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RESEARCH

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Co-designing a shared digital decision aid for HPV vaccination in French general practice

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Abstract

Background Human papillomavirus (HPV) is responsible for the most common sexually transmitted infection in the world and persistent infection of oncogenic types is associated with an increased risk of cancers. This infection could be prevented by vaccination. However, in a time of vaccine hesitancy, the decision to get vaccinated or to have a child vaccinated is the result of a complex process and decision aids are tools that may be of help in this context.

Objective The aim of this article is to present the development of a shared decision aid for HPV vaccination in France, destined to be used during general practice consultations.

Methods In order to develop the shared decision aid, we followed the steps recommended by the International Patient Decision Aids Standard (IPDAS), i.e. scoping and defining the objectives, assembling the steering group, designing (carrying out two focus groups and a narrative review of the literature) and testing in a alpha test phase (carrying out three focus groups and 11 individual interviews). The tool was co-constructed with adolescents, parents and general practitioners.

Results We created an online shared decision aid which included the definition of HPV, epidemiological data, the mode of contamination, the different locations of the disease, the development of cancer, the importance of Pap smears, the effectiveness of the vaccination as well as the possible side effects. The various focus groups as well as individual interviews made it possible to determine the values and expectations of patients and physicians thus improving the decision aid. This development also made it possible to confirm an existing need for this type of tool for both patients and physicians.

Conclusions We have developed a shared decision aid that could help general practitioners communicate about HPV vaccination and get more patients vaccinated. The impact of its use during the consultation will be evaluated on criteria such as the resolution of the decision-making conflict and ultimately on the vaccination coverage, as part of the PrevHPV study.

Keywords Decision making, shared, Papillomavirus vaccines, Primary health care

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Background

Human papillomavirus (HPV) is the most common sexually transmitted infection worldwide, with over 100 identified genotypes. Persistent infection with certain types of HPV can lead to cancers of the cervix, vagina, and vulva, as well as anal, penile, and oropharyngeal carcinomas, affecting both sexes [1–3]. In France, approximately 25% of HPV-related cancers occur in men [3]. Cervical cancer ranks third in lifetime incidence among women, with approximately 600,000 new cases and 340,000 deaths globally in 2020 [2]. In France, nearly 3,000 new cases and 1,117 deaths were reported in 2018 [4]. While condoms reduce HPV transmission, they do not provide full protection [5]. HPV-related cancers are largely preventable. The vaccine offers protection against approximately 90% of oncogenic HPV types [6, 7], significantly reduces cancer incidence [8, 9], and also prevents the spread of genital warts [10].

To accelerate prevention, the WHO launched a global strategy to eliminate cervical cancer by 2030, targeting 90% HPV vaccination coverage among girls by age 15, 70% screening at ages 35 and 45, and 90% treatment for cervical disease [11]. In France, HPV vaccination is recommended for all girls and boys aged 11–14, with catch-up options for older adolescents and men who have sex with men up to age 26 [12, 13]. Very recently, national recommendations have been extended to include all young adults up to age 26, regardless of gender or sexual orientation [14].

Despite this, France's vaccination coverage remains among the lowest in Europe—21% in 2016 [15]. Recent national data [16] show some progress: among girls born in 2008, 54.6% received at least one dose of the HPV vaccine by age 15, and 44.7% had completed the full vaccination schedule by age 16 (defined as two doses for this age group). Among boys of the same cohort, coverage remains much lower, with 25.9% receiving one dose and only 15.8% completing the full series—well below the 80% target set by the National Cancer Control Plan [17]. Low public confidence in vaccine safety [18] and vaccine hesitancy, defined as delayed acceptance or refusal despite availability [19], contribute to this issue.

General practitioners (GPs) play a key role in addressing hesitancy, particularly among adolescents and their parents [20, 21]. The COVID-19 pandemic highlighted the importance of clear provider communication and digital tools to improve vaccine uptake [22–25].

Decision aids (DAs) support shared decision-making and help align choices with patient values [26]. They have improved acceptance of both HPV [27] and COVID-19 vaccines [23, 25], especially when used during consultations [25, 27–29]. A systematic review [30] on DAs for vaccination included eight studies: five assessed effects on coverage; one improved uptake [31, 32], and one

improved vaccination intention [33]. One HPV-specific study in China showed improved intention among parents and adolescents [27]; a Dutch study reported reduced decisional conflict [34] and another combining a DA with clinician training improved uptake, though the DA's individual effect was unclear [35]. A recent meta-analysis confirmed higher uptake in intervention groups [36].

Currently, no decision aid (DA) for HPV vaccination is available for the French-speaking population, and existing tools are not freely accessible for clinical use. This study aimed to develop a shared decision aid (SDA) for use in general practice in France, as part of the PrevHPV program—a co-constructed, multicomponent intervention involving adolescents, parents, and healthcare professionals [37]. Multicomponent approaches of this kind have been shown to be among the most effective strategies to improve vaccine uptake [38, 39], yet few have integrated a co-developed, consultation-based decision aid in this population. The aim of this study was to describe the development of a shared decision aid (SDA) to support HPV vaccination decision-making in general practice in France.

Methods

The development process followed the International Patient Decision Aid Standards (IPDAS) guideline [40, 41], which emphasize the involvement of patients and healthcare professionals and the documentation of each step. This article focuses on the first five phases of the development process (Fig. 1): (1) scoping and defining objectives, (2) assembling a steering group, (3) designing the SDA, (4) prototype drafting, and (5) alpha testing. The tool was co-developed with adolescents, parents, and general practitioners (GPs) using qualitative methods, including focus groups and semi-structured interviews.

