



## Parent perspectives on childhood vaccination: How to deal with vaccine hesitancy and refusal?



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### ABSTRACT

**Background:** The aims of the study are to evaluate attitudes about childhood vaccines and vaccine refusal or delay among parents and to assess the role played by the variables mapped as potential determinants to suggest strategies that could improve childhood vaccination rates.

**Methods:** The cross-sectional study was intended for parents of kindergarteners. Parental attitudes were measured using the Parent Attitudes about Childhood Vaccines (PACV) survey, to screen for Vaccine Hesitancy (VH). In addition, selected factors have been grouped in three categories (contextual, individual and group and vaccine/vaccination-specific influences), and were explored as potential determinant of VH and vaccination refusal or delay.

**Results:** 7.7% of subjects were defined as VH parents (VHPs) through PACV score, while 24.6% reported having refused or delayed at least one dose of vaccine for their child. VH was more common in those parents that decided not to vaccinate their child after having received information from mass-media, in those who did not agree with mandatory vaccinations, and in those who agreed with political leaders who oppose to vaccination. Vaccine refusing/delaying parents were more frequently those who agreed that infant vaccinations are primarily an economic business of pharmaceutical companies, and who disagreed that access to the kindergarten should only be allowed to children who had been vaccinated.

**Conclusion:** The findings of the present study emphasize the importance of PACV as a tool to screen VHPs. Furthermore, results highlight important potential determinants of VH, such as communication and media environment, and attitudes about prevention. Health care providers could act as key components to improve the public trust to scientific and epidemiological evidence.

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### 1. Introduction

Vaccination is often cited as one of the most effective ways of controlling infectious diseases [1]. However, this success is being challenged by individuals and groups who choose to delay or refuse vaccines [2]. Examples of reluctant individuals include parents delaying vaccinations for their infants, pregnant women deciding not to vaccinate against flu or pertussis, elderly choosing not to vaccinate against flu or shingles, and even healthcare providers (HCPs) not vaccinating against flu [3].

Vaccine hesitancy (VH) refers to delay in acceptance or refusal of vaccines despite availability of vaccination services [4]. VH is also frequently denoted as “a continuum between those that accept all vaccines with no doubts, to complete refusal with no doubts, with vaccine hesitant individuals the heterogeneous group

between these two extremes” [5]. VH is a phenomenon existing since the introduction of vaccinations, but over recent decades it is certainly supported and amplified by the ever-conflicting and sometimes not evidence-based information [6,7]. VH is complex and context specific, is specific to sub-groups within populations and is rarely population-wide, and the reasons for its occurrence are highly varied and need to be better understood in order to appropriately address emerging concerns [8,9].

Vaccine hesitant parents (VHPs) may refuse one or two vaccines nevertheless they agree with all the others, delaying some doses or accepting them, but being unsure of submitting their children to vaccinations [10,11]. It is important to first understand who is hesitant about vaccination and what his/her concerns are in order to know how to best minimize the hesitancy [12].

In Italy, routine childhood vaccination was declining [13], until the recent legislation [14] around childhood immunization requirements for school admission, which is affecting vaccine coverage, with a mean immunization coverage near to the 95% goal coverage target set in our national immunization plan [15].

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**Table 1**  
Distribution of Vaccine Hesitancy and vaccine refusal potential determinants among parents participating in the study.

