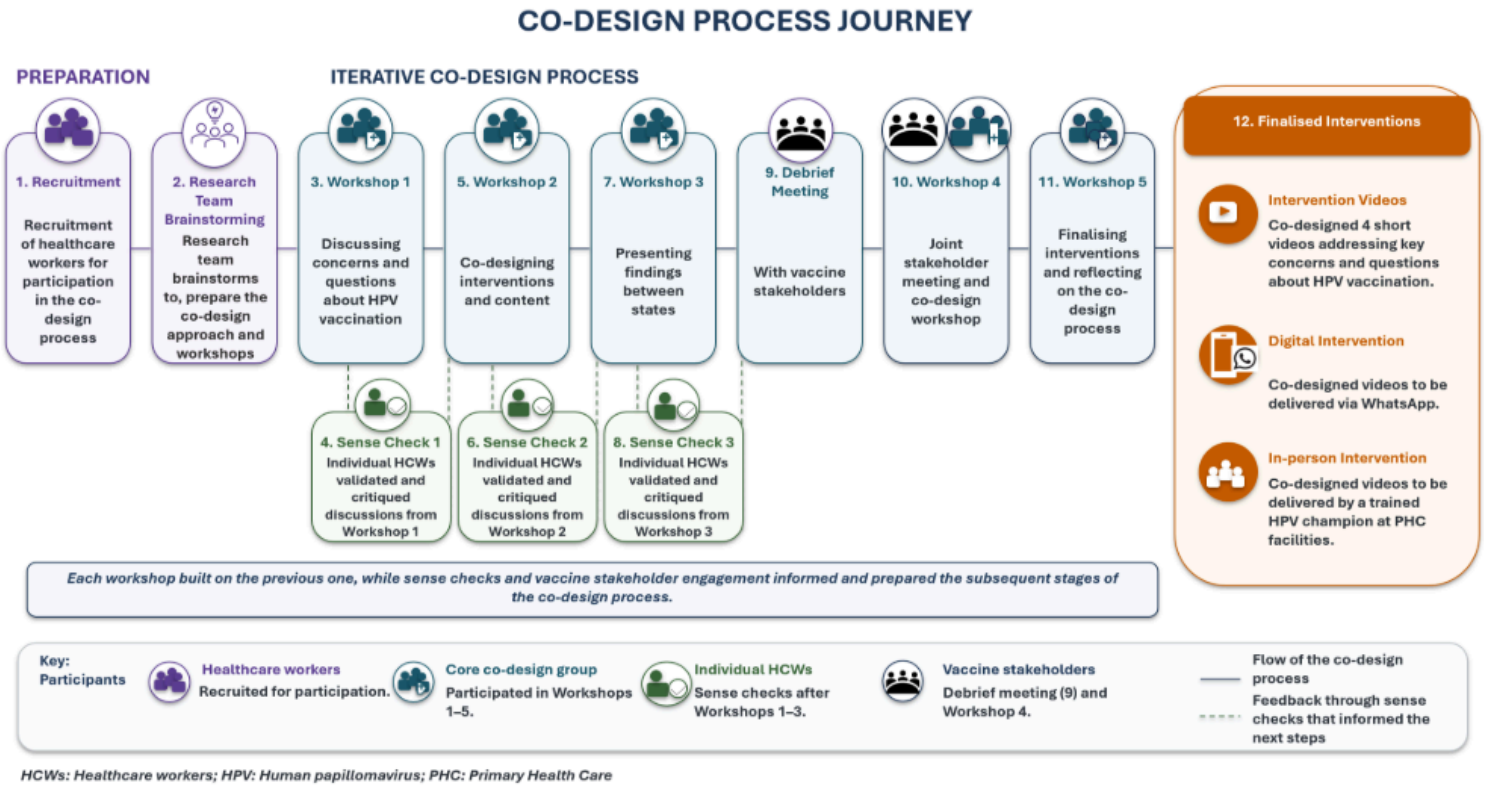


Figure 1

Co-design process

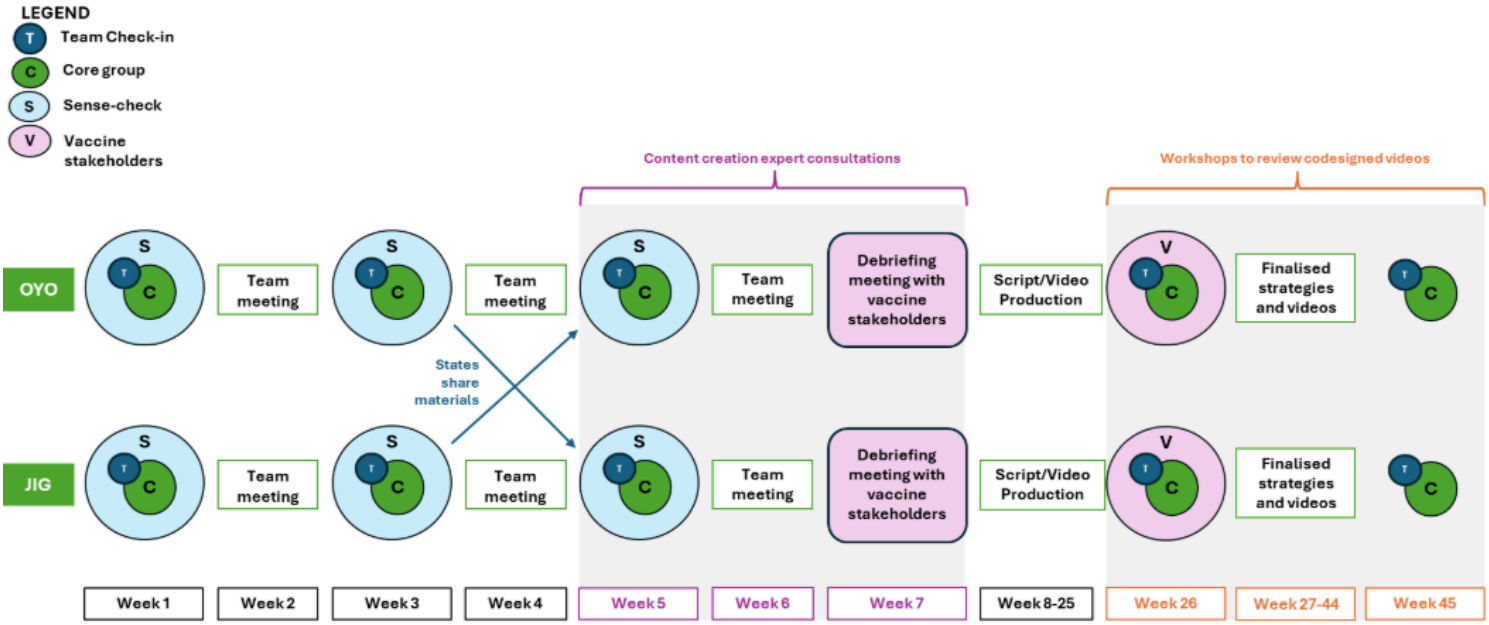


Figure 2

Co-design workshops

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