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A national survey of parents' views on childhood vaccinations in Ireland

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ABSTRACT

Introduction: Vaccine hesitancy is complex and multifactorial and a threat to global health. Uptake of some recommended childhood immunisations in Ireland remains below World Health Organisation targets. The aim of this study was to determine factors associated with vaccine uptake in Ireland. *Methods:* A cross-sectional, national survey of parental attitudes towards childhood vaccination for chil-

dren aged 0 to 48 months was conducted between June and August 2021 (N = 855). A descriptive analysis of questionnaire responses was conducted. Univariate and multivariable logistic regression models were constructed to identify the association of demographic parental characteristics and parental vaccine attitude scores with a delay in or lack of parental vaccine acceptance.

Results: There was a strongly positive sentiment towards childhood vaccinations. Self-reported uptake of recommended vaccines was 96.1 % with a strong belief in the importance (94.4 %) and safety (89.2 %) of vaccines. Trust in official vaccine information sources was high; 91.5 % and 89.2 % reported trust in the vaccine information provided by healthcare professionals and the Health Service Executive (HSE) respectively. The most commonly identified reasons for missed vaccines were concerns about safety and vaccine side effects. In multivariable regression analysis, parental trust in official vaccine information sources was a significant predictor of vaccine acceptance. For every one unit increase in the median parental trust in official vaccine information score, the odds of a parent having reduced vaccine acceptance decreased significantly (aOR 0.27 95 % CI 0.16, 0.46, p < 0.001).

Conclusion: Understanding parental attitudes towards vaccination will inform the development of evidence-informed, targeted interventions to increase childhood immunisation uptake. Vaccine information for parents should focus on vaccine safety and public health action should be taken to build trust and engage communities in order to increase and sustain the uptake of childhood vaccines delivered as part of the national childhood primary immunisation programme in Ireland.

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1. Introduction

The World Health Organisation (WHO) and the Strategic Advisory Group of Experts (SAGE) working group on vaccine hesitancy have defined vaccine hesitancy as the delay in the acceptance or the refusal of vaccination despite the availability of vaccination services [1,2]. While there are various definitions of vaccine hesitancy and some discrepancies about what is considered vaccine hesitancy, [3,4] overall, it is agreed that globally vaccine hesitancy

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https://doi.org/10.1016/j.vaccine.2023.05.004 0264-410X/© 2023 Elsevier Ltd. All rights reserved. is a major concern, [5,6] and it has been identified by the WHO as one of the top 10 threats to global health [1]. Vaccine hesitancy has recently been defined as "a state of indecision and uncertainty about vaccination before a decision is made to act (or not act)" [7]. Those who are vaccine hesitant may not ultimately be vaccine refusers [7,8]. Vaccine acceptance is the degree to which individuals accept, question or refuse vaccination [9]. Vaccine acceptance and hesitancy are context-specific and are influenced by many factors including convenience, complacency as well as confidence [2,10]. Therefore, the reasons for vaccine hesitancy are complex, and those who are vaccine hesitant or who have reduced vaccine acceptance are a heterogenous group [10]. Consequently, the public health interventions required to address vaccine hesitancy may be different depending on the underlying reason [11].





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In Ireland, the Health Service Executive (HSE) is the national healthcare body with responsibility for implementing national immunisation programmes. The childhood immunisation programme for children aged between 2 and 13 months is delivered in primary care by general practitioners (GPs) and general practice nurses over five consultations. The primary childhood immunisation schedule in Ireland is included in Appendix A. Childhood immunisations are available free of charge. While much progress has been made over recent decades in Ireland, national uptake of several childhood vaccines are below the WHO-recommended thresholds [12].

Existing regional immunisation information systems used in Ireland do not record parental characteristics such as socioeconomic status, education level, and country of origin or ethnicity and so it not possible to determine from routinely collected data if any of these factors are associated with sub-optimal vaccine uptake. However, studies have confirmed a strong socioeconomic gradient in childhood vaccination in the Republic of Ireland with lower uptake of childhood vaccines among children from lowersocioeconomic groups [13]. Outbreaks of vaccine-preventable diseases (VPDs) in some ethnic minority groups and in socioeconomically disadvantaged areas in Ireland also suggest lower vaccine uptake among these groups [14–16]. This pattern is observed internationally, [17,18] and the reasons for this lower uptake are likely multifactorial and include negative attitudes towards vaccination, low perceived risk of severe illness, vaccine safety concerns and practical access barriers including language barriers [19-21].

Vaccination attitudes of parents of infants and young children in Ireland are unknown, as is whether parental attitudes differ depending on demographic characteristics. This study, which was the first national survey of parents' attitudes towards childhood immunisation in Ireland, aimed to assess parental attitudes towards childhood immunisation among parents of children aged 0 to 48 months living in Ireland, and to explore the factors associated with vaccine uptake in Ireland.

2. Methods

2.1. Study design

Using computer assisted telephone interviews (CATIs), [22] a national cross-sectional survey was conducted between 7th June and 27th August 2021 to assess parental attitudes towards childhood vaccination. Random digit dialling (RDD) was used to generate telephone numbers. The sampling methodology used number stems issued by the Commission for Communications Regulation to generate a random selection of national mobile telephone numbers. Landline phones were not contacted. There are challenges acknowledged with accessing hard-to reach populations with mobile surveys, [23] however, mobile only sampling was chosen for this study due to the high coverage of mobile phones in the Irish population (97.1 %), [24] and to avoid introducing bias by giving those parents with both a mobile phone and a landline a greater opportunity for selection. Interviewers were not required to contact all phone numbers in the sample or to re-contact nonresponding numbers on multiple occasions. Responders were offered an opportunity to reschedule the interview and were allowed the opportunity to make an appointment which could be re-scheduled as many times as necessary and were available morning, afternoons and evenings as well as weekdays and weekends. Trained, professional interviewers from a contracted market research company carried out the sampling and CATIs. The interviews were conducted in English.

2.2. Study population

Parents or legal guardians of a child aged 0 to 48 months living in Ireland were defined as the study population. Those who were aged less than 16 years and those who could not complete the questionnaire due to language difficulties were excluded. If a respondent had more than one child in the age category they answered in respect of the oldest child. Based on the findings of the Vaccine Confidence Project which reported that 15.2 % of the Irish population would express some level of vaccine hesitancy, a precision-based sample size of 792 was calculated with a confidence interval of 95 % and a precision of ± 2.5 % [25]. Based on the assumption that 15 % of all phone numbers would be eligible to participate in the survey and that the assumption that the survey response rate would be 15 % (similar to previous national surveys), an effective sample size of 800 was calculated.

In total, 347,385 telephone numbers were contacted; 8,451 (2.4 %) were answered by a potential respondent and 855 (10.1 %) successfully completed the survey. The remaining 7,596 individuals were either ineligible or refused to participate in the survey.

2.3. Questionnaire design

A standardised questionnaire with 42 questions was developed, informed by similar studies carried out in other countries identified in the literature. Questions from the Parent Attitude about Childhood Vaccines (PACV) survey and the vaccine confidence scale from the London School of Hygiene and Tropical Medicine (LSHTM) were adapted for this survey [26–31]. National Adult Literacy Agency guidance informed the language used in the questionnaire [32]. The questionnaire included 23 questions on parental attitudes, knowledge and behaviour in relation to childhood immunisations and 19 baseline demographic questions.

