Critique Open Research & Review (CORR)

eISSN: 3023-3267

Volume. 03, Issue. 06, pp. 01-20, November 2025"

Parents' Sociodemographic Characteristics and Childhood Vaccine Hesitancy in The United Kingdom

Kennedy Oberhiri Obohwemu, PhD

Senior Lecturer, Faculty of Health, Wellness and Life Sciences, Leeds Trinity University, SSS Partnership, Birmingham Campus, United Kingdom; and PENKUP Research Institute, Birmingham, United Kingdom

Article received: 10/02/2025, Article Revised: 10/14/2025, Article Accepted: 09/28/2025 Article Published: 11/20/2025

DOI: https://doi.org/10.55640/corr-v03i06-01

ABSTRACT

Background: Vaccine hesitancy is a growing public health concern, undermining efforts to achieve optimal immunisation coverage. This study explores the relationship between sociodemographic characteristics and vaccine hesitancy among parents of children aged 0 to 6 years in the United Kingdom.

Methods: A cross-sectional survey was conducted with 818 parents and guardians recruited using convenience and snowball sampling. Data were collected via an online questionnaire hosted on Qualtrics, assessing sociodemographic factors and attitudes toward childhood vaccinations using the validated Parent Attitudes about Childhood Vaccines (PACV) scale. Scores ranged from 0 to 100, with scores above 50 indicating vaccine hesitancy. Descriptive and inferential analyses, including regression and ANOVA, were performed using SPSS to identify key determinants of hesitancy.

Results: Parents' sociodemographic characteristics, including age, ethnicity, and political ideology, significantly influenced vaccine hesitancy. Older parents and those identifying as "White Other" exhibited the highest levels of hesitancy. Distrust in healthcare systems and concerns over vaccine safety were major contributing factors. Participants relying on social media for vaccine information demonstrated higher hesitancy rates, emphasizing the role of misinformation. No significant differences in hesitancy were observed by income or education level.

Conclusion: Addressing vaccine hesitancy requires targeted public health strategies, including culturally sensitive communication, improved healthcare accessibility, and combating misinformation. This study underscores the importance of tailoring interventions to specific sociodemographic groups to enhance vaccine uptake and protect public health.

Keywords: Vaccines, Hesitancy, Parents, Health, Sociodemographics.

1. INTRODUCTION

Vaccine hesitancy presents a significant threat to global health, as noted by the World Health Organization (WHO, 2019a). While vaccines prevent approximately 2–3 million deaths annually (WHO, 2023), over 19 million infants worldwide missed routine immunization services in 2018 (WHO, 2019b). Effective vaccination programs rely on high coverage to provide direct protection to vaccinated individuals and herd immunity for communities (CDC, 2023). However, vaccine hesitancy, defined as a "delay in acceptance or refusal of vaccines despite the availability of vaccination services," is a complex issue that varies across time, place, and vaccines (MacDonald & SAGE Working Group, 2015).

Vaccine-hesitant individuals are heterogeneous, often accepting some vaccines while refusing or delaying others (Opel et al., 2013; European Centre for Disease Prevention and Control, 2017; Obohwemu, 2024a). In the

UK, vaccine hesitancy among parents has gained attention, particularly during the COVID-19 pandemic and subsequent vaccine rollouts (Baumgaertner et al., 2018; Khosravi, 2020; Siegrist et al., 2021; Obohwemu, 2025). Poorly managed vaccination efforts can lead to disease outbreaks, as demonstrated by the 2015 measles outbreak in California (Majumder et al., 2015). To prevent such outbreaks, the WHO recommends 95% vaccine coverage (WHO, 2019c). However, global measles vaccination rates in 2018 fell short, with only 86% of children receiving the first dose and 69% receiving the second (WHO, 2019d). Between 2010 and 2017, an estimated 169 million children globally missed their first dose of the measles vaccine, with the UK ranking third among high-income countries, having over half a million unvaccinated children (UNICEF, 2019).

Recent data on MMR vaccine coverage in England reveals a gradual but consistent decline over the past decade—from 91.6% in 2010–11 to 88.9% in 2023–24 (NHS Digital, 2024; UKHSA, 2025). MMR vaccine coverage for children aged 24 months dropped from 91.2% in 2017–18 to 90.3% in 2018–19, with London reporting the lowest rate at 83% (NHS, 2019). While year-on-year changes may appear modest, the cumulative trend is concerning, particularly in light of the WHO's 95% target for herd immunity.