Potential determinants	Response	Overall sample N (%)	VH as PACV Score (4 8 2) <sup>a</sup>			Vaccine-refusing parents (554) <sup>a</sup>	
			0–49 N (%)	50–100 N (%)	p	Refusal N (%)	p
<b>Contextual influences</b>							
<i>Communication and media environment</i>							
Parental seeking for information about vaccination from sources other than pediatrician (564) <sup>a</sup>	Yes	355 (62.9)	276 (62)	32 (84.5)	0.003	86 (63.2)	0.957
The decision not to vaccinate the child has been taken after having received information from mass media (559) <sup>a</sup>	Yes	67 (12)	38 (8.6)	19 (51.4)	<0.001	26 (19.4)	0.003
<i>Influential leaders, gatekeepers and anti- or pro-vaccination lobbies</i>							
Agreement with political leaders who are opposed to vaccination (558) <sup>a</sup>	Agree	55 (9.9)	34 (7.7)	14 (37.8)	<0.001	20 (15.2)	0.001
	Disagree	426 (76.3)	353 (80)	15 (40.6)		85 (64.4)	
	Not sure	77 (13.8)	54 (12.3)	8 (21.6)		27 (20.4)	
Preparedness of the National Health System workers on vaccinations (564) <sup>a</sup>	Agree	371 (65.8)	312 (70.3)	10 (27)	<0.001	81 (60.9)	0.26
	Disagree	71 (12.6)	45 (10.1)	11 (29.7)		21 (15.8)	
	Not sure	122 (21.6)	87 (19.6)	16 (43.3)		31 (23.3)	
<i>Politics/policies (Mandates)</i>							
The Ministry of Health decides the best for community health by making some vaccinations mandatory (562) <sup>a</sup>	Agree	448 (79.8)	379 (85.4)	8 (21.6)	<0.001	87 (64.9)	<0.001
	Disagree	57 (10.1)	26 (5.9)	21 (56.8)		26 (19.4)	
	Not sure	57 (10.1)	39 (8.7)	8 (21.6)		21 (15.7)	
<i>Perception of the pharmaceutical industry</i>							
Infant vaccinations are primarily an economic business of pharmaceutical companies (563) <sup>a</sup>	Agree	196 (34.8)	137 (30.9)	29 (78.4)	<0.001	66 (49.3)	<0.001
	Disagree	251 (44.6)	213 (48.1)	4 (10.8)		39 (29.1)	
	Not sure	116 (22.6)	93 (21)	4 (10.8)		29 (21.6)	
<b>Individual and group influences</b>							
<i>Experience with vaccination</i>							
The child had an adverse reaction after a dose of vaccine (554) <sup>a</sup>	Yes	188 (33.9)	150 (34.1)	16 (44.4)	0.21	50 (37.9)	0.19
<i>Beliefs, attitudes about prevention</i>							
Agreement level with the usefulness of the vaccination for the prevention of infectious diseases (573) <sup>a</sup>	1–5	18 (3)	– <sup>b</sup>	– <sup>b</sup>	– <sup>b</sup>	3 (2.2)	<0.001
	6–7	69 (12)	– <sup>b</sup>	– <sup>b</sup>		32 (23.5)	
	8–10	486 (85)	– <sup>b</sup>	– <sup>b</sup>		101 (74.3)	
There are more effective alternatives to vaccinations for the prevention of infectious diseases (564) <sup>a</sup>	Agree	30 (5.3)	18 (4)	5 (13.9)	0.001	6 (4.5)	0.853
	Disagree	357 (63.3)	295 (62.3)	14 (38.9)		84 (62.7)	
	Not sure	177 (31.4)	132 (29.7)	17 (47.2)		44 (32.8)	
Healthy lifestyles prevent diseases without the need to vaccinate (567) <sup>a</sup>	Agree	37 (6.5)	22 (4.9)	8 (21.6)	<0.001	15 (11.2)	0.009
	Disagree	456 (80.4)	376 (84.5)	19 (51.4)		96 (71.6)	
	Not sure	74 (13.1)	47 (10.6)	10 (27)		23 (17.2)	
It is preferable to acquire immunity by contracting infections rather than through vaccination (563) <sup>a</sup>	Agree	49 (8.7)	– <sup>b</sup>	– <sup>b</sup>	– <sup>b</sup>	19 (14.3)	0.001
	Disagree	418 (74.2)	– <sup>b</sup>	– <sup>b</sup>		84 (63.2)	
	Not sure	96 (17.1)	– <sup>b</sup>	– <sup>b</sup>		30 (22.5)	
<i>Health system and providers' trust and personal experience</i>							
The pediatrician provides enough information on childhood vaccinations (563) <sup>a</sup>	Yes	457 (81.2)	374 (84)	18 (48.6)	<0.001	105 (77.8)	0.287
Parental trust in the pediatrician regarding received information about vaccine (559) <sup>a</sup>	Yes	455 (81.4)	– <sup>b</sup>	– <sup>b</sup>	– <sup>b</sup>	92 (68.1)	<0.001
<i>Risk/benefits (perceived, heuristic)</i>							
Side effects of vaccination may be more serious than the preventable illnesses (564) <sup>a</sup>	Agree	147 (26.1)	– <sup>b</sup>	– <sup>b</sup>	– <sup>b</sup>	43 (32.3)	0.005
	Disagree	252 (44.7)	– <sup>b</sup>	– <sup>b</sup>		43 (32.3)	
	Not sure	165 (29.3)	– <sup>b</sup>	– <sup>b</sup>		47 (35.4)	
It is important to vaccinate children because the illnesses that are prevented may have very serious effects on health (566) <sup>a</sup>	Agree	533 (94.1)	– <sup>b</sup>	– <sup>b</sup>	– <sup>b</sup>	120 (89.6)	0.012
	Disagree	15 (2.7)	– <sup>b</sup>	– <sup>b</sup>		5 (3.7)	
	Not sure	18 (3.2)	– <sup>b</sup>	– <sup>b</sup>		9 (6.7)	
<i>Immunization as a social norm vs. not needed/harmful</i>							
Mass vaccination is important because it protects those who cannot be vaccinated (567) <sup>a</sup>	Agree	471 (83.1)	385 (86.5)	23 (62.2)	<0.001	112 (83.6)	0.606
	Disagree	33 (5.8)	17 (3.8)	7 (18.9)		9 (6.7)	
	Not sure	63 (11.1)	43 (9.7)	7 (18.9)		13 (9.7)	
Access to the nursery/school of infancy should only be allowed for children undergoing vaccinations provided in infancy (564) <sup>a</sup>	Agree	454 (80.5)	374 (84.2)	15 (40.6)	<0.001	90 (67.7)	<0.001
	Disagree	61 (10.8)	41 (9.2)	11 (29.7)		25 (18.8)	
	Not sure	49 (8.7)	29 (6.6)	11 (29.7)		18 (13.5)	

(continued on next page)