Following questionnaire development, cognitive testing was undertaken (N = 5). This qualitative cognitive testing involved conducting in-depth interviews with eligible respondents [33]. Following cognitive testing changes were made to the survey questionnaire including restructuring of the questions to account for situations where both parents did not live with the child and/ or make vaccination decisions together and the identification of questions where parents needed information from interviewers to aid understanding to be provided by interviewers e.g., the names of uncommon diseases. Subsequently, a pilot study (N = 21) was conducted. The length of the questionnaire was considered to be acceptable and few revisions were needed following the pilot study. However, on review of responses it was noted that questions with a a negative sentiment e.g., "The time involved visiting the GP's office is not worth it just for receiving a childhood vaccination" showed wider diversity than would be expected compared to those with a neutral or positive sentiment. Therefore, to ensure consistency in all statements read to respondents, questions were amended following the pilot study to use more positive language e.g., The time involved visiting the GP's office is worth it just for receiving a childhood vaccination".

2.4. Data collection

Trained interviewers contemporaneously entered data onto a secure database. Data were processed adhering to General Data Protection Regulation (GDPR)[EU] 2016/679 and national HSE policy [34].

2.5. Weighting

The survey did not generate a representative sample of the target population with respect to demographic or socio-economic characteristics. Therefore, based on population profiles from Census 2016 data, [35] target weights were determined and a weighting process was adopted using age categories of parent (16–24, 25– 34, 35–44, 45–54 and 55 + years), gender of parent (male, female) and educational attainment (primary-level or lower, lower secondary, upper secondary, non-degree or degree or higher). Probability weights were used in the data analysis.

2.6. Statistical analysis

A weighted and unweighted descriptive analysis of all questionnaire responses was conducted. This included descriptive analysis of the characteristics of the study population, self-reported childhood vaccination history, parental attitudes towards vaccination, sources of parental vaccine information and barriers to childhood vaccination. Absolute frequencies with percentages were generated for categorical variables. Weighted data were used for all other analysis.

To determine the factors associated with vaccine uptake in Ireland, for this study, vaccine acceptance was defined as the degree to which individuals accept, question or refuse vaccination [9]. A delay in or lack of vaccine acceptance variable was created to explore the characteristics of parents with less favourable attitudes towards vaccination. Two questions were used to define this variable; "Did your child receive all of their recommended vaccines when they were due" and "To what extent do you agree with the following statement: I believe vaccines are safe for my child to get". Parents of children aged over three months (N = 812) who self-reported that their children had not received all recommended vaccines within one month of them being due, and/or parents of children in all age categories (Total N = 855) who disagreed or strongly disagreed with the statement that vaccines are safe for their child were classified as having a delay in or lack of vaccine acceptance. Parents who did not know their child's vaccination status were excluded from the analysis. Parents who did not answer both questions were excluded from the analysis. Parents who did not give an opinion about vaccine safety but who delayed vaccines by more than one month were classified as having a delay in or lack of vaccine acceptance. Parents whose children were vaccinated on time (defined as those vaccinated within one month of vaccines being due) and parents who agreed what vaccines were safe were classified as having no delay in or lack or vaccine acceptance.

A chi-squared test for comparing proportions was used to test the null hypotheses that there was no difference in parental characteristics or attitudes towards vaccination between parents who were classified as having a delay in or lack of vaccine acceptance and parents who were not.

2.7. Creating vaccine attitude scales

A correlation matrix which calculated Spearman's Rho correlation coefficient was used to examine variables reporting parental attitudes towards childhood vaccination. Variables were grouped into categories of questions related to vaccine importance, trust in official sources of vaccine information, trust in unofficial sources of vaccine information and convenience of getting childhood vaccines. This categorisation was informed by research-based *apriori* knowledge of key factors influencing parental intention and decision to vaccinate and by the correlation matrix (Appendix B). Official sources of vaccine information were defined as information from healthcare workers (HCWs), the HSE and the Government of Ireland. Unofficial sources of vaccine information were defined as friends and family, media and social media. Attitude to vaccination questions were assessed using Likert scales which had six answer options; strongly disagree-coded as 1, disagree-coded as 2, neither agree nor disagree-coded as 3, agree-coded as 4, strongly agreecoded as 5, non-response/I don't know coded as missing values. Median scores were calculated to create four attitudes to vaccination scales (importance, trust in official sources, trust in unofficial sources and convenience) using the Likert scale scores from these variables. A belief in the seriousness of vaccine preventable diseases (VPD) score was also created based on how serious parents believed their child getting a VPD would be; not serious at allcoded as 1, not very serious-coded as 2, quite serious-coded as 3, very serious-coded as 4 (Appendix B).

2.8. Regression models

Univariate and multivariable logistic regression models were constructed to identify the association of parental characteristics with having a delay in or a lack of vaccine acceptance. The first univariate regression model included demographic variables that are known to be associated with reduced vaccine acceptance and also variables for which there was evidence of an association with parents demonstrating a delay in or a lack of vaccine acceptance following a chi-squared test.

The second univariate model examined parental attitudes to vaccination and included median scores for all vaccine attitude scales.

Two multivariable regression models were also created. In the first, only demographic variables which, following univariate analysis, had a p < 0.05 were included as independent variables.

The second multivariable model included demographic variables which remained significant in the first univariate model, as well as parental vaccine attitude variables which were significant in the second univariate model.

For each model, odds ratios (ORs) and adjusted odds ratios (aORs) with 95 % confidence intervals (CIs) were calculated. All statistical analysis was carried out using SPSS version 26.0 with complex samples and STATA version 17. The level of statistical significance for all group differences in this study was set at 5 % (p < 0.05).

2.9. Ethical approval

The Royal College of Physicians in Ireland Research Ethics Committee granted ethical approval for this study.

2.10. Funding

The Irish Department of Health provided funding for this study.

3. Results

3.1. Characteristics of the participants

Of the total 855 respondents, the majority of parents were in the 30–39-year age category (63.3 %), were married (68.2 %), had one or two children (75.6 %), were working (77.6 %) and were of white ethnicity (94.2 %). Unweighted and weighted analysis of the characteristics of the study population is presented in Table 1. As the results are similar, for the remainder of this paper only the results of the weighted analysis are presented.

3.2. Childhood vaccination history for children aged 3 months and older

Overall, 96.1 % (780/812) of parents and guardians surveyed reported that their child had ultimately received all recommended vaccines; 86.5 % (702/812) reported that their child had received

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Table 1

Descriptive characteristics of the study population.