Scoping, preliminary literature review, and objective definition

The SDA was intended as part of a multicomponent intervention that also included motivational interviewing training for GPs. Its goal was to provide impartial, evidence-based information on HPV-related diseases, transmission risk, natural disease progression, benefits of vaccination, and potential adverse effects. These objectives were informed by a narrative literature review conducted by two researchers (DPH, SB), covering studies published between 2015 and 2020 in the MEDLINE and Cochrane Library databases. Keywords included: “human papillomavirus,” “vaccine,” “effectiveness,” “safety,” “impact,” “coverage,” and “decision conflict.” The review focused on literature reviews, meta-analyses, and cohort studies and was conducted between October 2020 and February 2021. The summary of the results are available



Development of a shared medical decision support tool for vaccination against human papillomavirus.

- development process following IPDAS recommendations -

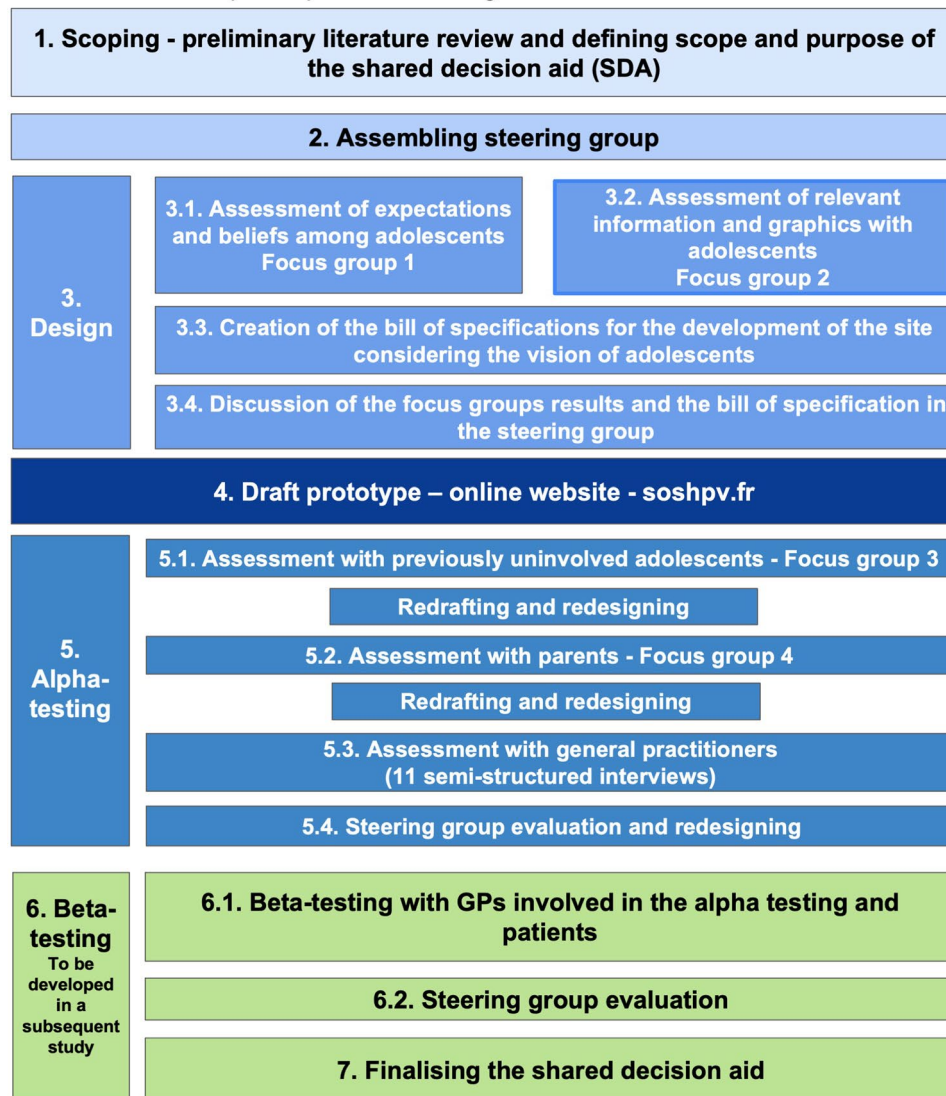


Fig. 1. Development process of the shared decision aid for HPV vaccination, following IPDAS guidelines

in supplementary materials 2 and further developed in results preliminary literature review.

Steering group formation and SDA design

The steering group was composed of members of the research team, including the study authors (e.g., GPs and a health psychology expert), who were directly involved in the development and evaluation process. Although invitations were extended to adolescents, parents, and external GPs to join the group, no external members accepted. The aim of this phase was to incorporate the

perspectives of the target population regarding content and format expectations.

A qualitative approach was used to inform the design phase of the tool, through the use of focus groups, which are particularly suited to idea generation and early-stage development [40–43]. Two online focus groups were conducted with adolescents aged 10–16 years, recruited via purposive and snowball sampling through social media. Parental consent was obtained. Guides for the focus groups were developed by SB, MZ, and DPH. The guides are available in English in supplementary material 1. The

first focus group explored HPV knowledge, risk perception, and visualization preferences; the second focused on vaccination experiences, preferences for data presentation, and design expectations. To engage discussion, a total of 33 graphs were presented, covering topics such as international vaccination coverage, HPV epidemiology in France, vaccination schedules, disease progression, transmission modes, vaccine effectiveness, and side effects (supplementary material 1).

Sessions were conducted in French, recorded, transcribed, and anonymized. Data were analyzed using MAXQDA 20.4.0 with inductive thematic analysis [44], double-coded independently by two researchers (DPH, MZ), and discussed in steering group meetings to inform the SDA specifications.

Prototype drafting

The SDA format was developed as a website by one of the team members (DPH), integrating WHO recommendations for effective vaccine communication [45]. Content followed IPDAS standards for decision support tools [40–46], including a section to explore patient values, as recommended.

Alpha testing

Alpha testing involved presenting the prototype to new adolescents, parents, and GPs. Adolescents and parents participated in focus groups, while GPs were interviewed individually using semi-structured formats. Sessions took place between March and June 2021. Recruitment was again purposive, followed by snowball sampling. Interview guides were developed specifically for this phase of the study and tailored to each participant group. They followed the same thematic approach and were designed to minimize confirmation bias using a pre/post-exposure structure. In the first part, participants' knowledge and needs were explored; in the second, the tool's acceptability, usability, and clarity were assessed. All guides are available in English in supplementary materials 1.