**Table 1** (continued)

Potential determinants	Response	Overall sample N (%)	VH as PACV Score (4 8 2) <sup>a</sup>			Vaccine-refusing parents (554) <sup>a</sup>	
			0–49 N (%)	50–100 N (%)	<i>p</i>	Refusal N (%)	<i>p</i>
<i>Vaccine/Vaccination –specific issues</i>							
<i>Risk/benefit (scientific evidence)</i>							
Most children tolerate the vaccines very well (569) <sup>a</sup>	Agree	411 (72.2)	342 (76.9)	10 (27)		83 (61)	
	Disagree	69 (12.1)	42 (9.4)	13 (35.2)		24 (17.7)	
	Not sure	89 (15.7)	61 (13.7)	14 (37.8)	<0.001	29 (21.3)	0.004
Need of more information about childhood vaccinations (551) <sup>a</sup>	Yes	282 (51.2)	207 (47.4)	30 (81.1)	<0.001	77 (57.9)	0.079
	No						
<i>Design of vaccination program</i>							
Preferred vaccine delivery setting for the child (556) <sup>a</sup>	Vaccination services	388 (68.6)	314 (71.5)	20 (55.6)		93 (69.9)	
	School	161 (29)	6 (1.4)	1 (2.7)		37 (27.8)	
	Pediatrician	7 (1.4)	119 (27.1)	15 (41.7)	0.125	3 (2.3)	0.509
<i>Reliability and/or source of vaccine supply</i>							
Presence of difficulties in the vaccination of a child (eg. absence of dose for vaccination) (565) <sup>a</sup>	Yes	65 (11.5)	50 (11.2)	3 (8.1)	0.559	23 (16.9)	0.024
<i>Vaccination schedule</i>							
Pediatric vaccines can be administered concurrently (568) <sup>a</sup>	Agree	318 (56)	271 (60.9)	6 (16.2)		64 (47.1)	
	Disagree	98 (17.2)	64 (14.4)	17 (45.9)		28 (20.6)	
	Not sure	152 (26.8)	110 (24.7)	14 (37.9)	<0.001	44 (32.3)	0.066
It is safer to administer less than three vaccines at one time to children (564) <sup>a</sup>	Agree	288 (51.1)	– <sup>b</sup>	– <sup>b</sup>		70 (52.6)	
	Disagree	74 (13.1)	– <sup>b</sup>	– <sup>b</sup>		17 (12.8)	
	Not sure	202 (35.8)	– <sup>b</sup>	– <sup>b</sup>	– <sup>b</sup>	46 (34.6)	0.944
<i>Role of healthcare professionals</i>							
The pediatrician discouraged to practice a vaccination to the child (566) <sup>a</sup>	Yes	67 (11.8)	47 (10.6)	11 (29.7)	0.001	24 (17.8)	0.007

Abbreviations: PACV, Parent Attitudes About Childhood Vaccines; VH, vaccine hesitancy.

<sup>a</sup> In brackets the number of parents responding to the question.

<sup>b</sup> Determinants were included in the PACV.

The aims of the study were to evaluate potential determinants of VH among parents of kindergarteners in Italy to suggest strategies that could improve childhood vaccination rates.

## 2. Methods

### 2.1. Study population

This cross-sectional study was conducted from April to June 2017. The survey was intended for parents having at least one child aged 1–5 years attending the kindergartens in the geographic area of Catanzaro and Cosenza, in the South of Italy. This area consists of 51 nursery schools with a total of 900 registered pupils.

A 2-stage sample design was planned. A simple randomization technique with replacement was adopted in selecting each kindergarten. A sampling frame of all parents of children was then assembled for each selected school. At the second stage of sampling, a sample of parents was randomly selected from each kindergarten.

Before starting data collection, a meeting with the principal and the school teachers of each selected kindergarten was arranged to present the project and to obtain collaboration.

Parents/guardians received an explanatory letter, an informed consent form and a self-administered questionnaire. The letter included a brief description of the study objectives and its importance, inviting only one self-identified parent to complete the questionnaire. Parents were assured about the voluntary participation to the survey and about the confidentiality of the information provided. The questionnaires were collected two weeks later and all participants provided written informed consent together with the questionnaire. In an attempt to maximize the response rate,

follow-up letters to encourage participation were made periodically until June 2017.

The study protocol was approved by the Institutional Ethical Committee (Italy) (2017/04/27).

### 2.2. Survey instrument

The self-administered questionnaire was developed based on previous studies [7,16,17]. Parental VH was classified using the Parent Attitudes about Childhood Vaccines (PACV) survey developed by Opel et al. [7]. Parental refusal/delay was explored with the PACV behavior item “Have you ever refused or delayed a vaccination for reasons other than illness or allergy?”

Briefly, the PACV contains 15 items under 3 domains (behavior, safety and efficacy, and general attitudes). It was scored by assigning a numeric score of 2 for items answered with a hesitant response, a score of 1 for items answered with a response of “don’t know or not sure” (except in the case of the 2 behavior items for which the “don’t know” responses were excluded as missing data because they likely reflected poor recall rather than immunization hesitancy), and a score of 0 for items answered with a non hesitant response. Item scores were summed in an unweighted fashion to obtain a total raw score. The total raw score was converted to a scale ranging from 0 (least hesitant) to 100 (most hesitant) with a score  $\geq 50$  that identified VHPs, while a score  $< 50$  that identified non hesitant parents [16].

Furthermore, selected factors were assessed according to the WHO Strategic Advisory Group of Experts (SAGE) on Immunization to explore potential additional determinants of VH that are not included in the PACV [17].