Key descriptive characteristics	Unweighted		Weighted			
Total N = 855	N	%	N	%		
Age category child						
Less than 3 months old	41	4.8	43	5.0		
3 to 17 months	216	25.3	206	24.1		
18 to 48 months	598	69.9	606	70.9		
Age category parent						
16 to 29 years	99	11.6	111	13.0		
30 to 39 years	523	61.2	541	63.3		
40 years and older	228	26.6	194	22.7		
Missing	5	0.6	9	1.0		
Gender						
Male	298	34.9	419	49.0		
Female	557	65.1	436	51.0		
Geographic Area						
Dublin	261	30.5	231	27.0		
Rest of Leinster	270	31.6	298	34.9		
Munster	210	24.6	219	25.6		
Connaught/Ulster	111	13.0	104	12.2		
Missing	3	0.3	3	0.3		
Relationship Status						
Single parent	72	8.4	83	9.7		
Married	611	71.5	583	68.2		
Co-habiting	166	19.4	185	21.6		
Missing	6	0.7	4	0.5		
Number of Children						
1	323	37.8	320	37.5		
2	304	35.5	326	38.1		
3	157	18.4	135	15.8		
4+	71	8.3	74	8.6		
Highest level of Education						
Upper secondary or less	165	19.3	419	49.0		
Vocational or certificate	174	20.4	31	3.6		
Bachelor's degree	317	37.1	214	25.1		
Postgraduate qualification/PhD	191	22.3	183	21.4		
Missing	8	0.9	8	0.9		
Occupational Status						
Working for payment	666	77.9	664	77.6		
Not working	32	3.7	39	4.6		
Full time homemaker/maternity leave	151	17.7	149	17.4		
Missing	6	0.7	3	0.4		
Annual Household Income						
Less than €50,000	180	21.1	205	23.9		
€50,000 or more	285	33.3	245	28.7		
Dia not report income	390	45.6	405	47.4		
Region/Country of Birth	N	%	N	%		
Ireland	687	80.3	688	80.5		
Northern/Southern/Western Europe*	43	5.0	38	4.4		
Central and Eastern Europe*	53	6.2	50	5.8		
Rest of world	69	8.1	/5	8.8		
MISSINg	2	0.4	4	0.5		
Ethnicity						
White	811	94.8	806	94.2		
Black or Black Irish	10	1.2	12	1.4		
Asian or Asian Irisn Other	23	2./	25	2.9		
ottier	11	1.5	12	1.5		
Religious	22.4					
Yes	694	81.2	699	81.8		
NO	12/	14.8	125	14.6		
wiissillg	54	4.0	51	3.0		
Child with chronic health problem	52	6.1	50	<u> </u>		
res	52	b.1	58	6.8		
INU Missing	/9/ 6	93.2	791	92.5 0 7		
1411331115	U	0.7	U	0.7		
Vaccine Decision Making	221	27.0	222	27.2		
One parent makes decisions	231	27.0	233	27.2		
Doth patents make decision Missing	021	12.0	010	/2.3		
3111001118	ر	0.4	4	0.5		

* As defined by the OECD [50].

their recommended vaccinations when they were due and 6.0 % (49/812) reported that vaccinations were delayed by less than one month (Fig. 1).

Among the 7.5 % (N = 60) of parents who reported that their child did not get all recommended vaccines within one month or that their child did not get all their recommended vaccinations or who did not know their child's vaccination status, almost half (48.3 %, 29/60) of parents reported that after the initial delay, their child had received all recommended vaccines. Almost one third of these parents (31.7 %, 19/60) reported that their child had received some but not all vaccinations recommended for their age. Just 11.7 % (7/60) reported that their child was never vaccinated accounting for less than 1 % of all parents.

Among parents whose children received some but not all vaccinations (N = 19), the 6-month (6 in 1, PCV and Men C) and the 13month (Hib/MenC and PCV) vaccines were identified as those not received by 72.6 % and 54.5 % of parents respectively (Fig. 2).

Among parents whose children were ultimately vaccinated after an initial delay (N = 29), the COVID-19 pandemic was identified by 37.9 % (11/29) of parents as a reason for delayed vaccination, illness was a factor in 27.6 % (8/29) and safety concerns were given as a reason in a small minority (3.4 %). In contrast, parents whose children were never or partially vaccinated (N = 26) identified safety concerns (76.9 %, 20/26) and religious reasons (15.4 %, 4/26) as the main reasons for not receiving vaccines.

3.3. Parental intention to vaccinate children aged less than 3 months

A total of 95.3 % (41/43) of parents reported that they intend that their baby will get all recommended vaccinations and 4.7 % (2/43) reported that their child will receive some but not all recommended vaccinations. No parent reported that their baby would not receive any of the recommended vaccinations.

3.4. Parental attitudes towards vaccinating their children

The majority of parents strongly agreed or tended to agree with the statement that vaccines are important (94.4 %, 807/855) and safe (89.2 %, 763/855) for their child to get, however 40.6 %

(347/855) reported feeling concerned about serious side effects (Fig. 3).

3.5. Sources of vaccine information

Almost two thirds of parents (65.8 %, 563/855) reported that they would ask their GP or practice nurse for information on vaccines, 47.5 % (406/855) reported they would use the HSE website and information materials which contains official national vaccination information materials developed by healthcare professionals. One in five parents reported they would use an internet search which could include the HSE website (20.9 %, 179/855) while 3.8 % (33/855) reported that they would check on social media (Fig. 4). Parents were able to state more than one source of vaccine information.

3.6. Trust in vaccine information

There were high levels of trust in official sources of childhood vaccination information. Nine in ten parents reported that they trust the information provided by healthcare workers (HCWs) and the HSE and almost eight in ten reported trusting information from the government. Trust in unofficial sources of information was lower, however 59.1 % (505/855) reported trusting information provided by family and friends. Almost one third reported trusting information in the media (31.7 %, 271/855) while 18.3 % (157/855) reported trusting information on social media (Fig. 5).

3.7. Barriers to childhood vaccination

Almost 9 in 10 parents strongly agreed or agreed that it is convenient to get their child vaccinated (87.4 %) and that the time visiting the GP's office is worth it to receive childhood vaccinations (88.9 %) while 1 in 10 parents (10.8 %) strongly agreed or agreed that everyday stresses prevent them from getting their child vaccinated.



Fig. 1. Child vaccination status (N = 812).



Fig. 2. Vaccines that children did not receive when some but not all vaccinations received (N = 19).



Fig. 3. Parental attitudes towards childhood vaccinations (N = 855).

3.8. Delay in or lack of vaccine acceptance

Overall, in this study 70 parents were classified as having a delay in or lack of vaccine acceptance. Parents whose children had not received all recommended vaccines within one month of them being due and/or parents who disagreed or strongly disagreed with the statement that vaccines are safe for their child were classified as having a delay in or lack of vaccine acceptance. After excluding parents who did not answer both questions or answered 'I don't know' in relation to their child's vaccination status, 756 responders remained in the analysis. Within this population, 9.3 % (70/756) were classified as having a delay in or lack of vaccine acceptance. Within the whole study population this proportion was 8.2 % (70/855). There were differences in the demographic characteristics of parents who were classified as having a

delay in or lack of vaccine acceptance compared to those who did not have a delay in or a lack of vaccine acceptance. (Table 2). There were differences by parents' relationship status; among those who had lower vaccine acceptance, a smaller proportion were married (52.9 %) compared to those who had no delay in vaccine acceptance (69.3 %) (p = 0.002). There was also a difference by parents' employment status, among those who had a delay in vaccine acceptance, a higher proportion were not working (17.1 % vs. 4.5 %, p = 0.001). There was also a difference by number of children, among those who had a delay in vaccine acceptance, a higher proportion acceptance, a higher proportion had four or more children compared to those who had no delay in vaccine acceptance (17.1 % vs. 7.7 %, p = 0.025). There were no significant differences in terms of parental age, gender, geographic location, household income, level of education, whether the parent was religious, whether the child had an underlying



Fig. 4. Parental sources of vaccine information (N = 855).



