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Frédérique Dorleans, Jonathan Sicsic, Valérie Henry, Isabelle Bonmarin, Gwladys Nadia Gbaguidi, et al.. What are parents' preferences for Human Papillomavirus vaccination promotion messages and communication? Application of a discrete choice experiment to a French Caribbean setting. *BMC Public Health*, 2025, 25 (1), pp.145. <10.1186/s12889-024-21006-6>. <hal-04893940>

HAL Id: hal-04893940

<https://ehesp.hal.science/hal-04893940v1>

Submitted on 17 Jan 2025

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RESEARCH

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What are parents' preferences for Human Papillomavirus vaccination promotion messages and communication? Application of a discrete choice experiment to a French Caribbean setting

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Abstract

Introduction Human Papillomavirus (HPV) vaccine uptake in the French Caribbean has remained below 25% since introduction in 2007, which is well behind national and international targets. Using a discrete choice experiment (DCE), we explored parental preferences around HPV vaccination and optimized communication content in a sample of parents of middle-school pupils in Guadeloupe.

Methods We conducted a cross-sectional survey in public and private middle age schools in Guadeloupe in June 2023 using an online questionnaire. Across a series of nine hypothetical scenarios, participants were asked to decide to vaccinate or not and how certain they were about this choice. Scenarios differed by five attributes (diseases characteristics, vaccine safety, health professionals or institutions promoting vaccination, social conformity and optimal vaccination age). We used random effect logit and linear regression models to estimate the effects of attribute levels on vaccine acceptance and vaccine eagerness.

Results A total of 389 parents out of the 23,184 pupils' parents completed the DCE survey. The attributes with a significant effect size on theoretical vaccine acceptance were "social conformity" and "optimal vaccination age". Overall, the odds of scenarios stating high vaccine coverage in adolescents were at least 1.8 (95% CI: 1.2—2.6) times more likely to yield theoretical vaccine acceptance compared to a low vaccine uptake reference. The odds of providing scientific explanation along with age yielded theoretical vaccination acceptance respectively up to 3.2 times higher (95% CI: 1.7 to 6.1) in parents reporting an un vaccinated child and not intention to vaccinate. For vaccine eagerness, we observe significant positive effects of communication content overall when stating high vaccination uptake in adolescents or scientific evidence along with age or mentioning cancer prevention. Parents always refusing vaccination remained unsensitive to communication contents.

Discussion and conclusion These original DCE results highlighted the need for tailoring specific HPV vaccination promotion communication in a French Caribbean setting. Contextual features such as sexuality concerns as regard

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to age and peers' adhesion to vaccination have to be thoroughly considered. The nationwide HPV vaccination campaign in middle schools should adapt communication in order to raise HPV vaccine uptake in the French Caribbean.

Keywords Human papillomavirus, HPV vaccination, Health communication, Preferences, Vaccine hesitancy, Discrete choice experiment, French Caribbean, Martinique, Guadeloupe

Background

The HPV-associated diseases Caribbean health context is characterized by a high burden of cervical cancer [1–5]. Within the French Caribbean region and each year, the estimated new cervical cancer cases account for a cumulated 54 cases in both the archipelago of Guadeloupe (383 559 inhabitants, 2020) and island of Martinique (361 225 inhabitants, 2020) [6–9]. Availability of preventive tools and adequate health services such as cervical screening and HPV vaccination might mitigate this epidemiological situation [10]. Indeed, HPV-associated-cancer burden could be alleviated with an increased HPV vaccination uptake given high HPV vaccines effectiveness and safety profile and enhanced HPV genotypes coverage with the 9-valent vaccine introduction as regards to the identified most prevalent circulating HPV genotypes [11–14]. In the French Caribbean, the Human Papillomavirus (HPV) vaccine recommended for girls since 2007 became universal in 2021 as vaccination recommendations were extended to boys [15]. As of 31st of December 2022, 26.5% of 15 year-old and 19.3% of 16-year-old girls had received respectively one or two HPV vaccine doses in Guadeloupe and in Martinique, they were 17.6% (15-year old girl, one dose) and 12.1% (16 year-old girls, two doses). Uptake estimates for boys were less than 5% in both islands [16]. The HPV vaccine uptake was much below the 70% goal set up in the French pluriennial cancer strategy (2021– 2030) and the 90% goal of the international initiative to eliminate cervical cancer (2020–2030) set up by the World Health Organization (WHO) [17]. A 2014 cross-sectional population survey identified that 33% (Guadeloupe) and 40% (Martinique) of the 15 to 75 years-old population were unfavorable to some vaccines including HPV vaccine [18]. In 2021, a similar updated survey found that 66% (Guadeloupe) and 69% (Martinique) of 15–18 years old girls' parents had heard about HPV infections or HPV vaccination: therefore, one third of this population was not aware about HPV infection or vaccination [19]. Barriers and incentives towards HPV-vaccination have been widely explored globally and specifically in continental France where vaccine uptake also remains suboptimal with 42.4% of the 16 year-old girls vaccinated with two doses [20–26]. Few information and data on the determinants of HPV vaccination decision and hesitancy are available in the French Caribbean region. Two surveys focusing on HPV-vaccination offer