The questions were grouped broadly into the following four wide categories: (a) socio-demographic characteristics of the parents (gender, age, marital status, level of education, working activity, nationality); (b) contextual influences (communication and media environment; influential leaders, gatekeepers and anti- or pro-vaccination lobbies; politics/policies; trust in the pharmaceutical industry); (c) individual and group influences (experience with past vaccination; beliefs and attitudes about prevention; trust in health system and providers; perceived risk and benefit; immunization as a social norm vs. not needed/harmful); (d) specific issues regarding vaccine/vaccination (scientific evidence of risk/benefits; design of vaccination program; reliability and/or source of vaccine supply; vaccination schedule; role of HCPs). Each section elicited responses in a variety of formats: closed-ended questions with multiple answers possible, yes or no questions and open option questions. The questionnaire culminated with the option of providing additional comments.

The PACV has been subjected to a cross-cultural translation and adaptation process into Italian. The process of cross-cultural adaptation involved several steps: (1) translation from English to Italian; (2) establishment of an expert committee that included two experienced researchers in survey design and cross-validation method, one language professional and one translator; (3) meeting of the expert committee to produce the first Italian draft; (4) pilot-testing; (5) meeting of the expert committee to produce a new consensus version; (6) back-translation to English; (7) re-evaluation by the committee members and production of the final draft.

### 2.3. Statistical analysis

Data were summarized using frequencies and percentages for categorical data and mean and standard deviations for continuous data.

The dichotomous outcome variables for the analysis were VH measured as PACV score (0 = score < 50; 1 = score ≥ 50) and parental refusal/delay (0 = non refusal, 1 = refusal). In the primary analysis we used the *t*-test (for continuous variables) and Pearson's chi-square (for categorical variables) to understand how potential determinants of VH not included in the PACV (contextual, individual and group and vaccine/vaccination-specific influences) impacted on the considered dependent variables. Those variables with *p* < 0.25 in the univariable analysis were forced into the two multiple logistic regression models adjusting for the possible confounders (gender, age, marital status, level of education, working activity, and nationality of the parent). Adjusted odds ratios (ORs) and respective 95% confidence interval (CI) were derived from such analyses. All reported *p* values are two-tailed and a value <0.05 was considered statistically significant. The questions that used a 10-point scale were grouped with categories of 1–5, 6–7, and 8–10. We also collapsed the items with 5-point Likert-type response categories into 3 groups with the two affirmative responses grouped together, the middle response maintained separately, and the two negative responses grouped together. The data were analyzed using Stata, version 14.1 [18].

## 3. Results

### 3.1. Sample characteristics

A total of 575 parents completed the survey, with a response rate of 67%.

The vast majority of respondents were mothers (80.3%) and the average age was 37.2 years (SD ± 5.9). Only 63% were employed. Mean age of index children was 4.1 years (SD ± 1) and 50.5% of

them were males. 68.8% of the parents had at least two children. Three quarters of parents (75.5%) reported that their child had received all vaccinations included in the vaccination schedule, while 6.3% had refused or delayed at least one dose of vaccine and 18.2% of them had refused or delayed not mandatory vaccinations. Regarding VH, 92.3% of parents scored 0–49 and were defined not hesitant; 7.7% scored 50–100 and were defined VHPs.

### 3.2. VH potential determinants

Table 1 reports the distribution of VH potential determinants.

- *Contextual influences.* Only 37.1% of the parents reported to seek information about vaccination from the pediatrician, and 12% of them reported that the decision to vaccinate their child was

**Table 2**

Result of the multivariable logistic regression model for estimates of associations of parental vaccine hesitancy with potential determinants.

Variable	Adjusted OR <sup>a</sup>	95% CI	p-value
Model: Vaccine hesitancy (PACV score) Log likelihood = -54.97; $\chi^2 = 137$ (13 df); <i>p</i> < 0.0001, No. of observations = 456			
<i>Contextual influences</i>			
<i>Agreement with political leaders who are opposed to vaccination</i>			
No-to-slight	1.00 <sup>b</sup>		
Moderate	2.24	0.57–8.79	0.249
High	7.51	1.97–28.55	0.003
<i>Evaluation of the preparedness of the National Health System operators on vaccinations</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	1.99	0.67–5.95	0.217
Agree	<sup>c</sup>		
<i>Infant vaccinations are primarily an economic business of pharmaceutical companies</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	0.35	0.05–2.58	0.306
Agree	2.66	0.59–11.95	0.203
<i>Individual and group influences</i>			
<i>Access to the nursery/school of infancy should only be allowed for children undergoing vaccinations provided in infancy</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	0.46	0.09–2.38	0.357
Agree	0.03	0.01–0.12	<0.001
<i>There are more effective alternatives to vaccinations for the prevention of infectious diseases</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	0.47	0.12–1.8	0.27
Agree	<sup>c</sup>		
<i>Healthy lifestyles prevent diseases without the need to vaccinate</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	2.98	0.67–13.26	0.152
Agree	<sup>c</sup>		
<i>The pediatrician provides enough information on childhood vaccinations</i>			
No	1.00 <sup>b</sup>		
Yes	0.35	0.12–1.03	0.056
<i>Vaccine/Vaccination –specific issues</i>			
<i>The pediatrician discouraged to practice a vaccination to the child</i>			
No	1.00 <sup>b</sup>		
Yes	1.9	0.6–6.49	0.259
<i>Most children tolerate the vaccines very well</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	<sup>c</sup>		
Agree	0.37	0.13–1.09	0.072

<sup>a</sup> Odds ratio adjusted for gender, age, marital status, level of education, working activity, and nationality of the parent.