Fig. 5. Parental trust in vaccine information (N = 855).

chronic illness or whether one or both parents made vaccination decisions (Table 2). Among parents who had a delay in vaccine acceptance, a greater proportion were born in a Central or Eastern European country, as defined by the Organisation for Economic Cooperation and Development (OECD), compared to those who did not have a delay in vaccine acceptance, however this difference was not statistically significant (p = 0.090) (Table 2).

Among parents who were classified as having a delay in or lack of vaccine acceptance, 75.0 % agreed vaccines were important compared to 100 % among those who were not classified as having a delay in or a lack of vaccine acceptance (p < 0.001). A smaller proportion of those who had a delay in or lack of vaccine acceptance agreed it was convenient to get vaccines (70.5 % vs. 96.0 %, p < 0.001) while a greater proportion reported that everyday stressors prevented vaccination (28.0 % vs. 9.5 %, p = 0.003). Among those who were classified as having a delay in or lack of vaccine acceptance, 3 in 4 (75.0 %) reported that all/most people they know get their child all recommended vaccines compared to 95.3 % of

those who did not have a delay in or a lack of vaccine acceptance (p < 0.001) (Table 3).

Trust in HCW was higher among those who got all recommended vaccines on time and agreed that vaccines were safe compared to those who were classified as having a delay in or lack of vaccine acceptance (99.4 % vs. 54.7 %, p < 0.001). Trust in other official sources of vaccine information (HSE and government) was also higher among those who got all recommended vaccines on time and agreed that vaccines were safe (p < 0.001). Among those who were classified as having a delay in or lack of vaccine acceptance, there were lower levels of trust in all official vaccine information sources as well as lower levels of trust in information from unofficial information such as family and friends (p < 0.001) and media (p = 0.097). Levels of trust in vaccine information from social media were slightly higher among those who were classified as having a delay in or lack of vaccine acceptance compared to those who got all recommended vaccines on time and agreed that vaccines were safe (22.2 % vs. 21.3 %, p = 0.828) (Table 3).

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Table 2

Demographic characteristics of parents with a delay in or lack of vaccine acceptance vs. those with no delay or lack of vaccine acceptance.

Demographic characteristics	Delay in vaccine (N = 70)	or lack of acceptance	No delay i vaccine a (N = 686)	in or lack of cceptance	Total (N =	756)	p-value ^a
	N	%	N N	%	N	%	
Age Category Parent (N = 749) *							
16 to 29 years	17	24.3	78	11.5	95	12.7	0.06
30 to 39 years	35	50.0	435	64.1	470	62.7	
40 + years	18	25.7	166	24.4	184	24.6	
Total	70	100.0	679	100.0	749	100.0	
Gender (N = 756)							
Male	29	41.4	342	49.9	371	49.1	0.315
Female	41	58.6	344	50.1	385	50.9	
Total	70	100.0	686	100.0	756	100.0	
Geographic Area (N = 754)							
Dublin	15	21.4	187	27.4	202	26.8	0.261
Rest of Leinster	23	32.9	243	35.5	266	35.3	
Munster	18	25.7	182	26.6	200	26.5	
Connaught/Ulster	14	20.0	72	10.5	86	11.4	
Total	70	100.0	684	100.0	754	100.0	
Marital Status (N = 755)							
Single parent	10	14.3	48	7.0	58	7.7	0.002
Married	37	52.9	486	71.0	523	69.3	
Co-habiting	18	25.7	146	21.3	164	21.7	
Separated/widow/divorced	5	7.1	5	0.7	10	1.3	
Total	70	100.0	685	100.0	755	100.0	
Number of Children (N = 756)							
1	17	24.3	263	38.3	280	37.0	0.025
2	22	31.4	266	38.8	288	38.1	
3	19	27.2	104	15.2	123	16.3	
4+	12	17.1	53	7.7	65	8.6	
Total	70	100.0	686	100.0	756	100.0	
Highest level of Education (N = 750)							
Upper secondary or less	37	52.9	325	47.8	362	48.3	0.139
Vocational or certificate	4	5.7	23	3.4	27	3.6	
Bachelors degree	21	30.0	169	24.8	190	25.3	
Postgraduate qualification/PhD	8	11.4	163	24.0	171	22.8	
Total	70	100.0	680	100.0	750	100.0	
Occupational Status (N = 752)							
Working for payment	44	62.9	552	80.9	596	79.3	0.001
Not working	12	17.1	22	3.3	34	4.5	
Homemaker/maternity leave	14	20.0	108	15.8	122	16.2	
Total	70	100.0	682	100.0	752	100.0	
Annual Household Income (N = 756)							
Less than €50.000	24	34.3	150	21.9	174	23.0	0.11
€50.000 or more	14	20.0	217	31.6	231	30.6	
Did not report income	32	45.7	319	46.5	351	46.4	
Total	70	100.0	686	100.0	756	100.0	
Country/Region of Birth (N = 753)							
Ireland	57	81.4	548	80.2	605	803	0.09
Northern/Southern/Western Europe"	2	2.8	30	44	32	42	0100
Central and Eastern Europe	9	12.9	38	5.6	47	63	
Rest of World	2	2.9	67	9.8	69	9.2	
Total	70	100.0	683	100.0	753	100.0	
Paligion (N = 732)							
Had a religion	59	86.8	564	84 9	623	85.1	0 772
Did not have a religion	99 Q	12.2	100	15.1	109	14 9	0.772
Total	68	100.0	664	100.0	732	100.0	
Child chronic illness $(N = 751)$			-		-		
Yes	3	45	50	73	53	71	0 329
No	64	95.5	634	92.7	698	92.9	0,323
Total	67	100.0	684	100.0	751	100.0	
Vaccine decision making (N = 752)							
One parent	15	21 4	185	27 1	200	26.6	0 362
Doth paronte	55	78.6	498	72.9	553	73.4	0.302
DOLLI DALEUIN				1 4 1		1	

* Missing values are not displayed in this table. * As defined by the OECD [50].

^a Chi Squared test.

Table 3

Parental attitudes, trust and information sources of parents with a delay in or lack of vaccine acceptance vs. those with no delay or lack of vaccine acceptance.