in this region identified providers' characteristics, opinions, attitudes and practices and emphasized the lack of providers' recommendations during medical consultations as documented elsewhere [26–28]. In addition, a qualitative survey among 37 parents of 11 to 17 year-old teenagers interviewed and implemented between December 2020 and February 2021 identified incentives obstacles towards HPV-vaccination in Martinique (unpublished data, Kantar. Volet qualitatif de l'étude des déterminants de l'acceptabilité de la vaccination à HPV aux Antilles. 2021 Mars 2021 [29]. Their main findings were in line with the global scientific literature and the scarce French Caribbean literature on HPV-vaccination determinants. Concerns about side effects, fears of encouraging sexual activity debut and sexual promiscuity in promoting HPV-vaccination in their children, mistrust in health authorities and in the pharmaceutical industry and lack of providers' recommendations, exacerbating gender disparities in vaccine uptakes, were found in individual interviews [30, 31]. We need to bring evidence on HPV-vaccination uptake determinants as well as to identify obstacles and incentives for overcoming hesitancy in our French Caribbean post COVID-19 pandemic social crisis setting [32]. Discrete choice experimentation is an innovative methodology widely used in the health field that enables elicitation of patients' preferences [33]. It has been applied to the continental French health context through several investigations including a national interventional research project aiming at increasing HPV vaccination uptake through a multicomponent strategy with middle schools [34]. To our knowledge, this method has not been applied to the French Caribbean health sector, therefore, we implemented this innovative design with the aim of evaluating parental preferences around HPV vaccination in parents of children targeting the 52 middle schools of Guadeloupe in order to help optimizing vaccine communication in the French Caribbean.

Methods

Survey design and inclusion of participants

We conducted a cross-sectional survey in the 52 public and private middle schools in Guadeloupe between June 7 and 30, 2023. We used an internet-based anonymous questionnaire with a single profile DCE component. Eligible persons were parents or legal tutors with at least one child enrolled in one of the 52 middle schools

of Guadeloupe at the time of the survey. According to annual statistics published by the Education Administration, a total of 23,184 pupils were enrolled in middle-age schools in 2022–2023 [35].

Invitations to participate in the online survey were sent on June 7, 2023 by the central level school administration via the educational online platform (Pronote) to pupils' parents followed by two additional reminders on June 14 and June 21, 2023. The invitation included a description of the survey objectives, methods, inclusion criteria and confidentiality regulations along with a web-based link to access the Limesurvey online questionnaire. Before starting the questionnaire, participants had to read the survey information detailing data confidentiality and autonomy and actively agreed to survey participation.

Data collection

The participating parents completed the questionnaire for the eldest of their child if they had several children enrolled in middle school. The survey questionnaire was structured into three different sections. The first section covered socio-economic and family characteristics, opinions and knowledge on vaccination and specifically HPV vaccination. The second section consisted in a single-profile DCE in which parents had to complete nine scenarios. For each of the nine scenarios, they had to decide, in theory, whether they would vaccinate the child. They also had to allocate a degree of certainty for each of the nine theoretical decisions. The third section was intended to collect information on beliefs, attitudes and practices towards HPV vaccination. A pilot phase including think-aloud exercises with at least twelve adults naïve towards DCE methodology was implemented in order to define the optimal number of questionnaire choice tasks before reaching saturation. Twelve choice tasks were tested in the pilot phase by five participants reaching an average of eight optimal number of choice tasks attained before saturation. Due to DCE optimal design constraints, we had to define nine choice tasks in the final questionnaire. Ten others tested the whole questionnaire and the average time taken to self-complete the three sections of the questionnaire was estimated to be ten minutes (Additional file 1).

Development of the DCE: frame, choice of attributes, creation of the design and expected effects to be tested

The frame and scenarios for the single-profile DCE were designed based on an extensive scientific literature review on determinants and preferences of HPV vaccination and the main findings of the priorly mentioned unpublished qualitative survey results in Martinique [36].