Adolescents in alpha testing had not participated in the earlier design phase to reduce bias. One parent focus group was conducted. GPs were interviewed individually to explore their HPV vaccination practices, beliefs, and feedback on the tool. The GP interview guide was informed by a previous PreVHPV qualitative study that identified three physician typologies based on their approach to HPV vaccination: highly engaged, supportive but less proactive, and hesitant [47].

After thematic analysis of the alpha test data, revisions were made to the SDA in accordance with the SUNDAE reporting checklist for patient decision aids [48]. GPs were informed of the updates before the subsequent beta testing phase.

Results

Preliminary literature review

A narrative literature review informed the first prototype draft, with 18 references selected to determine key content areas to be tested with adolescents and included in the decision aid. Data from the French National Cancer Institute and the the French National Authority for Health were used to present national epidemiological figures and vaccination guidelines [49, 50]. Coverage data were drawn from a systematic review [15] and a national cross-sectional study [51]. Vaccine effectiveness was supported by high-level evidence: a Swedish cohort study for cervical cancer [52], a Cochrane review for CIN2+ lesions [53], and meta-analyses on HPV-related cancers [54], anogenital warts [10], and potential public health impact [7].

Safety data were taken from meta-analyses [55, 53], national and international observational studies [56–58], and WHO guidance [59]. A summary of these sources and rationale for inclusion is available in supplementary material 2.

To evaluate decision conflict, several validated scales were considered [60, 61]. The SURE Test [61] was selected for integration in the SDA, given its brevity, two-choice response format, clinical relevance, and validation in parental immunization decision-making contexts [62].

Initial design: focus groups involving adolescents

Two focus groups were conducted with adolescents to inform the initial design of the shared digital decision aid (SDA). The first group included eight participants aged 10 to 15 years (median age: 13), with a majority being female (5/8). The second, follow-up group included six participants, again with a female majority (4/6). Participant characteristics are presented in supplementary material 3.

Overall, adolescents expressed a preference for information parity between girls and boys. Most participants reported limited knowledge about HPV infection but showed interest in data highlighting its national and international impact. Graphical formats were strongly favored over text, particularly those that presented data clearly and concisely. A website format with interactive or animated elements was preferred over a traditional written pamphlet. In addition, several French websites providing information on HPV were reviewed [63–66], and participants were invited to suggest domain names for the SDA website.

Concerning the vaccination coverage at the international level, adolescents responded positively to maps showing international coverage: - *"It is important to know how it is going at the global level, to see the countries that vaccinate"* (A3). Data without graphs were not appreciated *"We do not understand well without the chart"* (A8).

Regarding epidemiological data in France, they mainly chose a graph combining location and numerical data. *“Having figures is important, and moreover it’s easy to understand”* (A9), *“I think we understand well, we have the figures so it’s precise.”* (A3).

The various graphs presenting the evolution of the disease from infection to precancerous lesions and cancers were difficult to understand. Whether it was only numerical data or diagrams, understanding remained difficult. *“It’s too complex, it’s incomprehensible”* (A1).

Concerning the effectiveness of vaccination, the adolescents unanimously liked the representation of data in absolute terms, through the use of fact boxes: *“You can see clearly, it’s easy to understand”* (A8), *“I like it better when it’s visual”* (A1).

Participants preferred data presented in concise formats with minimal surrounding text. They found that images paired with medical content improved understanding, whereas long text blocks discouraged engagement: *“It takes a long time to read, when you see it you tell yourself that you are going to spend the day reading it”* (A7). Concerning side effects, they were represented most often in plain text on the various sites and adolescents preferred a more graphical approach.

Regarding the mode of transmission, some graphics were regarded as awkward, even if they presented coherent and appreciated information, *“Uh... it’s good because we can see how we can have it...how we get infected...uh...uh...that explains it well”* (A1).

Concerning the various websites presented, they liked the interactive ones which presented animated data. The adolescents preferred fact boxes to order understand HPV immunization data. They expressed a need for a mind map that summarizes the data into a fact sheet. Their preferences were used to form the bill of specifications of the SDA.

Draft version of the prototype

The SDA was made available online using the domain name chosen by the adolescents [67]. Destined to be used during a GP consultation, the first page that is displayed is represented by a graphic with an introductory question – “To get vaccinated against HPV?” – and with a button labelled “Let’s find out together” that invites the patient to discover the information while being guided by the physician.

By clicking on the “Let’s find out together” button, the user is directed to a drop-down menu from left to right presenting the themes concerning HPV and vaccination: (1) The human Papillomavirus (HPV), what is it?; (2) HPV-related diseases; (3) Prevention - the vaccine; (4) Vaccine effectiveness; (5) Side effects; (6) Your opinion; (7) Are you sure?. Each tab presents information visually (infographics and key figures) and textually,

allowing physicians to guide discussions or let patients explore independently. All data are referenced at the bottom of the page. The final tab includes the SURE Test [61] to screen for residual decisional conflict. Based on responses, a visual cue indicates whether conflict is present. A downloadable fact sheet summarizing key points is also available, based on adolescent input.

Graphics were adapted to adolescent preferences and follow WHO recommendations for presenting vaccination data [45]. Selected pages from the website are shown in supplementary material 4.

Alpha-testing

Focus group with previously non-involved adolescents

Five adolescents (ages 11–14; 4 female) participated in the alpha-testing focus group. Three were vaccinated against HPV, yet most had limited prior awareness. Participants characteristics are presented in supplementary material 3. To minimize confirmation bias, this group had not taken part in earlier stages of development. Their feedback highlighted both information needs and usability preferences, including concise visual formats, non-explicit framing of sexual transmission, and a desire for printed support materials. The verbatim data are structured thematically to reflect perceptions before and after presentation of the SDA.