	Delay in or lack vaccine acceptan (N = 70)	of nce	No delay in or lac vaccine acceptanc (N = 686)	k of e	Total (N = 756)		
	N	%	N	%	N	%	p-value ^a
Vaccines are important (!	N = 735) *						
Yes	45	75.0	675	100.0	720	98.0	< 0.001
No	15	25.0	0	0.0	15	2.0	
Convenient to get vaccine	es (N = 710)						
Yes	43	70.5	623	96.0	666	93.8	< 0.001
No	18	29.5	26	4.0	44	6.2	
Everyday stressors prever	nt vaccination (N =	717)					
Yes	18	28.1	62	9.5	80	11.2	0.003
No	46	71.9	591	90.5	637	88.8	
Those you know get reco	mmended vaccine	s(N = 728)					
All/most	51	75.0	629	95.3	680	93.4	< 0.001
Some/none	17	25.0	31	4.7	48	6.6	
Trust in $HCW(N = 734)$							
Yes	35	54 7	666	99.4	701	95 5	<0.001
No	29	45.3	4	0.6	33	45	-0.001
Truct in LISE $(N = 725)$			-				
Ves	37	53 3	657	98.8	689	95.0	<0.001
No	28	46.7	8	12	36	50	\$0.001
Trust in government (N =	601)	1017	0		50	510	
Yos	22	20.2	506	02.0	619	90.4	<0.001
No	34	59.5 60.7	30	95.9 6 1	73	09.4 10.6	<0.001
		00.7	25	0.1	15	10.0	
Trust in family and friend	ds (N = 587)	40.2	410	70.0	445	75.0	-0.001
res No	29	48.3 51.7	410	78.9	445 142	/5.8	<0.001
	51	51.7	111	21.1	142	24.2	
Trust in media (N = 581)	45	27.2	222	12.2	007	10.0	0.007
Yes	15	27.3	222	42.2	237	40.8	0.097
NO	40	12.1	304	57.8	344	59.2	
Trust in social media (N =	= 642)						
Yes	12	22.2	125	21.3	137	21.3	0.828
No	42	77.8	463	78.7	505	78.7	
Seeks information from (GP/practice nurse (N = 756)					
Yes	32	45.7	477	69.5	509	67.3	0.003
No	38	54.3	209	30.5	247	32.7	
Seeks information from H	HSE website/inform	nation materials (N =	755)				
Yes	24	34.8	335	48.8	359	47.5	0.095
No	45	65.2	351	51.2	396	52.5	
Seeks information from s	ocial media (N = 7	56)					
Yes	7	10.0	22	3.2	29	3.8	0.071
No	63	90.0	664	96.8	727	96.2	
Seeks information from f	amily and friends	(N = 756)					
Yes	14	20.0	51	7.4	65	8.6	0.014
No	56	80.0	635	92.6	691	91.4	

* Missing values are not displayed in this table.

^a Chi Squared test.

A smaller proportion of those who were classified as having a delay in or lack of vaccine acceptance reported seeking vaccine information from their GP or practice nurse compared to those who were got all recommended vaccines on time and agreed that vaccines were safe (45.7 % vs. 69.5 %, p = 0.003). Similarly, a smaller proportion of those who were classified as having a delay in or lack of vaccine acceptance reported seeking information from the HSE website and information materials, however this difference did not reach statistical significance (p = 0.095). A greater proportion of those who were classified as having a delay in or lack of vaccine acceptance reported seeking vaccine information from family and friends compared to those who were not classified as having a delay in or a lack of vaccine acceptance (p = 0.014). Similarly, more parents who were classified as having a delay in or lack of vaccine acceptance reported seeking information on social media compared to those who got all recommended vaccines on time and agreed that vaccines were safe, however this difference was not statistically significant (p = 0.071) (Table 3).

Univariate analysis examining parental demographic factors of having a delay in or lack of vaccine acceptance showed that the odds of a parent being classified as having a delay in or lack of vaccine acceptance was higher among those who were single parents compared to those who were married (OR 3.82, 95 % CI 1.54, 9.43, p = 0.004), those who were not working compared to those who were working (OR 6.45, 95 % CI 2.02, 20.59, p = 0.002) and among those with three or four or more children compared those with one child (OR 2.77, 95 % CI 1.14, 6.73, p = 0.025 and OR 3.62, 95 % CI 1.27, 10.31, p = 0.016 respectively). Those born in a Central or Eastern European country had 2.23-fold increased odds of having a delay in or lack of vaccine acceptance compared to those born in Ireland, however the 95 % confidence interval around this estimate includes 1. Parents who had an income of €50,000 or more had a

lower odds of having a delay in or lack of vaccine acceptance (OR 0.40, 95 % CI 0.17, 0.92, p = 0.030) and parents aged 30–39 years had a lower odds of having a delay in or lack of vaccine acceptance compared to those aged 16-29 years old (OR 0.37, 95 % CI 0.15, 0.92, p = 0.033). In multivariable analysis, the number of children and parental occupational status remained statistically significant demographic predictors of having a delay in or lack of vaccine acceptance. After controlling for other factors, the odds of having a delay in or lack of vaccine acceptance are more than three times higher for parents with three children or more children compared to those with one child (aOR 3.50, 95 % CI 1.39, 8.79, p = 0.008 and aOR 3.68, 95 % CI 1.13, 11.98, p = 0.031 respectively). There was evidence of an association between parental working status and having a delay in or lack of vaccine acceptance. Parents who were not working had an increased odds of having a delay in or lack of vaccine acceptance compared to those who were working (aOR 3.29, 95 % CI 1.08, 10.0, p = 0.036) (Table 4).

Univariate analysis examining vaccine attitude predictors of having a delay in or lack of vaccine acceptance showed that higher median parental scores for belief in vaccine importance, trust in official (HCW, HSE and government) vaccine information sources, agreeing that vaccines are convenient and increasing belief in the seriousness of VPDs were associated with significantly lower odds Vaccine 41 (2023) 3740-3754

of a parent having a delay in or lack of vaccine acceptance (Table 5). In the multivariable model, parental trust in official vaccine information sources and remained a significant predictor of a parent having a delay in or lack of vaccine acceptance. For every one unit increase in the median parental trust in official vaccine information score, the odds of a parent having a delay in or lack of vaccine acceptance reduced significantly (aOR 0.27 95 % CI 0.16, 0.46, p < 0.001) (Table 5). When all significant demographic and vaccine attitude predictors were included in a multivariable regression model, trust in official vaccine information sources remained the only significant predictor of a parent having a delay in or lack of vaccine acceptance (Appendix C).

4. Discussion

4.1. Parental attitudes towards vaccination

This study has shown that there is a strongly positive sentiment towards childhood vaccinations and overall high vaccine acceptance among parents of children aged 0 to 48 months in Ireland. Overall, parental intention to vaccinate children under 3 months old was 94.7 % and self-reported vaccine uptake was 96.1 % for children aged over 3 months. Belief in the importance and safety

Table 4

Parental demographic factors associated with a delay in or lack of vaccine acceptance.