The single profile DCE frame defined an imaginary situation in which the proposed vaccine provides a 90%

protection against a benign infection mainly transmitted by close contacts and that can affect anyone. The vaccine was not named to avoid a-priori preferences affecting the individual decisions although questions in the two other sections targeted specifically HPV vaccination. We selected five attributes, each one broken down into several levels in accordance with the DCE methodology: disease characteristics (attribute n°1, 4 levels), vaccine safety (attribute n°2, 4 levels), health professionals or institutions promoting vaccination (attribute n°3, 3 levels), social conformity (attribute n°4, 3 levels) and optimal age (attribute n°5, 3 levels), providing a total of 17 attribute levels (Table 1). To obtain a scenario, we randomly combined one level of each of the five attributes into a set containing five options (levels). By repeating this combination design as many times as allowed by the numbers of attributes (5) and levels (17), we generated a "full-factorial design" of 432 unique scenarios. We then randomly extracted eighteen scenarios that we further grouped into two blocks of nine scenarios each. Each participant was randomly attributed a nine-scenarios block by actively choosing a letter between A and J (at the design phase, A, C, E, G, I were assigned to one of the two blocks and B, D, F, H, J to the other block) before completing the nine scenarios. After reading each scenario, they had to make a binary theoretical choice deciding to vaccinate (yes) or not to vaccinate (no) their child. For each of their theoretical choice, respondent had to determine a degree of certainty by choosing a number 1 to 10 scale, 10 corresponding to the highest degree of certainty. In total, each respondent who fully completed this DCE provided eighteen answers, nine for the theoretical vaccination binary choice and nine for the certainty degree ordinal choice (1 to 10) [37–39]. We made the answers obligatory to complete in order to optimize the survey results.

Attribute levels and assumptions

Disease characteristics (4 levels)

This attribute describes the forms of the disease in terms of gradient of severity and impact on quality of life over time. Based on the literature, we tested the vaccination willingness and adherence in the context of occurrence of a benign form of the disease (genital warts on intimate parts or on the mouth), as compared to occurrence of a serious disease such as cancer with a life-threatening prognosis ($H_0 > 0$). Assessing the impact on quality of life through the occurrence of discomfort in future sexual life could either dissuade reluctant parents from vaccination because of its link with sexuality or encourage them to choose vaccination from a preventive perspective for the well-being of sexual life of the child becoming a sexually active adult in the future ($H_0 > 0$). Finally, we hypothesized that there would be greater parental acceptance

Table 1 Scenarios' attributes, levels, formulations and tested hypotheses of the DCE, 7–30 June 2023, Guadeloupe

Attributes	Attributes levels	Attributes' levels' formulations for the scenario	Hypotheses
Disease characteristics	Genital and oral warts	The vaccine protects against warts on intimate parts of the body and the mouth	Reference
	Cancer prevention	The vaccine protects against cancer that could occur in 20 years	H1: OR ^a > 1
	Prevention of pregnancy complications	The vaccine protects against severe complications that may occur during pregnancy	H2: OR > 1
	Sexual discomfort	The vaccine protects against a disease that could cause sexual discomfort in adulthood	H3: OR > 1
Vaccine safety	No side effects	The vaccine has no side effects	Reference
	Long term observation	Vaccine safety has been evaluated worldwide for some 15 years: no serious side effects have been scientifically demonstrated	H4: OR > 1
	WHO: vaccine effective and safe	Worldwide use of HPV vaccine recommended by WHO // One hundred and seven (107) countries use the vaccine which the World Health Organization (WHO) considers to be effective and safe	H5: OR > 1
Health professionals or institutions promoting vaccination	Favorable risk–benefit balance	The expected benefits outweigh the risks	H6: OR < 1
	General practitioner	Your family doctor recommends that you have your children vaccinated	Reference
	School health and maternal and Child welfare services	School health services and the Maternal and Child welfare system recommend vaccinating your children	H7: OR < 1
	Ministry of Health and regional health authority	The Ministry of Health and the regional health authority recommend that your child be vaccinated	H8: OR < 1
Social conformity	Low vaccination coverage in adolescents (15%)	The proportion of adolescents vaccinated is low (15%)	Reference
	High vaccination coverage in adolescents (70%)	The proportion of adolescents vaccinated is high (70%)	H9: OR > 1
	High vaccination coverage in adolescents (> 70%) in Puerto Rico and Canada	The proportion of adolescents vaccinated in Canada and Puerto Rico is high (> 70%)	H10: OR > 1
Optimal age	Vaccine effective at all ages	The vaccine is effective at all ages	Reference
	Vaccine more effective before 14 years: optimal antibody production	The vaccine is most effective and protects best before the age of 14 when antibody production is optimal	H11: OR > 1
	Vaccine more effective before sexual debut	The vaccine is most effective when administered before the sexual debut	H12: OR < 1

^a OR Odds Ratio. Conditional logit regression

of the argument that the vaccine would protect against future pregnancy complications, and that this would lead to greater vaccine adherence (H0 > 0) (Table 1).

Vaccine safety (4 levels)

This attribute provides varied information on vaccine safety, indicating the absence of side effects as the reference modality for the analyses. We wanted to test the hypothesis that the longer the vaccine has been marketed, recommended and administered, the greater the adherence to vaccination (H0 > 0). We assumed that the vaccine used in many countries and recommended by the World Health Organization (WHO) would strengthen trust and increase vaccine uptake (H0 > 0). Finally, we

tested the expression "benefit-risk balance" frequently used during the COVID-19 vaccination social crisis in the French Caribbean and we assumed that it was associated with a negative context and, as such, did not encourage vaccination. We also hypothesized that this argument could be misleading as somehow misunderstood by the general public because of its technicity: its use is not convincing (H0 < 0). (Table 1).