Before viewing the SDA

Participants reported limited HPV awareness, despite having been vaccinated in some cases. Informal sources such as YouTube were referenced, and vaccination decisions were sometimes made without understanding the rationale: *“Oh yes, we are vaccinated, we have heard a little but not too much”* (AFGA3), *“Yeah, I heard talking about it on Youtube”* (AGFA1).

After viewing the SDA

They particularly appreciated the non-explicit framing of sexual transmission: *“We don’t insist on it being a sexually transmitted disease and that’s good”* (AFGA5), and supported its use during consultations: *“The site I find it well done and I find that we don’t actually talk a lot about HPV (...),”* and *“I think it’s a really good idea to use it in the consultation because it’s much more telling – you can see the diagrams, the graphs – it’s telling”* (AFGA1).

The inclusion of the SURE test [61] was also well received as a prompt for reflection: *“It’s good because it allows us to reflect on what we’ve learned”* (AFGA2).

However, suggestions for improvement were made, including simplifying some terminology (*“Strains too”* (AFGA5)), adding legends to the fact boxes, and offering a printable fact sheet to support discussions beyond the consultation. The summary of the findings from this focus group can be found in Tables 1 and 2

Table 1 Alpha testing verbatims adolescents – before the SDA presentation

Subtheme	Verbatims
Ways of getting information	'Yeah, I heard talking about it on Youtube' (AGFA1, 14 years, male old, not vaccinated)
Vaccinated but not aware	'No, never heard of HPV' (AGFA3, 14 years old, Female, vaccinated), 'I don't know' (AGFA5, 11 years old, Female, vaccinated)
Not very informed	"Oh yes, we are vaccinated, we have heard a little but not too much" (AFGA3 speaking of AFGA3 and AFGA4).

Focus group with parents

Eight parents (median age: 46; 7 female) participated. Four were healthcare professionals (undisclosed during the session), and six had vaccinated children. Their responses addressed both initial knowledge gaps and post-SDA impressions, with a focus on the tool's role in supporting family discussion, trust-building, and clarifying medical information. Quotes are again presented before and after SDA exposure.

Before viewing the SDA

Parents expressed limited familiarity with HPV or its vaccine and described relying heavily on physicians for guidance. Several mentioned discomfort discussing sexual health with preadolescents, identifying this as a barrier to vaccine communication ("We haven't talked about sexuality yet... we'll talk again the day they reach sexual age" (PFGA6)).

After viewing the SDA

Parents found the tool helpful in reducing decisional conflict and enabling shared discussion at home: "if I had this support a year ago, I think I would be...I would have said yes uh... more easily, I think what I... what I missed a

year ago year for decision-making it is indeed this support and... and a more complete explanation" (PFGA8).

Parents appreciated the inclusion of information on HPV's asymptomatic nature, which was added to the SDA following this session. While some found the SURE Test useful, others did not fully understand it.

The summary of the findings from this focus group can be found in Tables 3 and 4.

Evaluation with general practitioners

Eleven GPs participated (age range: 27–50; 7/11 female). Most were academic supervisors (7/11) with established practices (9/11); two were locums. Based on the typology described in the Methods section, participants included eight "convinced physicians," two "convinced but unconvincing," and one "reluctant." Participants characteristics can be found in supplementary material 3.

Before viewing the SDA

GPs emphasized the centrality of shared decision-making in their clinical routines—"It's primordial, major, central!" (DIA10)—though practices varied. Some reported systematic vaccine proposals framed outside the context of sexuality—"I propose it from the age of 11...while trying to talk about everything except the problem of sexual order" (DIA5)—whereas others found communication more difficult, especially when discussing sexual health with parents and adolescents. One participant reflected on personal uncertainty following exposure to conflicting information: "I promote it a little less... I keep silent about the article" (DIA4). Several GPs expressed a need for clear, up-to-date data on vaccine effectiveness, side effects, and dosage schedules.

Table 2 Alpha testing verbatims adolescents – after the SDA presentation

Subtheme	Verbatims
A need for informations	"The site I find it well done and I find that we don't actually talk a lot about HPV (...)" AFGA1. "For me it is important to know all about the risks, what could happen after having been vaccinated" (AFGA1); "For me it is above all to know the protection in the future" (AFGA5).
Informing without sexualising	"I think it's not not bothersome" (AFGA1) "maybe it's a little sensitive but it won't be bothersome, no" (AFGA2); "we don't insist on it being a sexually transmitted disease and that's good" (AFGA5). "Yes it's very important to have all the information! (AFGA1, AFGA2, AFGA3 AFGA4).
Desired use in consultation	"I think it's a really good idea to use it in the consultation because it's much more telling – you can see the diagrams, the graphs – it's telling" (AFGA1)
Appreciated objectivity	"it's true that when we read the site we are given the positive points and the negative points and that's super pleasant" (AFGA2)
Visually appealing	"The images are easy to understand" (AFGA2), "The diagrams nevertheless bring a visual side" (AFGA3)
The presence of some complicated words	"Body words like peripheral nerves" (AFGA1), "Strains too" (AFGA5). "what does the question of having enough support mean exactly? (AFGA4)
Importance of a printable mind map	"I would also like to have it printed, the consultation with the doctor... sometimes it can happen quickly. It will still be good to have information in paper format and also after going to the site. I think it will be good to have both" (AFGA5)
Importance of evaluating the decisional conflict	"I think it's good, it's good for dusting off our ideas and our answers" (AFGA1), "it's good because it allows us to reflect on what we've learned so I think it's good" (AFGA2).