<sup>b</sup> Reference category.

<sup>c</sup> Removed by the model.

based on the information received from the mass-media. In general, 34.2% of them thought that the National Health System (NHS) workers were not well informed on vaccination and 20.2% did not agree with the decision of the Ministry of Health to make some vaccinations mandatory. Of note, 34.8% of the respondents thought that infant vaccinations represent an economic business for pharmaceutical companies while 22.6% were uncertain.

- *Individual and group influences.* Adverse reactions after a dose of vaccine were reported to have occurred in 33.9% of children and in 11% of them this event had influenced the decision to submit the child to other vaccinations. In general, 15% of parents expressed a medium-low level of agreement with the usefulness of the vaccination for the prevention of infectious diseases. Almost 20% of parents stated that the pediatrician did not provide enough information on childhood vaccinations and 19% reported no trust on the information received. 16.9% thought that mass vaccination did not protect those who cannot be vaccinated and almost 20% were insecure or disagreed with the obligation of vaccines for access to schools.
- *Vaccination specific issues.* 28% of parents believed or were unsure that the vaccine is well tolerated by children and more than half of them (51.2%) thought they needed more information about child vaccination. 51.1% of the parents believed that it is safer to administer less than three vaccines at one time. In 11.8% of cases parents reported to have been discouraged by the pediatrician to practice a vaccination to the child.

### 3.3. Correlates of VH

Univariable analysis showing the association between PACV score and potential determinants is reported in Table 1. Significantly more VHPs (vs. non-VHPs) reported receiving information from mass-media ( $\chi^2 = 59.36$ , 1 df,  $p < 0.001$ ), agreed that childhood vaccinations are primarily a profitable business for pharmaceutical companies ( $\chi^2 = 34.48$ , 2 df,  $p < 0.001$ ), stated that the pediatrician did not provide enough information on childhood vaccinations ( $\chi^2 = 28.18$ , 1 df,  $p < 0.001$ ) or were even discouraged to allow vaccination of their child ( $\chi^2 = 11.8$ , 1 df,  $p = 0.001$ ).

Results of the multivariable logistic regression are shown in Table 2. VHPs had significantly increased odds of seeking information about vaccination from sources other than their pediatrician (OR = 6.62; 95%CI = 1.88–23.29); of disagreeing with mandatory vaccinations (OR = 0.04; 95%CI = 0.01–0.18); and of agreeing with political leaders who oppose vaccination (OR = 6.84; 95%CI = 1.36–34.36).

### 3.4. Correlates of vaccine refusal

Overall, 24.6% of parents reported having refused or delayed at least one dose of vaccine for their child. Significantly more vaccine refusing or delaying parents reported receiving information from the mass-media ( $\chi^2 = 8.94$ , 1 df,  $p = 0.003$ ); lack of trust regarding information about vaccines given by the pediatrician ( $\chi^2 = 19.76$ , 1 df,  $p < 0.001$ ); having been discouraged by the pediatrician to vaccinate their child ( $\chi^2 = 11.06$ , 2 df,  $p = 0.007$ ).

Results of the multivariable logistic regression are shown in Table 3. Vaccine refusing or delaying parents had significantly increased odds of agreeing that infant vaccinations are primarily an economic business of pharmaceutical companies (OR = 1.59; 95%CI = 1.01–2.51); of not trusting the information about vaccine received from pediatrician (OR = 0.56; 95%CI = 0.32–0.96); of disagreeing that access to the nursery/kindergarten should only be allowed to children who had been vaccinated in infancy (OR = 0.48; 95%CI = 0.29–0.8).

**Table 3**

Result of the multivariable logistic regression model for estimates of associations of parental vaccine refusal with potential determinants.

Variable	Adjusted OR <sup>a</sup>	95% CI	p-value
Model: vaccine refusing parents Log likelihood = -256.58; $\chi^2 = 51.46$ (19 df); $p < 0.0001$ , No. of observations = 504			
Contextual influences			
<i>Agreement with political leaders who are opposed to vaccination</i>			
No-to-slight	1.00 <sup>b</sup>		
Moderate	1.34	0.75–2.41	0.321
High	<sup>c</sup>		
<i>Infant vaccinations are primarily an economic business of pharmaceutical companies</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	<sup>c</sup>		
Agree	1.59	1.01–2.51	0.045
Individual and group influences			
<i>Agreement level with the usefulness of the vaccination for the prevention of infectious diseases</i>			
No-to-slight	1.00 <sup>b</sup>		
Moderate	<sup>c</sup>		
High	0.76	0.41–1.4	0.374
<i>Parental trust in the pediatrician regarding received information about vaccine</i>			
No	1.00 <sup>b</sup>		
Yes	0.56	0.32–0.96	0.036
<i>Side effects of vaccination may be more serious than the preventable illnesses</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	1.46	0.91–2.33	0.115
Agree	<sup>c</sup>		
<i>Access to the nursery/school of infancy should only be allowed for children undergoing vaccinations provided in infancy</i>			
Disagree	1.00 <sup>b</sup>		
Uncertain	<sup>c</sup>		
Agree	0.48	0.29–0.8	0.005
Vaccine/Vaccination –specific issues			
<i>Presence of difficulties in the vaccination of a child (eg. absence of dose for vaccination)</i>			
No	1.00 <sup>b</sup>		
Yes	1.73	0.92–3.24	0.089
<i>The pediatrician discouraged to practice a vaccination to the child</i>			
No	1.00 <sup>b</sup>		
Yes	1.8	0.98–3.3	0.057

<sup>a</sup> Odds ratio adjusted for gender, age, marital status, level of education, working activity, and nationality of the parent.