	Unadjusted	l			Adjusted ^a			
	OR	CI Lower	CI Upper	p-value	aOR	CI Lower	CI Upper	p-value
Age Category Parent 16–29 years 30–39 years Over 40 years	1.0 (Ref) 0.37 0.50	0.15 0.19	0.92 1.30	0.033 0.159	1.0 (Ref) 0.47 0.55	0.17 0.19	1.32 1.64	0.152 0.287
Gender Parent Male Female	1.0 (Ref) 1.42	0.71	2.79	0.316	_	_	_	_
Level of Education Upper secondary or less Vocational or Certificate Bachelor degree Postgraduate or PhD	1.0 (Ref) 1.40 1.08 0.45	0.69 0.53 0.20	2.87 2.22 1.04	0.354 0.826 0.063	- -	- -	- -	
Region/Country of Birth Ireland Northern/Western/Southern Europe* Central/Eastern Europe* Rest of World	1.0 (Ref) 0.76 2.23 0.28	0.17 0.81 0.06	3.38 6.13 1.29	0.722 0.119 0.101	- -	- -	- -	- -
Relationship status Married Single parent Co-habiting	1.0 (Ref) 3.82 1.62	1.54 0.68	9.43 3.85	0.004 0.273	2.14 1.60	0.80 0.65	5.76 3.93	0.132 0.305
Occupational status Working for payment Not working Full time homemaker	1.0 (Ref) 6.45 1.60	2.02 0.69	20.59 3.75	0.002 0.271	1.0 (Ref) 3.29 1.60	1.08 0.32	10.0 2.06	0.036 0.305
Religious Yes No Refused to answer	1.0 (Ref) 0.87 0.55	0.34 0.12	2.55 2.49	0.772 0.434	1.0 (Ref) - -	-	-	
Annual income Less than €50,000 € 50,000 or more Did not report income	1.0 (Ref) 0.40 0.63	0.17 0.28	0.92 1.41	0.030 0.261	1.0 (Ref) 0.71 0.84	0.22 0.33	2.22 2.19	0.551 0.728
Number of children 1 2 3 4+	1.0 (Ref) 1.28 2.77 3.62	0.54 1.14 1.27	3.07 6.73 10.31	0.577 0.025 0.016	1.0 (Ref) 1.85 3.50 3.68	0.74 1.39 1.13	4.67 8.79 11.98	0.190 0.008 0.031

* As defined by the OECD [50].

^a Adjusted for age, relationship status, occupational status, number of children and annual income.

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Table 5

Vaccine attitude predictors of a delay in or lack of vaccine acceptance.

Vaccine Attitude Median Score	Unadjus	sted		_	Adjusted ^a					
	OR	CI Lower	CI Upper	p-value	aOR	CI Lower	CI Upper	p-value		
Vaccine importance	0.24	0.16	0.34	<0.001	1.01	0.55	1.87	0.965		
Trust in official vaccine information	0.20	0.13	0.31	<0.001	0.27	0.16	0.46	<0.001		
Trust in unofficial vaccine information	0.77	0.56	1.05	0.096	-	-	-	-		
Vaccine convenience	0.29	0.21	0.41	<0.001	0.61	0.62	1.07	0.088		
Belief in seriousness of VPD	0.25	0.15	0.43	<0.001	0.69	0.37	1.27	0.235		

^a Adjusted for demographic predictors as per Table 4 (multivariable model) and vaccine importance score, trust in official vaccination information sources score, vaccine convenience score and belief in seriousness of VPD score.

of vaccines was high, 94.4 % of parents agreed that vaccines are important and 89.2 % agreed that vaccines are safe. However, the finding that 40.6 % of parents felt concerned about serious side effects suggests that perhaps some parents do not consider vaccine side effects and safety to be related or they might consider that vaccine safety is a more longer-term issue while side effects are immediate complications. This finding warrants further exploration.

4.2. Trusted sources of information on vaccines

The key sources of vaccination information identified by parents were GPs and practice nurses and HSE vaccination information materials. Trust in these official vaccine information sources was high; 91.5 % of parents trust their local healthcare professional and 89.2 % of parents trust official HSE vaccination information.

4.3. Parents with a delay in or a lack of vaccine acceptance

In this study, parental delay in or lack of vaccine acceptance was associated with being a single parent, not currently working and with having a higher number of children. These demographic factors may have influenced the ability of parents to get easy access to vaccination services and more parents who were classified as having a delay in or a lack of vaccine acceptance reported that it was not convenient to access vaccines. This is in keeping with published evidence stating that both vaccine acceptance and hesitancy are multifactorial and influenced by convenience, complacency, in addition to vaccine confidence.

Trust also emerged as a factor influencing parental vaccine attitudes and self-reported vaccination in this study. Levels of trust in all information sources except social media were lower among parents who delayed or missed vaccines and who disagreed that vaccines were safe. In particular, increasing levels of trust in official national vaccination information sources (HSE, government, healthcare professionals) was associated with a lower odds of a parent having a delay in or a lack of vaccine acceptance. There were also differences in parental sources of information, parents with who delayed or missed vaccines and who disagreed that vaccines were safe were less likely to seek vaccine information from their GP or practice nurse but were more likely to seek information from family and friends compared to parents who were not classified as having a delay in or lack of vaccine acceptance.

For those parents who delayed vaccination by more than one month but whose child ultimately received all recommended vaccinations, the COVID-19 pandemic was identified as a key factor, suggesting that the pandemic had an impact on vaccination uptake and contributed to reduced vaccine acceptance. Among the small minority of parents whose child received some but not all vaccines or whose received no vaccinations, 3.0 % of the total study population, safety concerns and concerns about side effects were identified as the key factors in the decision not to vaccinate. This finding emphasises the importance of focusing on vaccine safety information for parents, as well as supporting healthcare professionals to address these concerns, while recognising the multifactorial nature of vaccine hesitancy and the requirement for tailored, multifaceted interventions to build trust and improve vaccine confidence and uptake [11,36].

Among parents whose child received some but not all vaccines (N = 19), it was the 6-month and 13-month vaccines that were most commonly refused. Additional sub-group analysis was limited by small numbers however, this finding should be explored in further research to identify if there are specific issues related to parent experiences with the vaccination process as has been reported in Ireland previously [37].

In this study, a greater proportion of parents who were born in a Central or Eastern European country were classified as having a delay in or lack of vaccine acceptance. While the differences compared to those born in other countries were not statistically significant, this finding is in keeping with international experience [38–40]. This finding suggests the need for further exploration of the factors that may be influencing vaccine uptake in order to build trust and to inform the tailoring of immunisation programmes to build vaccine confidence and improve uptake within this population.

4.4. Implications of the findings of this study

The findings of this study are consistent with published data showing high levels of vaccine confidence among the general population in Ireland and positive attitudes particularly towards the importance of vaccination [41–44]. The findings are also consistent with other studies examining vaccine hesitancy and vaccine acceptance that have identified trust, safety concerns, access to vaccinations and socioeconomic status as factors that influence parental vaccination decisions [3,8,10,13,41]. The high levels of trust in information provided by healthcare professionals in this study emphasises the paramount importance of healthcare professionals as powerful influencers in the decision to accept vaccination [41,45,46]. This includes the ability to provide information about vaccine side effects and reassurance about robust vaccine safety monitoring [8]. It is important that healthcare professionals are supported to address parental concerns and to communicate with parents who may be hesitant about vaccines; [36,47] a specific elearning module has been developed by the National Immunisation Office in Ireland for healthcare professionals to facilitate this.

While this study has demonstrated a strongly positive sentiment towards childhood vaccination among parents of young children in Ireland and supports the effectiveness of national vaccine information, a minority of parents have demonstrated a delay in or lack of vaccine acceptance and concerns about vaccine safety. This requires further exploration.

Convenience and barriers to accessing vaccination services among parents with lower vaccine acceptance need to be explored further based on the results of this survey. There is a need for further qualitative research to assess in greater depth the context

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specific factors associated with vaccine hesitancy and vaccine acceptance in Ireland, particularly the factors associated with low levels of trust in information sources. There is also a need to further understand parental vaccine safety concerns to tailor immunisation information and to ensure that concerns can be addressed comprehensively by trusted healthcare professionals. Further research is also required to explore attitudes towards vaccination and access to vaccination services amongst parents from vulnerable and underserved populations, and those from migrant communities who may not be represented in this survey.