Table 3 Alpha testing verbatims parents – before the SDA presentation

Subtheme	Verbatims
Not a very well known subject	“so for my part, no, not really until yesterday” (PFGA5), “So I went on the internet, I found out and... here it is... I knew but I did not know the term at all, I did not know that he had a vaccine. I spoke to my wife about it, who informed me that my eldest was already vaccinated...that her sister will be vaccinated next week. So there you go, now I know. (PFGA1)
General practitioner referral – a facilitator	“for my part, it was my general practitioner who spoke to my daughter during a consultation and suddenly after we went home with... to explain a little more what it consists of and why the vaccine and all the diseases that can result from it (PFGA4); “it was also the general practitioner who had started to approach the discussion in relation to the papillomavirus and then the discussion started from there and it actually made it possible to...explain more” (PFGA2). “The physician advised us to do it...we followed without worries. (PFGA1).
Vaccine hesitancy due to lack of communication with the health professional	“I also heard about it last year through the pediatrician because my daughter was 11 years old since I haven’t...I haven’t because she was insistent but no, we didn’t have time to...ask too many questions...so there you go”. (PFGA8)
Sexualization – not a mandatory discussion	“so for me, my daughter last year was 11 and she was told she needed to have a vaccine. We haven’t talked about sexuality yet, even though she’s 12 now... we’ll talk again the day they reach sexual age” (PFGA6). “But it’s true that they have to have a certain age and a certain maturity to understand what sexuality is. » (PFGA4) « But actually at 12 years old, I didn’t go into the practical details of what sexuality is » (PFGA7)
Communication at the heart of the decision	“in my opinion, elements that could allow me to make my decision, I think that in fact it is... the responsibility of the physician and his way of approaching the question uh...we can have better supports... to explain uh... whatever if the physician isn’t convinced of what you... are asking you to do... do to your child... you’ll make a decision uh... one way or the other depending on how and you make it... the... the... the vaccination is offered to you, and even today I find that there are far too many general practitioners who do not offer or... or not well” (PFGA3).
Community as facilitator	“Because when I said that the neighbours who are 12, 14 and 16 years old were vaccinated right away, she said to herself, what’s the good” (PFGA8).
Perceived barriers – lack of studies and side effects	“I don’t know... we have... we have how many years of experience? Finally, how many years of hindsight experience do you have on...on the studies that have been done, on...on the data, on...on lots of things like that? (PFGA1). “I found it interesting to have a more global vision of the diseases. After the risks too because it was a concern. And this is a point that stands out for parents” (PFGA8).

Table 4 – Alpha testing verbatims parents – after the SDA presentation

Subtheme	Verbatims
The SDA, communication facilitator between parents and children	“But I think you have to take the time to talk about sexuality also through this vaccine...and it’s true that the screen approach can be simpler than with the pediatrician. (PFGA8). “I think it also makes it possible to talk about it with the spouse who is not there in consultation as well uh...” (PFGA8).
The SDA, a solution for vaccine hesitancy	“if I had this support a year ago, I think I would be...I would have said yes uh... more easily, I think what I... what I missed a year ago year for decision-making it is indeed this support and... and a more complete explanation” (PFGA8) “it actually made it possible to... to provide complete information uh... to be able to measure benefit risk and... and... uh it also made it possible to make a... a choice” (PFGA2).
The SDA, a solution for better understanding	“Uh me too, it helped me a lot, uh... we clearly show that vaccination from what to what age and uh... one two three vaccines uh... so it allows us to show the... well why have to do early too uh... and then what is it for finally... because uh... all the illnesses that they can be prevented... that they can be inherent in the face of this illness, that’s it” (PFGA4);
Appreciated objectivity	“You don’t give a positive or negative opinion, it’s up to everyone to choose, so it’s a positive point” (PFGA1).
Points to improve	“the diagram there, that one, it could put more forward to explain the mode of transmission and that... well... that 90% of it can be cured and I find that this one is not highlighted enough advance according to me” (PFGA3), nevertheless others find the need for an accompaniment for the reading “the back and forth of the arrows of the same colors uh... it makes it difficult for me to read what... uh the bottom arrow is linked...uh...I...I don’t actually understand it” (PFGA6). “You don’t talk too much about the symptoms of the primary infection so I wondered and the teenagers too, how to recognize, how do we know if we are infected? (PFGA3).
The SURE test, a translation to improve	“it’s cool the questionnaire, in any case it’s good, after I don’t quite get... you are sure what constitutes the best choice for you, I don’t know me, I think it’s a question of... of formulation” (PFGA1); “five questions, it’s clear, I find that the first could be badly formulated, I admit that I see that and I say to myself but what would I answer to that” (PFGA3).

After viewing the SDA

After viewing the SDA, GPs found it met their informational needs and praised its visual clarity, intuitive design, and the inclusion of a printable fact sheet to support time-constrained consultations.

In this evaluation, the reluctant GP was reassured after the presentation of the SDA, allowing him to resume vaccine recommendations and emphasizing the need for

peer-reviewed data in clinical practice “*Thank you by the way... for having provided all these details in relation to HPV vaccination (.), I think I am going to get back to vaccination and I will consult the sources to finish convincing myself. It did me good to have that point*” (DIA4). As for the convinced but unconvincing GPs, a need for such a tool was mentioned by one of the participants “(regarding the possible use of tool for HPV vaccination) - yes honestly

i find it quite neat because i think it's actually the vaccination where i have the most trouble being convincing" (DIA9).

Suggestions for improvement included standardizing the data presentation format (favoring fact boxes) and clarifying the SURE Test, which received mixed reactions—some fearing it might provoke rejection, others praising its role in empowering patients. The summary of the findings from this focus group can be found in Tables 5 and 6.

Final version of the prototype

Following the alpha testing phase, several modifications were made to improve the SDA's usability and content. Based on feedback from the parents' focus group, web ergonomics were enhanced through technical adjustments. Infographics were revised to include additional information, such as the asymptomatic nature of HPV, which was added to the initial image.

Content updates included the integration of the most recent French data into the European vaccination coverage map and modifications to the cervical cancer infographic, which now features the term "pap smear" and a visual of the cervix to improve clarity. All changes made after alpha testing are summarized in Table 7, following the SUNDAE checklist for decision aid development [47]. Table 8 showcases the summary of the results.