Unsurprisingly, disease outbreaks have followed, with 991 confirmed measles cases in England and Wales in 2018, up from 284 in 2017 (Public Health England, 2019). These declines contributed to the UK losing its "measles-free" status in 2019 (Stewart & Sayer, 2021).

Vaccine-preventable diseases impose significant health and economic burdens. For instance, treating a single pertussis case costs over $4,000, while vaccines can save up to $90 billion in lifetime healthcare costs (Moser et al., 2015). High vaccination rates also provide herd immunity, protecting vulnerable populations such as infants, pregnant women, and immunosuppressed individuals (Omer et al., 2009; Fine, Eames & Heymann, 2011; Obohwemu, 2022).

Key barriers to vaccination include vaccine hesitancy, supply issues, and cost concerns. Hesitancy has been observed across various vaccines, including those for H1N1 influenza, HPV, and COVID-19 (Karafillakis et al., 2019; Lin et al., 2021; Obohwemu, 2025). Factors influencing vaccine uptake include demographic characteristics, previous vaccination history, and perceptions of vaccine safety and efficacy (Anastasiou & Heger, 2021; Patelarou et al., 2021; Martinelli & Veltri, 2022).

This study aims to identify sociodemographic factors associated with vaccine hesitancy among parents in the UK. To date, there has been limited exploration of this issue in the UK. By addressing this gap, the study seeks to inform decision-makers and guide strategies to mitigate hesitancy and improve public health.

2. MATERIAL AND METHODS

2.1 Research Question

To what extent do parents' sociodemographic characteristics—such as age, gender, education level, income, and number of children—predict attitudes toward childhood vaccination, as measured by PACV scores?

2.2 Research Hypothesis

This study was guided by the hypothesis that parents' sociodemographic characteristics significantly correlate with childhood vaccine hesitancy. Specifically, it posited that these characteristics, including age, education, income, ethnicity, and political ideology, would influence parental attitudes and behaviours toward childhood immunisations.

2.3 Study Design and Population

A cross-sectional survey was conducted among 818 parents and guardians of children aged 0 to 6 years in the United Kingdom. This age group was chosen because it falls within the recommended vaccination schedule for children under seven, a period often associated with vaccine hesitancy due to concerns about the frequency and timing of immunisations (Opel et al., 2013; Public Health England, 2023). To ensure data integrity and avoid duplication, participants were asked to provide information on only one child in their household, typically the one requiring immunisation at the time of data collection (Tsuzuki et al., 2020).

2.4 Sampling Techniques

The study employed a combination of convenience and snowball sampling techniques. Convenience sampling was conducted through professional networks and institutional mailing lists, targeting individuals who met the inclusion criteria and were willing to participate. Where personal contacts were involved, steps were taken to ensure diversity and minimise bias. Snowball sampling was subsequently used to extend the survey's reach. This approach relied on initial participants recommending others who met the inclusion criteria, thereby leveraging social networks to expand the sample (Parker, Scott & Geddes, 2019). This dual-sampling approach facilitated access to a diverse group of participants across different sociodemographic categories.

While non-probability sampling methods can limit generalisability and introduce potential bias, the chosen strategy was considered appropriate given the exploratory nature of the study and the need to engage participants who might not be reached through formal recruitment channels. Inclusion criteria were clearly defined, and diversity within the sample was monitored throughout the process to mitigate the risk of network homogeneity.

The sampling approach was justified on the basis that it facilitated meaningful participation, particularly among individuals less likely to engage through conventional means. It aligned with the study's aim to generate rich, practice-informed insights while respecting ethical considerations and participant accessibility. The methodology reflected a balance between pragmatic recruitment and a commitment to inclusivity, transparency, and rigour.

2.5 Data Collection

Data were collected using an online survey designed and hosted on Qualtrics, a secure electronic data collection platform provided by the University of Sunderland. Participants were directed to the survey through social media campaigns, Google advertisements, and promotional videos shared widely online. A video presentation of the study, delivered at the 2021 Public Health England Research and Science Conference, further enhanced visibility and recruitment.