Health professionals or institutions promoting vaccination (3 levels)

The available literature supports that the involvement of the family doctor or health professional in vaccine promotion is crucial in the decision to vaccinate and that

barriers in health care services can increase vaccination refusal. This modality is the reference that we compare with other actors promoting vaccination: local actors such as the Maternal and Child Protection Regional Services (“Protection Maternelle et Infantile (PMI)”) and State school health services, which could boost decision to vaccinate ($H_0 > 0$). Finally, distrust towards public health state institutions (the Ministry of Health and Prevention -i.e. Le Ministère de la Santé et de la Prévention—and the Regional Health Agency -i.e., l’Agence Régionale de Santé, ARS) rooted into the context of the environmental pollution by chlordecone and the COVID-19 pandemic crisis became a major concern.. We expect this modality to lead to disaffection towards vaccination ($H_0 < 0$) (Table 1).

Social conformity (3 levels)

Social norms and health behavior are often correlated. Generally, institutional campaigns and debates emphasize low vaccine uptakes giving therefore visibility to a social norm generating low uptake. Therefore, we tested the impact of social norms on the level of motivation to vaccinate through a positive message conveying the idea that the majority is committed to vaccination ($H_0 > 0$). The reference was a message indicating low levels of vaccination coverage. We also tested the effect of messages using neighboring countries of the region of the Caribbean and Americas demonstrating successful vaccination performance. We aim at measuring the impact of messages referring to neighboring foreign countries with which we may identify ourselves on different aspects ($H_0 > 0$) (Table 1).

Optimal age (3 levels)

Study results show that many parents consider the age of vaccination to be too early as the vaccine preventing a sexual infection might disinhibit sexuality. This is a common finding identified in many settings including the French Caribbean one. We hypothesized that, compared with the reference that vaccine efficacy is age-independent, pedagogical arguments based on the immunological effects of vaccination could increase adherence to vaccination ($H_0 > 0$). On the other hand, arguments referring to sexuality could be dissuasive ($H_0 < 0$) (Table 1).

Vaccine acceptance

According to the respondents’ answers, we defined two different respondents’ categories, the non-uniform category and the uniform category including serial demanders and non-demanders.

Uniform respondents case definition

They were defined as parents who systematically accepted or systematically refused theoretical vaccination across the nine scenarios answered. Within this category, we define as serial demanders the uniform respondents who systematically accepted vaccination and as serial non-demanders the uniform respondents who systematically refused vaccination.

Non-uniform respondents’ case definition

They were defined as respondents who changed their decision at least once across the nine scenarios. Attribute effects on vaccine acceptance can only be estimated among non-uniform respondents. We further investigated the changes in other sub-groups: females, parents reporting their child not being vaccinated against HPV and parents reporting no intention to vaccinate their child.

Vaccine eagerness

Vaccine eagerness offers a framework that “evaluate post-choice certainty information to elicit preferences amongst uniform and non-uniform respondents”. We created a “vaccination eagerness” variable that respectively takes a negative value with serial non-demanders and a positive value with serial demanders’ choice on a 1 to 10 scale. Analyses on vaccination eagerness thus allowed including all participants independent of vaccine choice behavior while focusing on motivating effects that do not necessarily translate in change in decision [40].

Statistical analyses

We conducted a descriptive analysis for the main demographic characteristics of participants. Sociodemographic (age, sex) information, HPV vaccination reporting status and DCE profile were analyzed as frequency, percentage or mean. We estimated the relative weight of each attribute level using a random intercept logit function based on information coming from non-uniform demanders only as provided by the DCE methodology. We used a fixed-effect linear regression to analyze the impact of each attribute on vaccination eagerness. Analyses on vaccination eagerness allow using the information from all participants, irrespective of theoretical vaccine decision behavior and exploring attribute effects on motivation that do not necessarily translated into changed decision. Given sample size limitations, we did not perform interaction analyses. Where sample size allowed, we conducted specific subgroup analyses (female respondents, parents stating that their children are unvaccinated against HPV

or that they do not intend to vaccinate their children against HPV). All analyses were performed using Stata/SE software version 14.2.

Results

Out of the 23,184 pupils’ parents, 504 self-connected to the web-based questionnaire of whom 389 completed the DCE questionnaire section. Amongst the 389 respondents, females accounted for 93.6% and 55.8% reported that the child had received at least one dose of HPV

vaccine and that they intended to vaccinate the child (Table 2).

Assessment and quantification of parents’ HPV vaccination preferences

Out of the 389 DCE participants, 111 (28.5%) were non-uniform respondents and 278 (71.5%) were uniform respondents, 145 (37.3%) of whom were serial non-demanders and 133 (34.2%) serial demanders. According to parents’ reporting on real-life HPV vaccination status, 38% of non-uniforms, 72% of serial demanders and 1% of serial non-demanders reported a child vaccinated against HPV and reported willingness to have their child vaccinated against HPV (Table 2).