Discussion

This study describes the development of the first shared decision aid (SDA) for HPV vaccination designed for use in French general practice. The tool was created in alignment with the International Patient Decision Aid Standards (IPDAS) [40] and co-constructed with adolescents, parents, and general practitioners (GPs), ensuring relevance to clinical workflows and user expectations. As shown in Table 8, each step of the IPDAS has been adhered to, ensuring the SDA's integrity and effectiveness.

The SDA aims to improve communication about HPV vaccination and support GPs in addressing common barriers to vaccination uptake. It incorporates evidence-based content, graphical data presentation, and interactive elements, aligned with known facilitators of vaccine acceptance [68]. Its emphasis on provider–patient communication aligns with findings from both European [21] and international contexts [69, 70].

To our knowledge, this appears to be the first publicly available shared decision aid for HPV vaccination developed specifically in French. Its development followed a participatory approach, involving adolescents throughout the design process and integrating feedback from parents and general practitioners. The contribution of practicing GPs also helped ensure alignment with real-world consultation dynamics.

Table 5 Alpha testing verbatims physicians – before the SDA presentation

Subtheme	Verbatims
Central role of shared decision making and patient partnership	"Shared decision has a very big place, that's why my consultations last a very long time (laughing)" (DIA11). "It's primordial, major, central! (PC); "Central. The concept of patient partnership is said to be the step after the patient-centered relationship. (DIA10);
A typology of general practitioners - Those who vaccinate without difficulty: A non sexualized systematic approach	"In general, I already offer it when I see the children who come for the reminder of the DTAP at 11 years old, so I take advantage of these consultations there to say that there is a vaccination even if it is not compulsory concerning the papillomavirus" (DIA3). " I propose it from the age of 11 to girls or boys at the same time as the vaccination against tetanus while trying all the same at that age obviously to talk about everything except the problem of sexual order, I'm obviously quite vague on that" (DIA5).
A typology of general practitioners - Convinced but unconvincing: Too much information and sexualization	"Afterwards I systematically propose to young girls at the time of the recall of eleven years but I do not necessarily have a rate of 'very good acceptance' (DIA8); "I think it's always trickier because I like the young people I offer to understand what we offer them. And it is often consultations where I receive the young person with his parents. Eleven years old finally here is when we start, at eleven, twelve, thirteen years old there that we start to propose it (...) but suddenly it is sexual health in fact because it is necessary to explain that is it cervical cancer." (DIA9).
A typology of general practitioners - The reluctant towards vaccination	"precisely in relation to the HPV vaccine, I began to promote the vaccine quite systematically and then there I came across an article which questioned all beliefs, so I admit, I promote it a little less when patients talk about it, I talk to them about it with what I think about it... and I admit I keep silent about the article, I don't talk about it but I don't go to duty anymore... since I read this article" (DIA4).
Information necessities - a need for vaccination data and for recalling vaccination schedule	"so perhaps to be more on the side effects to be more square there are really numbers and to be able to be more uh yeah... more training, more to have answers that are more formal. On the side effects, on the hindsight we have" (DIA1) "But indeed small boards would be not bad and which give precise information. on everything... of I don't know on... with numbers!" (DIA2) "Er, the vaccination protocol changes all the time (DIA8); - Then there are points where... I'm not... uh on 1–2... how many 2 or 3 doses each time it's something that takes a bit so each time I check. (DIA2)
Use of shared decision aids - a common practice and an opportunity for HPV vaccination	"...I use a lot of websites where it's very visual, for example for the introduction of statins, for cholesterol (medication) (DIA3)." " (regarding the possible use of tool for HPV vaccination) - yes honestly i find it quite neat because i think it's actually the vaccination where i have the most trouble being convincing" (DIA9)

Table 6 Alpha testing verbatims physicians – after the SDA presentation

Subtheme	Verbatims
The SDA: A didactic, intuitive tool and visually appealing tool	"Didactic, it answers I think almost all the questions that patients may ask themselves and it seems easy to use(…) it's easy to show them on the computer" (DIA1); "Afterwards, visually, finally just on the ergonomic aspect, I did not manipulate, but it seems easy to me(DIA8)". "Visual, the information is clear, in an accessible and... precise and global sense (DIA4).
The SDA: A tool responding to the physician information needs	"The reminder of the vaccination schedules is quite interesting" (DIA7); "very intuitive and sourced data" (DIA2);
The SDA: A possible facilitator for the reluctant physician	"Thank you by the way... for having provided all these details in relation to HPV vaccination (..), I think I am going to get back to vaccination and I will consult the sources to finish convincing myself. It did me good to have that point" (DIA4)
The SDA: A possible integration into the usual practice	I think it must be current practice in fact" (DIA2) "it can be practical and that's why I said and I will have an address when it will be available, when it will be broadcast and I will gladly use it at that time, but in any case I will broadcast to my students" (DIA7). "It's a tool that we absolutely have to get to grips with(…) and not hesitate to use it" (DIA5).
The printable fact sheet: a time saving feature and an invitation for a dedicated consultation	" I'll mark it for you on the prescription (the vaccine), look on this site and talk about it and we'll see you for the vaccine" (DIA1). "So having a paper medium is still useful. At least to have the fact sheet with big messages to be able to share it with the patient, yes. (DIA8). "I try to print since I have a population with a low level of literacy...I try to print a lot... because I know very well that when they leave the consultation they don't get it if there is a lot of information. (DIA7).
Possible usability barrier of the SDA: fear of overtime	"uh if we don't do the mental map it may be a bit long uh is- what we are not going to open questions that they did not necessarily have in fact if you if we show them the, diseases linked to HPV" (DIA1). "I might say it's a bit long for a consultation...but that's it. I think that for me is the negative point" (DIA3). "
Possible usability barrier of the SDA: fear of the side effects presentation	"I do not address the serious, non significant statistical adverse effects... if it was me who would have thought, designed the site, I would not have put everything that is not statistical significant. People always tend to focus on the worst" (DIA4). "Me, the insignificant stuff I wouldn't put them there, in my opinion there are too many." (DIA10).
The infographics - a certain desire for real world anatomical photos	"In addition the magnifying glass is on the thin vagina... it's a bit me, it seems to me that I would tend... me often I show what the cervix is on a photograph finally... I do this all the time and I take pictures that I find on google randomly. But very very very realistic in fact. Because suddenly I explain, I say...here it is, it is the vagina" (DIA9); "... in fact the thought behind it is to say to oneself. . . an illness remains, it's not just a drawing. There is a sense, it's a reality that sometimes perhaps in our culture we tend to hide what we don't like" (DIA8).
The infographics - a view on the ethical consideration and data visualization	"There you come in front of an ethical dilemma. Am I telling patients the truth even if it doesn't push the way I want it to go? It's a real dilemma. You used the previous infographic because it allows you to understand well and there if you do this infographic, you realize that the difference is almost 0. And suddenly you deliberately choose another presentation which is less clear so that goes your way. From an ethical point of view it is difficult. But at the same time make a shared medical decision support tool that shows that the benefit is minimal...It's tricky... (DIA10)."
The SURE test - a fear of rejection	"I'm not sure how to use it. But maybe it's me who's afraid they'll tell us no" (DIA1).
The SURE test - rephrasing and improving translation	"I am not sure I understand the basic questions. Does the tool allow you to make the best choice for me, right?... I didn't understand that when reading the question. I find it suggestive...I'll revise it" (DIA8)
The SURE test - a way to respect patient views	"I think it's great, it's at the end when we do it and we says that we still need time, to give people freedom, it also shows them that well... when they're not ready to do something, we're not going to do it despite everything" (DIA11). "Well, it can be interesting for us as a practitioner because if our message is not well received, that is a very good tool for me as a practitioner. Frankly. (DIA6).