<sup>b</sup> Reference category.

<sup>c</sup> Removed by the model.

## 4. Discussion

This study offers an insight on potential determinants of VH among parents of kindergarteners. Indeed, to address VH in a constructive way, it is first crucial to measure the perspectives of those who do not vaccinate or delay vaccinations for their child. It is also essential to understand the reasons why children are under- or unvaccinated in a particular setting to be able to deal with VH.

Perhaps our most notable finding is that 24.6% of the parents reported having refused or delayed at least one dose of vaccine for their child. This finding is of concern given that when some vaccines are delayed or omitted, the risk of contracting vaccine preventable diseases increases. However, it is interesting to note that there was an important difference in our sample between the prevalence of vaccine refusing/delaying parents and those classified as VHPs through the use of PACV score (7.7% of the responders). It is well known that PACV is a measure of the attitudes towards vaccines, and discrepancies between attitudes and actual behavior have been of concern to investigators for a long time

[19]. Indeed a strong bias for people to overestimate the likelihood that they will engage in a socially desirable behavior, such as vaccination, exists and this bias may produce inconsistencies between intentions and actions. However, given the strong positive attitudes towards vaccination reported in the present study, it could be argued that a sizeable proportion of parents, even among those who comply with recommended vaccination guidelines, could forget vaccination. Indeed, a statewide survey of parents in North Carolina showed that who most often refuse or delay vaccines would seem to be the ones best equipped for getting their children preventive care [19]. On the other hand, the inconsistency between PACV score and vaccines refusal/delay could be explained by the fact that VH is considered a complex and context specific issue, and its determinants could vary among different countries. Hence, there may be additional cultural nuances in attitudes and beliefs among parents that the standard PACV did not capture in our setting, such as anti-vaccinationist influences and trust in the National Health System. These two important factors could probably influence the decision-making of a subgroup of parents, thus needing to be more thoroughly explored.

Of note, one third of participating parents reported the child had an adverse reaction after a dose of vaccine and more than half believed that it is safer to administer less than three vaccines at one time. Undoubtedly, VH is linked to safety issues [20,21]. A study conducted in Australia also found that parents whose children had experienced a suspected side effect were significantly more likely to report greater concerns about vaccine safety [22]. Recent surveys also show that a proportion of parents are skeptical about vaccine safety, and hesitate to have their child vaccinated [23,24].

Some findings from our survey highlight that various forms of mistrust exist: refusal of vaccination was significantly associated with the belief that infant vaccinations are primarily an economic business of pharmaceutical companies. Parents' perceptions of the pharmaceutical industry have to be taken seriously as a significant driver of the distrust that induces vaccine refusal [25]. Vaccine refusing parents were also those who cited mistrust in the pediatrician regarding information received about vaccine. These results show that great effort needs to be made in the way health institutions deal with communication to the general population about vaccines, and it must be able to reach families.

It is important to consider that 62% of parents participating in our study referred to seek for information about vaccination from sources other than the pediatrician, and 12% decided to vaccinate or not to vaccinate after having received information from the mass-media. There is plenty of research showing that the mass-media are widely used for information seeking in the general population, particularly the Internet, where misinformation and inaccurate data are now widespread [25]. Among searched items, critical arguments are present that include many aspects of healthcare [25–27]. Mass-media, and mostly the Internet, represent an important source of information, but also a harmful tool when it is not possible to filter the great amount of information shared. In particular, most objections to vaccination spread by these channels are currently cached in simple language that appeal to uncertain parents and are difficult for scientists to object to [25].

In our study, VHPs also agreed with political anti-vaccinationist leaders. Indeed, research on vaccine acceptance has shown that individual decision-making regarding vaccination is very complex and may involve, in addition to cognitive factors [28,29], emotional, cultural, social, and also political factors. It has been demonstrated that members of political parties endorsing social health care programs are more willing to be vaccinated than others [30]. Moreover, scientific and epidemiological evidence could help to tackle the opinions of anti-vaccine groups. Although HCPs and scientific journals keep opposing the opinions of anti-

vaccinationists about the efficacy and safety of vaccines, they are often too slow in reaching the general population to correct false information [31,32], with also a small proportion of physicians reporting doubts about risks and usefulness of vaccines [3,33]. Actually, in our sample 11.8% of parents self-reported that the pediatrician discouraged them to practice a vaccination to their child. Moreover, since most anti vaccination source on mass-media argue against vaccine safety, using emotive appeals such as personal stories of vaccine damage [25], HCPs should emphasize the important benefits of vaccination weighed against the risks, and answer questions about common vaccine safety concerns. Indeed, physicians and pediatricians are key components of a successful vaccination program, and when they represent the principal source of information about vaccination, a higher level of knowledge and a positive attitude towards childhood vaccinations are present [34,35].