Table 2 DCE respondents characteristics and profiles, 7–30 June 2023, Guadeloupe

	N	%
Number of DCE respondents	389	100
Characteristics of DCE respondents (N= 389)		
Sex (N= 389)		
Females	364	93.6
Males	25	6.4
Age (N= 388)		
Less than 35 years	24	6.2
35–44 years	199	51.2
45–54 years	151	38.8
55–64 years	13	3.3
65 years and more	1	0.3
Profiles (N= 389)		
Serial demanders	145	37.3
Serial non-demanders	133	34.2
Non-uniforms	111	28.5
Vaccination status reporting (N= 251)		
Child not vaccinated against HPV and no intention to vaccinate against HPV	140	44.2
Child vaccinated against HPV and intention to vaccinate against HPV	111	55.8

Across all scenarios, an average of 64.2% of DCE respondents accepted vaccination with theoretical acceptance of individual scenarios ranging from 55.2% for the least accepted to 72.4% for the most accepted. Among non-uniforms, an average of 54.2% of respondents accepted vaccination with theoretical acceptance of individual scenarios ranging from 37.3% for the least accepted to 76.5% for the most accepted (Table 3).

The two attributes with a significant positive impact on theoretical vaccine acceptance were "social conformity" and "optimal age". Compared to the reference stating "Low vaccination coverage in adolescents (15%)", the odds of scenarios including the attribute levels "High vaccination coverage in adolescents (70%)" and "High vaccination coverage in adolescents (70%) in Puerto Rico and Canada" were respectively 1.76 (95% CI: 1.18–2.63) and 2.0 (95% CI: 1.34 – 2.99) times more likely to yield theoretical vaccine acceptance. By exploring attributes effects in the non-uniform females’ subgroup, we found similar attribute effects for the same three attributes levels (Table 4).

Table 3 Scenarios’ contents yielding the lowest and the highest theoretical acceptance (TA), 7–30 June 2023, Guadeloupe

Scenario’s details contents	Scenario with the lowest TA in total sample (55.2%) and the lowest TA in non-uniform respondents (37.3%)	Scenario with the highest TA in the total sample (72.4%)	Scenario with the highest TA in non-uniform respondents (76.5%)
Disease characteristics	Sexual discomfort	Sexual discomfort	Cancer prevention
Vaccine safety	No side effects	Long term observation	Long-term observation
Health professionals or institutions promoting vaccination	General practitioner	Ministry of Health and regional health authority	General practitioner
Social conformity	Low vaccination coverage in adolescents	High vaccination coverage in adolescents (> 70%)	High vaccination coverage in adolescents (> 70%) in Puerto Rico and Canada
Optimal Age	Vaccine more effective before 14 years: optimal antibody production	Vaccine more effective before sexual debut	Vaccine more effective before 14 years: optimal antibody production

Table 4 Preference weights for vaccine acceptance, 7–30 June 2023, Guadeloupe

Attributes and levels	Non-uniforms respondents (N=111)			Non-uniform female respondents (N=104)			Non-uniform respondents reporting a child not vaccinated against HPV and reporting no intention to vaccinate (N=43)		
	Odds Ratio	[95% confidence interval]		Odds Ratio	[95% confidence interval]		Odds Ratio	[95% confidence interval]	
Disease characteristics									
Genital and oral warts	Ref			Ref			Ref		
Cancer prevention	1.30	0.84	2.01	1.23	0.78	1.92	1.20	0.61	2.36
Prevention of pregnancy complications	0.72	0.48	1.07	0.76	0.50	1.15	0.84	0.45	1.59
Sexual discomfort	0.79	0.50	1.24	0.72	0.45	1.14	0.64	0.31	1.31
Vaccine safety									
No side effects	Ref			Ref			Ref		
Long term observation	1.28	0.80	2.04	1.35	0.83	2.19	0.90	0.44	1.85
WHO: vaccine effective and safe	0.69	0.45	1.07	0.65	0.41	1.02	0.51	0.25	1.02
Favorable risk–benefit balance	0.80	0.52	1.24	0.82	0.52	1.27	1.00	0.50	2.01
Recommendation sources									
Ministry of Health and regional health authority	Ref			Ref			Ref		
School health and maternal and Child welfare services	1.03	0.69	1.52	1.02	0.68	1.54	0.73	0.39	1.34
General practitioner	0.92	0.64	1.34	0.92	0.63	1.36	0.65	0.36	1.17
Social conformity									
Low vaccination coverage in adolescents (15%)	Ref			Ref			Ref		
High vaccination coverage in adolescents (70%)	1.76	1.18	2.63	1.81	1.19	2.73	1.28	0.68	2.44
High vaccination coverage in adolescents (> 70%) in Puerto Rico and Canada	2.00	1.34	2.99	2.09	1.38	3.17	1.60	0.84	3.03
Optimal age									
Vaccine effective at all ages	Ref			Ref			Ref		
Vaccine more effective before 14 years: optimal antibody production	1.87	1.26	2.77	1.80	1.20	2.69	3.21	1.70	6.07
Vaccine more effective before sexual debut	1.38	0.95	2.00	1.27	0.87	1.86	1.17	0.65	2.10