Strengths and limitations

This study followed a structured, participatory development process guided by IPDAS criteria and current scientific evidence. The SDA was co-designed with adolescents, parents, and general practitioners, ensuring relevance to clinical use. Researcher reflexivity was built into the analysis through interdisciplinary collaboration, and a new group of adolescents was involved in alpha testing to reduce confirmation bias.

While thematic analysis was appropriate for tool development, it offered limited theoretical depth. Further evaluation is also needed to assess long-term use and real-world impact on HPV vaccination uptake. Selection bias may have influenced qualitative findings, as focus group participants were predominantly female and highly educated. This limits generalizability to more diverse

or socially disadvantaged populations. Future research should assess the tool's acceptability across broader socio-cultural groups.

Participation in the steering group was limited. Invitations were made at the end of focus groups, without financial incentives—likely reducing engagement, especially among underrepresented profiles. Structured invitations and incentive strategies have been shown to improve participation [71] and should be considered in future co-design efforts.

Finally, this article does not report quantitative outcomes such as vaccination uptake. These are being evaluated in the larger PrevHPV cluster-randomized trial [72], which includes a component on the SDA and an educational intervention for GPs. Additional studies are also

Table 7 Changes in the shared decision aid after the alpha testing

SUNDAE Checklist [48]	Results of the alpha test			Changes made after discussion with the steering group and within project meeting
	Focus group with parents	Focus group with adolescents	Interview with GPs	
Explicit description of the decision	Validated	Validated	Validated	Validated
Description of the health problem	Validated	Validated	Validated	Validated
Information on options, their benefits, risks, and consequences	Add information regarding the fact that this is an asymptomatic course	Validated	Specify the pap smear on the image of the cervical cancer evolution	'Often asymptomatic' added to the dedicated chart. The smear added on the dedicated graph.
Information on options, their benefits, risks, and consequences	Validated	Validated	Could be improved by leaving more choices for the personal values according to a GP	Added personal values to aid deliberation with a printable version with free text
Numerical probabilities	Validated	Add legend to charts	Two doctors criticised the format of the infographics	Validated
Clarification of values (implicit and explicit)	Validation on explored values. SURE test not yet validated	SURE test not yet validated	SURE test not yet validated	Changes to the SURE test translation
Guidance in deliberation	SURE test to be reformulated	SURE test to be reformulated	SURE test to be reformulated	Changes to the SURE test translation. Added personal values to aid deliberation.
Guidance in communication	Validated	Validated	Validated	Validated
Reading and comprehension level	Some charts deemed complicated. Use scenario improved.	Simplify some words - ex - <i>strain</i>	Simplify certain words - ex - <i>valence</i>	Changes made to the ease of reading
Other	Ergonomics of the side navigation	/	/	Changes made to the navigation buttons

Table 8 Summary of the results

IPDAS Development Steps	Implementation in Our Study
1. Scoping and Defining Objectives	Established goals post-literature review; integration into a multicomponent intervention.
2. Assembling the Steering Group	Included GPs and health psychology experts; invited adolescents and parents in the process.
3. Designing the SDA	Used qualitative methods (focus groups) to explore perceptions and expectations.
4. Draft Prototype Construction	Developed a web-based prototype, informed by WHO recommendations for communication.
5. Alpha Testing	Employed focus groups and semi-structured interviews to refine the tool based on feedback.

underway to examine the SDA's effect on decisional conflict and vaccination intention.

It is also important to note that the SDA was co-designed specifically for adolescents, in collaboration with teenagers and their parents. As such, it was not originally intended to address the recently expanded catch-up recommendations issued in May 2025, which now include all young adults up to age 26 [14]. While these updates are highly relevant from a public health perspective, the tool has not yet been adapted or tested

for this broader age group, and we acknowledge this as a limitation.

Comparison with the literature

Several studies have assessed the use of DAs to support HPV vaccination decision-making. In China, a DA developed for parents and young women was shown to improve vaccination intention [27]. Pot et al. [34] conducted a randomized controlled trial in the Netherlands, evaluating a web-based decision support tool for mothers considering HPV vaccination for their daughters. While vaccination coverage was high in both arms, the intervention group showed reduced decisional conflict and improved informed decision-making.