Limitations of the study attain to the cross-sectional design, not allowing to draw conclusions on causality about the observed associations, and to the self-reporting of practices, only a proxy of real practice. Parental behavior was self-reported, which is a limitation that our study shares with other previous publications. However, in some cases self-administered procedures are considered to be better than interviews, since the presence of an interviewer may influence respondent answers. Moreover, the self-administered questionnaire, where the respondent has most of the control and can read the questions and answer at leisure, may result in more reliable and consistent responses. Finally, our data refer to an area of Southern Italy, therefore concern about generalizability of results may arise. However, although data describing the extent of VH and of attitudes towards vaccinations may be generalized only to our context, data on determinants of VH and refusal may be of more general interest, since they relate to subjects characteristics, beliefs and behaviors, that are less prone to be influenced by the specific context in which they are retrieved.

Even with these potential limitations, the findings of the present study have the potential for application to health decision and communication to help HCPs keep an open dialogue to build trust and to guide parents to choose wisely about childhood vaccination. Longitudinal research is needed to better characterize the trends in the incidence of VH and vaccinations refusal or delay.

### Contributors' statement

Dr Mascaro collected data, and carried out the analyses, and drafted the initial manuscript.

Dr Zucco collected data, and carried out the initial analyses.

Prof Bianco conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, drafted the initial manuscript, and critically reviewed the manuscript for important intellectual content.

Prof Pavia conceptualized and designed the study, coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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## Declarations of interest

None.