Compared to the reference “Vaccine effective at all ages”, completing the age statement by scientific explanation such as immunity evidence, “Vaccine more effective before 14 years: optimal antibody production” yielded higher theoretical vaccine acceptance [OR: 1.87; 95% CI: 1.26 to 2.77]. Similar effect sizes were observed in the non-uniform females subgroup [OR: 1.80; 95% CI: 1.20 to 2.69] and a stronger effect identified in non-uniform respondents reporting a child not vaccinated against HPV and no intention to vaccinate [OR: 3.21; 95% CI: 1.70 to 6.07] (Table 4).

Compared to the following reference “The vaccine does not generate side effects”, the attribute level, “WHO: vaccine effective and safe” had no significant impact on parental decisions overall but tended to demotivate vaccine acceptance among females [OR: 0.65, 95% CI: 0.41–1.02] as well as among non-uniform respondents reporting a child not vaccinated against HPV and reporting no intention to vaccinate [OR: 0.51, 95% CI: 0.25–1.02] (Table 4).

Vaccine eagerness

Considering all respondents regardless of their behavior, mean vaccine eagerness across the 18 scenarios was +2.3 (scale –10 to +10). Overall, we observed a positive effect on vaccine eagerness [Coeff: 0.48; 95% CI: 0.06 – 0.90] employing the statement “The vaccine protects against cancer that could occur in 20 years” compared to “The vaccine protects against warts on intimate parts of the body and the mouth.” Compared to the reference, we also found positive effects on vaccine eagerness with the use of social conformity attributes like “high vaccination coverage in adolescents (70%), [Coeff: 0.80; 95% CI: 0.41 – 1.19]” and “high vaccination coverage in adolescents (70%) in Puerto-Rico and Canada” [Coeff: 0.76; 95% CI: 0.38 – 1.15]. When arguing on the age criteria using the following statements “The vaccine is most effective and protects best before the age of 14, when antibody production is optimal” and “The vaccine is most effective when administered before sexual debut”, we observed a positive trend on vaccine eagerness with the respective following coefficients [Coeff: 0.71; 95% CI: 0.33 – 1.09] and [Coeff:

0.37; 95% CI: 0.01 – 0.73]. A negative effect was reported with the attribute level “WHO: vaccine effective and safe” [Coeff.: -0.49; 95% CI: -0.91; -0.06] compared to the reference attribute level “No side effects” and a stronger effect was observed with the same statement in respondents reporting a child not vaccinated against HPV and reporting no intention to vaccinate [Coeff.: -0.98; 95% CI: -1.71; -0.25]. In this last subgroup, the only attribute affecting favorably vaccine eagerness was the following, “Vaccine more effective before 14 years: optimal antibody production” [Coeff.: 1.23; 95% CI: 0.57; 1.89] and in the serial non-demanders subgroup, we could not identify any argument affecting vaccine eagerness (Table 5).

Discussion

In this first single-profile DCE implemented in middle-age schools in the French Caribbean ‘s archipelago of Guadeloupe eliciting parents’ preferences on messages promoting a vaccine with similar features as the HPV vaccine, we

found that communication content targeting on “social conformity”, and “optimal age” favorably impacted theoretical acceptance of vaccination. Importantly, similar preferences were expressed among mothers who accounted for at least nine out of ten survey respondents while “optimal age” only affected theoretical vaccination in parents who did not have their child vaccinated against HPV and who did not intend to do so. In both groups, communication highlighting “vaccine safety” vocabulary discourages vaccination adhesion. Communicating appropriately on the need for early HPV vaccination and providing adequate health information is as crucial as offering accessible and adequate vaccination services [41, 42]. In a DCE in the Netherlands on parents’ preferences for vaccinating daughters against human papillomavirus (HPV), it was found that participants preferred vaccination at age 14 years instead of at a younger age [43]. This finding was in line with most of the scientific literature on HPV vaccination hesitancy: many studies show that parents fear that