Further understanding of the reasons for delays in or a lack of vaccine acceptance followed by tailoring communication, building trust, engaging communities, increasing access to vaccination services and addressing structural causes of inequality is paramount [3,10,48].

4.5. Strengths

The findings of this study will support national immunisation programmes in Ireland to design, plan and tailor responses to build and sustain vaccination uptake. It is anticipated that this survey will be repeated at intervals which will enable tracking of parental attitudes towards vaccination over time, exploring attitudes and perceptions towards childhood immunisations and perceptions and intentions towards new vaccines within the Irish population. The results are useful and informative for planning further research, developing immunisation information and for informing an approach to addressing national vaccine uptake that is below the WHO recommended thresholds [49].

4.6. Limitations

As with all surveys, there is a risk of selection bias in this study as those who have negative attitudes towards vaccination or who have not vaccinated their child may be less likely to have participated in this survey. In addition, while this study was a large representative sample of the parental population and its findings are likely to be generalisable to the population who are accepting of vaccines, there were only a small number of parents (N = 70)who were classified as having a delay in or lack of vaccine acceptance. Overall, less than 1 % of the study population (N = 7) stated that their child was never vaccinated. This limited the classification of parents as being "vaccine hesitant" and limited analysis of the parental factors associated with vaccine hesitancy in Ireland. A delay in and lack of vaccine acceptance was examined however small numbers in this category limited the ability for subgroup analysis and it is important to consider the public health and clinical significance in observed statistically significant differences between groups where the numbers are small. In this quantitative survey, there were limitations to the attitudes towards vaccination that could be explored, and therefore, there is a need for qualitative research to explore attitudes further. Additionally, the definition of a delay in or lack of vaccine acceptance in this study included parents who delayed and missed vaccines and also parents who disagreed that vaccines were safe. There may have been differences in vaccine attitudes between these groups of parents which were not examined in this study.

Another source of selection bias is that individuals who do not own a mobile telephone or who were not able to complete the telephone survey due to language difficulties were excluded. Additional research is required to examine vaccination attitudes within these populations. This is especially important as parents from socio-economically disadvantaged or marginalised groups and from migrant communities may be under-represented as a result.

Childhood immunisation uptake was self-reported and the vaccine status of children was not verified. Self-reporting may be unreliable and in addition there was a risk of recall bias or a risk of the provision of socially acceptable responses to questions. However, due to the potentially sensitive nature of the questions related to attitudes and actions towards childhood vaccinations, anonymised surveys may provide more valid, reliable and complete data compared to personally identifiable data collection methods. Ireland does not currently have a national immunisation information system so verification of self-reported vaccination status would not be possible. Missed vaccines were recorded by the timing of when the vaccine was due e.g., 12-month vaccines and not by vaccine type e.g., MMR vaccine or Meningococcal B vaccine. Therefore, it was not possible to assess if parents had decided to refuse particular vaccines for their child.

Nonetheless, this is the first national survey of parents' views on childhood vaccination in Ireland and the results of this study will inform the development of targeted interventions to increase the uptake of childhood vaccines delivered as part of the national childhood primary immunisation programme.

5. Conclusion

This study has shown that there is a strongly positive sentiment towards childhood vaccinations among parents of children aged 0 to 48 months in Ireland with high uptake and strong belief in the importance and safety of vaccines. Official sources of information were trusted, with particular trust in healthcare professionals and HSE vaccination information highlighting the importance of trusted healthcare professionals in the provision of vaccine information to parents. Parents who had lower level of vaccine acceptance reported lower levels of trust in official vaccine information sources. Safety concerns and concern about vaccine side effects were the most commonly identified as reasons for delayed and missed vaccines emphasising that vaccine information material should focus on vaccine safety. This study adds to the understanding of parental attitudes towards vaccination in Ireland and will inform public health action to build trust, engage communities in order to increase and sustain the uptake of childhood vaccines delivered as part of the national childhood primary immunisation programme in Ireland.

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All authors attest they meet the ICMJE criteria for authorship.

Data availability

The authors do not have permission to share data.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The National Immunisation Office, Dublin Ireland reports administrative support was provided by Ipsos MBRI.

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Appendix A. Immunisation schedule in Ireland

See Table A1.

Table A1

Primary childhood immunisation schedule in Ireland.

Age	Vaccinations
2 months	6 in 1, PCV, Men B, Rotavirus
4 months	6 in 1, Men B, Rotavirus
6 months	6 in 1, PCV and Men C
12 months	MMR and Men B
13 months	Hib/Men C and PCV

6 in 1 = Diphtheria, tetanus, pertussis, Haemophilus influenzae type b (Hib), polio (inactivated) vaccine. PCV = Pneumococcal conjugate vaccine. MMR = Measles Mumps Rubella vaccine. Men B = Meningococcal B vaccine. Men C = Meningococcal C vaccine. Hib/Men C = Haemophilus influenzae type b, Meningococcal C combined vaccine.

Appendix B. Creation of a delay in or a lack of vaccine acceptance scales

See Table A2.1, Table A2.2, Table A2.3.

Table A2.1

Variables included in correlation matrix.

Category	Variable	Question: To what extent do you agree or disagree with the following statement
Importance	q17a	The effectiveness of vaccines against infectious diseases has been scientifically proven
Importance	q17b	Childhood vaccinations do more good than harm
Importance	q17d	Vaccines are important for children to have
Importance	q17e	If we stop vaccinating children many diseases could return
Importance	q20c	Vaccines are important for my child to have
Importance	q26b	Children vaccinated to protect others with weaker immune system
Official trust	q19a	I trust information I am given on vaccination from local HCW
Official trust	q19b	HCWs often provide biased or incomplete information on side effects
Official trust	q19c	I trust the information I am given on vaccination by the HSE
Official trust	q19d	I trust the information I am given on vaccination by the government
Official trust	q19e	I'm convinced that the government purchases the highest quality vaccines available
Official trust	q24d	Generally, I do what my doctor or healthcare professional recommend about childhood vaccines
Unofficial trust	q19f	I trust the information I am given on vaccination by family/friends
Unofficial trust	q19g	I trust the information I am given on vaccination by the media
Unofficial trust	q19h	I trust the information I am given on vaccination on social media
Convenience	q24a	The time involved visiting the GP's office is worth it just for receiving a childhood vaccination
Convenience	q24b	It is convenient to get my child vaccinated