## References

- [1] Andre FE, Booy R, Bock HL, Clemens J, Datta, SK, John, TJ, et al. Vaccination greatly reduces disease, disability, death and inequity worldwide. <http://www.who.int/bulletin/volumes/86/2/07-040089/en> [accessed 24.10.17].
- [2] Larson HJ, Jarrett C, Eckersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. *Vaccine* 2014;32:2150–9. <https://doi.org/10.1016/j.vaccine.2014.01.081>.
- [3] Paterson P, Meurice F, Stanberry LR, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. *Vaccine* 2016;34:6700–6. <https://doi.org/10.1016/j.vaccine.2016.10.042>.
- [4] ECDC. Vaccine hesitancy. <https://ecdc.europa.eu/en/immunisation-vaccines/vaccine-hesitancy> [accessed 24.10.17].
- [5] MacDonald NE. SAGE Working group on vaccine hesitancy Vaccine hesitancy: definition, scope and determinants. *Vaccine* 2015;33:4161–4. <https://doi.org/10.1016/j.vaccine.2015.04.036>.
- [6] WHO. Addressing vaccine hesitancy. Available from: [http://www.who.int/immunization/programmes\\_systems/vaccine\\_hesitancy/en/](http://www.who.int/immunization/programmes_systems/vaccine_hesitancy/en/) [accessed 12.02.18].
- [7] Opel DJ, Taylor JA, Mangione-Smith R, Solomon C, Zhao C, Catz S, et al. Validity and reliability of a survey to identify vaccine-hesitant parents. *Vaccine* 2011;29:6598–605. <https://doi.org/10.1016/j.vaccine.2011.06.115>.
- [8] Cooper LZ, Larson HJ, Katz SL. Protecting public trust in immunization. *Pediatrics* 2008;122:149–53. <https://doi.org/10.1542/peds.2008-0987>.
- [9] Bloom BE. Addressing vaccine hesitancy. *Science* 2014;344:339. <https://doi.org/10.1126/science.1254834>.
- [10] Benin AL, Wisler-Scher DJ, Colson E, Shapiro ED, Holmboe ES. Qualitative analysis of mother's decision-making about vaccines for infants: the importance of trust. *Pediatrics* 2006;117:1532–41. <https://doi.org/10.1542/peds.2005-1728>.
- [11] Smith PJ, Humiston SG, Marcuse EK, Zhao Z, Dorell CG, Howes C, et al. Parental delay or refusal of vaccine doses, childhood vaccination coverage at 24 months of age, and the Health Belief model. *Public Health Rep* 2011;126(Suppl 2):135–46. <https://doi.org/10.1177/00333549111260S215>.
- [12] Larson HJ, Jarrett C, Schulz WS, Chaudhuri M, Zhou Y, Dube E, et al. Working group on vaccine hesitancy. Measuring vaccine hesitancy: the development of a survey tool. *Vaccine* 2015;33:4165–75. <https://doi.org/10.1016/j.vaccine.2015.04.037>.
- [13] Ministero della Salute. Vaccinazioni, i dati 2016: in calo le coperture vaccinali dall'infanzia all'adolescenza. [http://www.salute.gov.it/portale/news/p3\\_2\\_1\\_1\\_1.jsp?lingua=italiano&menu=notizie&p=dalministero&id=2971](http://www.salute.gov.it/portale/news/p3_2_1_1_1.jsp?lingua=italiano&menu=notizie&p=dalministero&id=2971) [accessed 02.02.18].
- [14] Law no.119 of July 31, 2017 "Disposizioni urgenti in materia di prevenzione vaccinale".
- [15] Ministero della Salute. Coperture vaccinali in età pediatrica. [http://www.salute.gov.it/portale/documentazione/p6\\_2\\_8\\_3\\_1.jsp?lingua=italiano&id=20](http://www.salute.gov.it/portale/documentazione/p6_2_8_3_1.jsp?lingua=italiano&id=20) [accessed 02.02.18].
- [16] Opel DJ, Taylor JA, Zhou C, Catz S, Myaing M, Mangione-Smith R. The relationship between parent attitudes about childhood vaccines survey scores and future child immunization status: a validation study. *JAMA Pediatr* 2013;167:1065–71. <https://doi.org/10.1001/jamapediatrics.2013.2483>.
- [17] WHO. Report of the SAGE Working Group on Vaccine Hesitancy. [http://www.who.int/immunization/sage/meetings/2014/october/1\\_Report\\_WORKING\\_GROUP\\_vaccine\\_hesitancy\\_final.pdf](http://www.who.int/immunization/sage/meetings/2014/october/1_Report_WORKING_GROUP_vaccine_hesitancy_final.pdf) [accessed 24.10.17].
- [18] Stata Corporation: Stata reference manual. Release 14. College Station TX: 2009.
- [19] Ajzen I, Brown TC, Carvajal F. Explaining the discrepancy between intentions and actions: the case of hypothetical bias in contingent valuation. *Pers Soc Psychol Bull* 2004;30:1108–21.
- [20] Gilkey MB, McRee AL, Brewer NT. Forgone vaccination during childhood and adolescence: findings of a statewide survey of parents. *Prev Med* 2013;56:202–6. <https://doi.org/10.1016/j.ypmed.2012.12.019>.
- [21] Marti M, de Cola M, MacDonald NE, Dumolard L, Duclos P. Assessments of global drivers of vaccine hesitancy in 2014 - Looking beyond safety concerns. *PLoS ONE* 2017;12. <https://doi.org/10.1371/journal.pone.0172310>.
- [22] My C, Danchin M, Willaby HW, Pemberton S, Leask J. Parental attitudes, beliefs, behaviours and concerns towards childhood vaccinations in Australia: a national online survey. *Aust Fam Physician* 2017;46:145–51.
- [23] Greenberg J, Dube E, Driedger M. Vaccine hesitancy: in search of the risk communication comfort zone. *PLoS Curr* 2017. <https://doi.org/10.1371/currents.outbreaks.0561a011117a1d1f9596e24949e8690b>.
- [24] Dubé E, Gagnon D, Zhou Z, Decuninck G. Parental vaccine hesitancy in Quebec (Canada). *PLoS Curr* 2016. <https://doi.org/10.1371/currents.outbreaks.9e239605f4d320c6ad27ce2aea5aad2>.
- [25] Kata A. Anti-vaccine activists, web 2.0, and the postmodern paradigm – an overview of tactics and tropes used online by the anti-vaccination movement. *Vaccine* 2012;30:3778–89. <https://doi.org/10.1016/j.vaccine.2011.11.112>.
- [26] Bianco A, Zucco R, Nobile CG, Pileggi C, Pavia M. Parents seeking health-related information on the internet: cross-sectional study. *J Med Internet Res* 2013;15. <https://doi.org/10.2196/jmir.2752>.
- [27] Zucco R, Lavano F, Anfoso R, Bianco A, Pileggi C, Pavia M. Internet and social media use for antibiotic-related information seeking: Findings from a survey among adult population in Italy. *Int J Med Inform* 2018;111:131–9. <https://doi.org/10.1016/j.ijmedinf.2017.12.005>.
- [28] Vannice KS, Salmon DA, Shui I, Omer SB, Kissner J, Edwards KM, et al. Attitudes and beliefs of parents concerned about vaccines: impact of timing of immunization information. *Pediatrics* 2011;127(Suppl 1):S120–6. <https://doi.org/10.1542/peds.2010-1722R>.
- [29] Esposito S, Principi N, Cornaglia G. ESCMID Vaccine Study Group (EVASG). Barriers to the vaccination of children and adolescents and possible solutions. *Clin Microbiol Infect* 2014;20(Suppl 5):25–31. <https://doi.org/10.1111/1469-0691.12447>.
- [30] Mesch GS, Schwirian KP. Social and political determinants of vaccine hesitancy: lessons learned from the H1N1 pandemic of 2009–2010. *Am J Infect Control* 2015;43:1161–5. <https://doi.org/10.1016/j.ajic.2015.06.031>.
- [31] Larson HJ, Cooper LZ, Eskola J, Katz SL, Ratzan SC. Addressing the vaccine confidence gap. *The Lancet* 2011;378:526–35. [https://doi.org/10.1016/S0140-6736\(11\)60678-8](https://doi.org/10.1016/S0140-6736(11)60678-8).
- [32] Poland GA, Spier R. Fear, misinformation, and innumerates: how the Wakefield paper, the press, and advocacy groups damaged the public health. *Vaccine* 2010;28:2361–2. <https://doi.org/10.1016/j.vaccine.2010.02.052>.
- [33] Verger P, Collange F, Fressard L, Bocquier A, Gautier A, Pulcini C, et al. Prevalence and correlates of vaccine hesitancy among general practitioners: a cross-sectional telephone survey in France, April to July 2014. *Euro Surveill* 2016;21:30406. <https://doi.org/10.2807/1560-7917.ES.2016.21.47.30406>.
- [34] Bianco A, Pileggi C, Iozzo F, Nobile CG, Pavia M. Vaccination against human papilloma virus infection in male adolescents: knowledge, attitudes, and acceptability among parents in Italy. *Hum Vaccin Immunother* 2014;10:2536–42. <https://doi.org/10.4161/21645515.2014.969614>.
- [35] Napolitano F, D'Alessandro A, Angelillo IF. Investigating Italian parents' vaccine hesitancy: a cross-sectional survey. *Hum Vaccin Immunother* 2018;14:1558–65. <https://doi.org/10.1080/21645515.2018.1463943>.