Table 5 Preference weights for vaccine eagerness, 7–30 June 2023, Guadeloupe

	All respondents (N = 389)			Serial non-demanders (N = 133)			All respondents reporting a child not vaccinated against HPV and reporting no intention to vaccinate (N = 111)		
	Coeff	[95% confidence interval]		Coeff	[95% confidence interval]		Coeff	[95% confidence interval]	
Disease									
Genital and oral warts	Ref			Ref			Ref		
Cancer prevention	0.48	0.06	0.90	0.06	-0.08	0.21	0.33	-0.39	1.05
Prevention of pregnancy complications	-0.15	-0.55	0.24	0.09	-0.05	0.23	-0.13	-0.80	0.55
Sexual discomfort	-0.12	-0.55	0.32	-0.03	-0.19	0.13	-0.29	-1.04	0.47
Vaccine safety									
No side effects	Ref			Ref			Ref		
Long term observation	0.13	-0.33	0.58	-0.01	-0.18	0.15	-0.23	-1.01	0.55
WHO: vaccine effective and safe	-0.49	-0.91	-0.06	-0.14	-0.29	0.01	-0.98	-1.71	-0.25
Favorable risk–benefit balance	-0.37	-0.79	0.06	-0.14	-0.29	0.01	-0.19	-0.91	0.53
Recommendation sources									
Ministry of Health and regional health authority	Ref			Ref			Ref		
School health and maternal and Child welfare services	0.00	-0.39	0.38	0.02	-0.12	0.15	-0.44	-1.10	0.22
General practitioner	-0.07	-0.43	0.30	0.06	-0.07	0.19	-0.47	-1.09	0.16
Social conformity									
Low vaccination coverage in adolescents (15%)	Ref			Ref			Ref		
High vaccination coverage in adolescents (70%)	0.80	0.41	1.19	0.04	-0.10	0.18	0.45	-0.22	1.12
High vaccination coverage in adolescents (> 70%) in Puerto Rico and Canada	0.76	0.38	1.15	-0.03	-0.17	0.11	0.57	-0.09	1.23
Optimal age									
Vaccine effective at all ages	Ref			Ref			Ref		
Vaccine more effective before 14 years: optimal antibody production	0.71	0.33	1.09	0.03	-0.11	0.17	1.23	0.57	1.89
Vaccine more effective before sexual debut	0.37	0.01	0.73	-0.06	-0.19	0.07	0.17	-0.46	0.79

HPV vaccination will encourage early sexual life debut and sexual promiscuity. This finding on sexual life was previously identified in a qualitative survey on HPV vaccination implemented in the neighboring French Caribbean island of Martinique emphasizing that parents were worried about their children being vaccinated against HPV too young mainly because of sexuality concerns [36]. Similar results in two different surveys in Guadeloupe and Martinique exploring HPV vaccination barriers highlighted that recommending HPV vaccination was not systematic and sometimes discouraged by medical providers mostly males belonging to older generations of physicians [28]. In a global and systematic regional review, Cooper and Wiysonge underlined that hesitancy towards HPV vaccination was “uniquely connected to sociocultural norms surrounding adolescence, sexuality, and gender, and the values people attach to different sexual practices and sexualities” [30]. Specifically in the French Caribbean, Lefaucheur and Mulot explored the social norms of sexuality towards their work on the construction and costs of the injunction to virility in Martinique [44]. This perspective emphasizes the challenges that a similar society as the Guadeloupean one has to take up when dealing with sexuality. Public health measures targeting sexually transmitted infections such HPV-associated diseases interact with beliefs and attitudes rooted in societies and as such, communication should be carefully thought of and designed within a multidisciplinary approach including social scientists [45]. We therefore tailored messages accordingly for the DCE and found out that additional information such as immunological arguments combined in statement dealing with age was driving willingness to vaccinate. In line with literature finding, “social conformity” was positively associated with vaccination adhesion or hesitancy. Cooper and Wiysonge identified that “in some instances vaccine hesitancy was about a desire to belong and feel included among peers, a positively prosocial act to build social relations and kinship”. Indeed, we show that the arguments conveying the idea of a broad population’s adhesion into vaccination programmes reflected by high vaccine uptake (70%) were effective. In our experiment, stating neighboring American countries of the region increased willingness to vaccinate in parent’s theoretical decisions including parents whose children are declared not to be vaccinated against HPV. Surprisingly and although moderate, communication messages from official health organizations (WHO) affected negatively theoretical vaccine acceptance while we would expect the opposite impact. As emphasized by Cooper, “vaccine hesitancy is driven by multiple socio-political forces” and “distrust as a driver of vaccine hesitancy needs to be better contextualized and disaggregated” [30]. In fact, during the COVID-19 pandemic management crisis preceding our