In Canada, an online tool was developed to provide general public information about HPV vaccination. Although its impact on vaccine uptake has not been evaluated, its usage data helped identify informational needs and behaviors among users [73].

In the United States, a multicomponent intervention that included physician communication training, a dedicated website for parents, a decision aid, and a fact sheet led to an increase in HPV vaccination initiation [35]. However, a follow-up study revealed that physicians predominantly used the fact sheet—similar to the one of our tool—while the decision aid itself was rarely utilized [74].

In contrast, the SDA developed in our study was well received by participating GPs, who perceived its integration into clinical consultations as feasible and potentially valuable. Its interactive, visual, and consultation-centered format may explain this difference in acceptability. In fact, several GPs indicated that the tool could support vaccine discussions in practice. While this suggests potential for influencing provider attitudes, it should be noted that a scoping review found that communication interventions do not consistently shift healthcare providers' vaccine attitudes [75]. The aforementioned interventions mainly targeted parents or young women but did not involve them in their development in contrast to our study.

The development of an online SDA for HPV vaccination comes at a critical moment, as studies from diverse contexts, including France [76] and China [77], highlight low awareness and knowledge among target populations as a key barrier to vaccination. This gap extends beyond awareness to broader issues of vaccine hesitancy, including confidence, complacency, and calculation [78]. Our SDA addresses these challenges by providing interactive, evidence-based content that visually communicates vaccine safety and effectiveness, aiming to build trust and engagement. The link between parental awareness and vaccination uptake, particularly shown in China [77], reinforces the value of tools that support informed decision-making. By clarifying misconceptions and guiding value-based deliberation, online SDAs can play a key role in improving HPV vaccination rates across cultural settings.

Conclusions

Improving HPV vaccination coverage remains a public health priority, particularly in countries like France where uptake is low. Given the pivotal role of general practitioners in vaccine acceptance, we developed a SDA designed for use during GP consultations. Built in accordance with international standards, the tool supports meaningful, structured conversations with adolescents and their parents about HPV vaccination.

While this study focused on the tool's development and initial user testing, its impact on vaccine decision-making and hesitancy will need to be assessed in real-world settings. This will be addressed in the next phase of our research through a cluster randomized trial.

Beyond this specific intervention, our findings highlight the need for broader strategies to support vaccine-related communication. Clear, consistent messaging about the benefits and safety of HPV vaccination, supported by evidence-based tools and complemented by behavioral prevention strategies, should be part of routine care. Ultimately, the SDA is intended to support informed and confident decisions about HPV vaccination. By

strengthening provider–patient communication and improving access to reliable information, this tool may contribute meaningfully to national and international efforts to reduce HPV-related disease.

Abbreviations

AFGA	Adolescents focus group alpha-phase
PFGA	Parents focus group alpha-phase
DIA	Doctor interviewed alpha-phase
CIN	Cervical intraepithelial neoplasia
GP	General practitioner
HPV	Human papillomavirus
IPDAS	International patient decision aid standards
SDA	Shared decision aid
SUNDAE	Standards for UNiversal reporting of patient decision aid evaluation studies
WHO	World health organisation

Supplementary Information

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Supplementary Material 1
Supplementary Material 2
Supplementary Material 3
Supplementary Material 4

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Author contributions

DPH: Corresponding author. Contributed to Conceptualization, Investigation, Data Curation, Data triangulation, Visualization, Methodology, Project Administration, Writing – Original Draft, and Writing – Review & Editing. Responsible for constructing the SDA and creating graphics, and a member of the steering group. AT: Contributed to Conceptualization, Investigation, Data Curation, Data triangulation, Design of the Interview Guides, Writing – Review & Editing, and served as a member of the steering group for the SDA's creation. MZ: Involved in Conceptualization, Investigation, Design of the Interview Guides, Investigation in Focus Groups, Writing – Review & Editing, and was a member of the steering group. ME: Played a role in Conceptualization, Writing – Review & Editing, and was a member of the steering group for the SDA's creation. JP, LR, HP: Contributed to Conceptualization, Writing – Review & Editing, and served as members of the steering group for the SDA's creation. SG: Involved in Conceptualization, Project Administration, Writing – Original Draft, Writing – Review & Editing, Supervision, Funding Acquisition and was a member of the steering group for the SDA's creation. JLB: Contributed to Conceptualization, Writing – Review & Editing, and served as a member of the steering group for the SDA's creation. AG, AGB, MM, JEM: Involved in Conceptualization, Supervision and Writing – Review & Editing. NT: Contributed to Conceptualization, Supervision, Writing – Review & Editing, Project Administration, and Funding Acquisition. SB: Played a role in to Conceptualization, Investigation, Data Curation, Data triangulation, Visualization, Methodology, Project Administration, Writing – Original Draft,

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Data availability

The data that support the findings of this study are available from the corresponding author upon request. The rationale for the data selection for the SDA are available in supplementary material 2.

Declarations

Ethics approval and consent to participate

This qualitative study was conducted in accordance with the ethical principles of the Declaration of Helsinki and relevant national guidelines. The alpha-testing phase received approval from the 'CPP Sud-Est VI' ethics committee of Clermont-Ferrand University Hospital on December 22, 2020 (ID-RCB: 2020-A02031-38, IRB00008526). The design phase, conducted as part of the broader PrevHPV project, was approved by the Inserm Institutional Review Board (IRB00003888, IORG0003254, FWA00005831) on December 10, 2019. Data were anonymized during transcription, and confidentiality was maintained throughout the process. Data collection and analysis were authorized by the French Data Protection Authority (CNIL, DR-2021-299). Participation was voluntary. Written informed consent was obtained from parents of adolescent participants for focus groups. Verbal consent was obtained and recorded for all individual interviews and for the parent focus group.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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