Table A2.2										
Correlation	matrix	for variables	included	in '	Table A	21.	Spearman's	correlation	coeffi	rien

	q17a	q17b	q17d	q17e	q20c	q26b	a19a	q19b	q19c	q19d	q19e	q24d	q19f	q19g	q19h	q24a	q24b
q17a	1	0.542	0.584	0.483	0.454	0.286	0.437**	0.308**	0.454**	0.479**	0.425	0.427**	0.149**	0.119	-0.022	0.316	0.287**
q17b	0.542	1	0.565	0.455	0.457	0.319	0.377	0.237	0.423	0.388	0.363	0.367	0.124	0.033	-0.087*	0.304	0.328
q17d	0.584	0.565	1	0.607	0.562	0.361	0.463	0.212	0.484	0.490	0.410	0.437	0.188	0.144	0.044	0.350	0.334
q17e	0.483	0.455	0.607	1	0.483	0.385	0.394	0.268	0.408	0.401	0.333	0.358	0.131	0.126	-0.082*	0.364	0.312
q20c	0.454	0.457	0.562	0.483	1	0.558	0.523	0.256	0.574	0.460	0.407	0.565	0.199	0.166	0.026	0.471	0.383
q26b	0.286	0.319	0.361	0.385	0.558	1	0.424	0.210	0.495	0.381	0.293	0.478	0.148	0.079*	-0.028	0.432	0.371
q19a	0.437	0.377	0.463	0.394	0.523	0.424	1	0.264	0.643	0.551	0.456	0.514	0.286	0.122	0.041	0.450	0.435
q19b	0.308	0.237	0.212	0.268	0.256	0.210	0.264	1	0.341	0.285	0.189	0.210	-0.029	0.009	-0.203	0.264	0.201
q19c	0.454	0.423	0.484	0.408	0.574	0.495	0.643	0.341	1	0.712	0.563	0.534	0.224	0.157	0.035	0.389	0.388
q19d	0.479	0.388	0.490	0.401	0.460	0.381	0.551	0.285	0.712	1	0.657	0.463	0.210	0.262	0.095	0.311	0.357
q19e	0.425	0.363	0.410	0.333	0.407	0.293	0.456	0.189	0.563	0.657	1	0.389	0.283	0.185	0.142	0.221	0.326
q24d	0.427	0.367	0.437	0.358	0.565	0.478	0.514	0.210	0.534	0.463	0.389	1	0.262	0.180	0.106	0.483	0.477
q19f	0.149	0.124	0.188	0.131	0.199	0.148	0.286	-0.029	0.224	0.210	0.283	0.262	1	0.288	0.349	0.143	0.174
q19g	0.119	0.033	0.144	0.126	0.166	0.079*	0.122	0.009	0.157	0.262	0.185	0.180	0.288	1	0.559	0.059	0.066
q19h	-0.022	-0.087*	0.044	-0.082*	0.026	-0.028	0.041	-0.203	0.035	0.095	0.142	0.106	0.349	0.559	1	-0.090	-0.012
q24a	0.316	0.304	0.350	0.364	0.471	0.432	0.450	0.264	0.389	0.311	0.221	0.483	0.143	0.059	-0.090	1	0.450
q24b	0.287	0.328	0.334	0.312	0.383	0.371	0.435	0.201	0.388	0.357	0.326	0.477	0.174	0.066	-0.012	0.450	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

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Table A2.3

Delay in or lack of vaccine acceptance by mean and median Likert scale score and inter quartile range (IQR).

	Delay in or lack of vaccine acceptance (N = 70)			No delay acceptan	in or lack of vac ce (N = 686)	cine	Total (N = 756)			
	Mean	Median	IQR	Mean	Median	IQR	Mean	Median	IQR	
Importance score	3.6	4	2.5-5	4.7	5	4.5-5	4.6	5	4-5	
Official source trust score	2.9	3	1.5-4	4.6	5	4-5	4.4	5	4-5	
Unofficial source trust score	2.4	2	1-3	2.8	3	2-4	2.7	3	2-4	
Convenience score	3.5	3.5	3-5	4.5	5	4-5	4.4	5	4-5	
Seriousness of VPD score	4.0	4	3–5	4.6	5	4-5	4.5	5	4–5	

Appendix C. Regression model 2

See Table A3.

Table A3

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Parental factors associated with having a delay in or a lack of vaccine acceptance: Full regression model 2.

	Unadjuste	d			Adjusted	1			
	OR	CI Lower	CI Upper	p-value	aOR	CI Lower	CI Upper	p-value	
Age Category Parent									
16–29 years	1.0 (Ref)				1.0 (Ref)				
30–39 years	0.37	0.15	0.92	0.033	0.57	0.19	1.71	0.320	
Over 40 years	0.50	0.19	1.30	0.159	0.49	0.14	1.74	0.274	
Gender Parent									
Male	1.0 (Ref)								
Female	1.42	0.71	2.79	0.316	-	-	-	-	
Level of Education									
Upper secondary or less	1.0 (Ref)								
Vocational or Certificate	1.40	0.69	2.87	0.354	-	-	-	-	
Bachelor degree	1.08	0.53	2.22	0.826	-	-	-	-	
Postgraduate or PhD	0.45	0.20	1.04	0.063	-	-	-	-	
Region/Country of Birth									
Ireland	1.0 (Ref)								
Northern/Western/Southern Europe*	0.76	0.17	3.38	0.722	-	-	-	-	
Central/Eastern Europe*	2.23	0.81	6.13	0.119	-	-	-	-	
Rest of World	0.28	0.06	1.29	0.101	-	-	-	-	
Relationship status									
Married	1.0 (Ref)				1.0 (Ref)				
Single parent	3.82	1.54	9.43	0.004	1.82	0.49	6.77	0.371	
Co-habiting	1.62	0.68	3.85	0.273	1.23	0.47	3.23	0.675	
Occupational status									
Working for payment	1.0 (Ref)				1.0 (Ref)				
Not working	6.45	2.02	20.59	0.002	1.73	0.25	12.02	0.578	
Full time homemaker	1.60	0.69	3.75	0.271	1.26	0.35	4.52	0.728	
Religious									
Vec	1.0 (Ref)								
No	0.87	0.34	2 55	0 772	_	_	_		
Refused to answer	0.55	0.12	2.33	0.434	_	_	_		
	0.55	0.12	2.15	0.151					
Annual income	10 (0.6)				10 (0.5)				
	1.0 (Rel)	0.17	0.02	0.020	1.0 (Kel)	0.22	2.01	0.745	
Did not report income	0.40	0.17	0.92	0.050	0.81	0.22	2.91	0.743	
	0.05	0.28	1.41	0.201	0.80	0.29	2.55	0.788	
Number of children									
1	1.0 (Ref)				1.0 (Ref)				
2	1.28	0.54	3.07	0.577	0.78	0.29	2.09	0.626	
3	2.77	1.14	6.73	0.025	1.59	0.56	4.51	0.382	
4+	3.62	1.27	10.31	0.016	1.83	0.45	7.51	0.400	
Vaccine Attitude Median Score	Unadj	usted			Adjuste	d ^a			
	OR	CI Lower	CI Upper	p-value	aOR	CI Lower	CI Upper	p-value	
Vaccine importance	0.24	0.16	0.34	<0.001	1.01	0.55	1.87	0.965	
Trust in official vaccine information	0.20	0.13	0.31	<0.001	0.27	0.16	0.46	<0.001	
Trust in unofficial vaccine information	0.77	0.56	1.05	0.096	-	-	-		
Vaccine convenience	0.29	0.21	0.41	<0.001	0.61	0.62	1.07	0.088	
Belief in seriousness of VPD	0.25	0.15	0.43	<0.001	0.69	0.37	1.27	0.235	

^a Adjusted for age, relationship status, occupational status, number of children and annual income and vaccine importance score, trust in official vaccination information sources score, vaccine convenience score and belief in seriousness of VPD score.

* As defined by the OECD [50].

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