study, governmental and international health institutions’ decisions have been controverted given rise in the French Caribbean to an unprecedented vaccination refusal movement leading to hyperpolarized debates within our societies as explored by Mulot and local government research bodies [32, 46]. It has been argued that people’s distrust in experts, institutions and systems such as the pharmaceutical industry fuels vaccine refusal [47–50]. Vaccine eagerness, a combination of choice and choice certainty, was favorably influenced by the “disease characteristics” attribute in addition of the same attributes as in vaccine acceptance in the entire sample. It allows exploring uniform participants such as those who constantly refused vaccination (serial non-demanders) who appear to remain unsensitive to communication contents. Communication highlighting “vaccine safety” vocabulary tends to discourage vaccination adhesion while suggesting that vaccination protects against future cancer occurrence influences positively all participants. We found that uniform respondents accounted for 70% of respondents that is higher than that of a much larger sample-sized DCE study finding among health care and social welfare sector (HCSWS) in France at the start of the COVID-19 vaccine campaign estimated to account for 61.1% of total respondents. Another similar study among parents in mainland France found that 56.4% of participants made serial decisions [51]. We cannot exclude that serial demanders and serial non-demanders may have a higher participation rate than non-uniform respondents. Indeed, voluntary self-participation may over select parents with a more straightforward opinion about vaccination as well as that might be the case of parents with higher literacy skills and economic resources [52]. Therefore, there is room for persuading reluctant (serial non-demanders) and hesitant (non-uniform respondents) persons to vaccinate their offspring as vaccine hesitancy relies on a decisional gradient [53] if communication relies on effective and reliable arguments. Our results on vaccine acceptance and vaccine eagerness in parents in Guadeloupe emphasize that appropriate tailored messages and contextualized communication according to parents’ preferences are highly recommended to enhance vaccination adhesion as well as informing the remaining parents still unaware of HPV health risk and prevention in this region. This is particularly crucial in environmental chlordecone-related crisis and post-COVID-19 era in regions like the French Caribbean where mistrust in health authorities remains predominant. Addressing vaccine hesitancy through strategies that resonate with local norms and context as well as rebuilding trust in public health institutions could be essential to improving HPV vaccine uptake [54–56].

Our study has a number of limitations. Given the recent COVID-19 vaccination crisis background, we

had to deal with delayed institutional authorizations to implement the survey in schools. Therefore, our school survey was implemented only three weeks before the end of classes, period that matches with final examinations and holidays 'preparations. This was not an optimal period for attracting parents' interests other than educational purposes and despite survey reminders. We did not control for parent's unique participation although our results finding a majority of females participation suggests that multiple participations for each child might be limited. We also found that the survey participants had a socio-economic profile different from that of the population of Guadeloupe and only the DCE results can be extrapolated to the general population. Our sample size was too small to conduct extensive stratified analyses to explore the effect variations by subgroups. However, apart from parents constantly refusing vaccination, the observed subgroups showed globally similar effects to the overall sample. Furthermore, DCE tend to overestimate willingness to vaccinate and selected preferences do not always reflect choices made in real life. Our results are specific to a population surveyed in Guadeloupe and extrapolating results to other Caribbean populations should be done cautiously.

Conclusion

This innovative and first single profile DCE study among parents of middle-school age pupils applied to a French Caribbean context suggests that providing information on high HPV vaccine uptakes elsewhere in the region of the Americas and explaining the early vaccination age through immunological arguments can increase vaccine acceptance, including among parents who are not inclined to vaccinate their child against HPV. Our study preceded of a few months the launch in October 2023 of a French nationwide HPV vaccination campaign targeting young people in the 5th grade of secondary schools of all French territories. The results can help stakeholders and HPV vaccination actors in tailoring communication and promotion messages from October 2023 onwards.

Abbreviations

DCE	Discrete Choice Experiment
HCSWS	Health care and social welfare sector
HPV	Human Papillomavirus
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-21006-6>.

Additional file 1.

Acknowledgements

Dr. Frank Assogba, Dr. Florelle Bradamantis, Dr. Armelle Ezelin, M. Arnaud Gauthier, Mrs. Clothilde Hachin, Mrs. Diana Ledreck, Dr. Mathilde Melin, Dr. Jérôme Naud, Dr. Christophe Perrey, Mrs. Cindy Thelise.

Authors' contributions

FGED, JEM and JS conceived the original study concept and the analysis plan. FGED performed the statistics and wrote the first draft of the manuscript. FGED, JEM, JS, LL, GNB, VH, IB, JRau, JRo contributed to questionnaire development. FGED performed the data collection. All authors contributed to interpretation, revised and approved the final version of the manuscript.

Funding

Not applicable.

Data availability

The data that support the findings of this study are available upon reasonable request and with permission of the French National Public Health Agency, Sante publique France. The reuse of data is subject to compliance with the General Data Protection Regulation (GDPR) and French regulations.

Declarations

Ethics approval and consent to participate

Ethics approval: This study was conducted in adherence to the Declaration of Helsinki.

The study protocol was approved by the IRB of Institut Pasteur on November 8, 2022 under the following reference: IRB reference: IRB2022-L-Exemp. The database was registered by Sante publique France according to the General Data Protection Regulation (GRDP). Because the data collection was observational, anonymous without any risk of indirect identification and collected no sensitive and only self-declared biomedical information, no informed consent was required according to the French regulation (<https://www.cnil.fr/fr/lanon-y-misation-des-donnees-un-traitement-cle-pour-lopen-data>).

Consent to participate: Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 26 February 2024 Accepted: 6 December 2024

Published online: 14 January 2025

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