2.6 Study Instrument

The survey consisted of two main sections. The first section gathered sociodemographic information, including age, gender, marital status, education level, household income, ethnicity, and political and social ideologies. These variables were selected based on prior research indicating their potential influence on vaccine hesitancy (Opel et al., 2011a; Opel et al., 2011b; Opel et al., 2013). The second section utilized the Parent Attitudes about Childhood Vaccines (PACV) scale, a validated tool for assessing vaccine hesitancy in high-income settings (Omer et al., 2009; Opel et al., 2013). The PACV scale comprises 15 items divided into three subdomains: behaviour, safety and efficacy, and general attitudes. Responses were scored on a scale from 0 to 100, with higher scores indicating greater vaccine hesitancy. Scores above 50 were classified as hesitant (Azizi et al., 2017).

2.7 Variables

The primary response variable was vaccine hesitancy, operationalised through the validated PACV scale. Sociodemographic characteristics—including age, gender, education level, household income, and number of children—were treated as explanatory variables. Education was categorised into seven levels, ranging from GCSE or equivalent to doctoral degrees, while the number of children was grouped into four categories: one, two, three, and four or more.

2.8 Statistical Analysis

Data were analyzed using SPSS software (version 26.0). Descriptive statistics were used to summarize responses. Univariate analyses, including chi-squared tests, examined associations between sociodemographic variables and vaccine hesitancy. Regression analysis further explored the direction and strength of these associations. Analysis of variance (ANOVA) was employed to identify significant differences in vaccine hesitancy based on factors such as marital status, household income, number of children, and political ideology.

2.9 Ethical Considerations

Ethical approval was obtained from the University of Sunderland's ethical committee. Participation was entirely voluntary, and respondents could skip questions they found uncomfortable. Anonymity and confidentiality were maintained through secure data collection methods, including the deactivation of IP tracking and external cookies. The study adhered to the UK Research Integrity Office Code of Practice for Research, ensuring that all data were used solely for research purposes and stored securely to protect participant privacy (Desmond & Dierickx, 2021).

This rigorous methodological framework ensured the collection of high-quality, reliable data, offering valuable insights into the factors influencing vaccine hesitancy among parents in the United Kingdom.

3. RESULTS

3.1. Participants' Characteristics

A total of 818 eligible parents and guardians completed the survey. Due to the use of convenience and snowball sampling—both of which lack a predefined sampling frame—it was not feasible to calculate a formal response rate for the study. Of these respondents, 44 were removed from the analysis of the data because of inconsistent answers or incomplete data, leaving 774 respondents. Each participant's missing data were unique, and no pattern could be found. Given that just 5% of the sample had missing data, it was deemed reasonable to exclude them from the analyses (Petrie & Sabin, 2019).

About half of the research participants were White British, one-fifth were White Other, and just a small

number were Black British or Black Caribbean, according to an analysis of their sociodemographic features (Table 1). Most of the participants were more socially or politically conservative.

Table 1: Sociodemographic Characteristics of the study participants

Variables	Median (IQR)*	Frequency	Percentages
Marital Status			
Married		369	47.7
Single		201	26.0
Living with a partner		89	11.5
Widowed		59	7.6
Separated		40	5.2
Divorced		15	1.9
Annual household Income			
£20,000 or less		215	28.0
£20,001-£40,000		310	40.3
£40,001-£60,000		186	24.2
£60,001 or more		58	7.5
Number of Children			
One		158	20.7
Two		258	33.7
Three		253	33.1
Four or More		96	12.5
Ethnicity			
White British		392	50.6
White Other		162	20.9
Black African		121	15.6
Black British		52	6.7
Others		30	3.9
Asian		9	1.0
Black Caribbean		8	1.0
Child's Birth Order			
First Child		555	71.9
Not First Child		216	28.1
Relationship			
Father		211	27.4
Mother		295	38.2
Other		265	34.4
Political ideology			

0-4	3 (2)	150	19.7
5		168	22.0
6-10	9 (2)	445	58.3
Social ideology			
0-4	4 (2)	114	14.9
5		176	23.0
6-10	8 (2)	475	62.1

*IQR = Interquartile range

The table summarizes the sociodemographic characteristics of the study participants, including marital status, annual household income, number of children, ethnicity, child's birth order, parental relationship to the child, and political and social ideologies. Median values and interquartile ranges (IQR) are provided where applicable, along with frequency counts and percentages. Among marital status categories, married participants formed the largest group (47.7%). Annual household income was divided into four brackets, with the majority (40.3%) falling within £20,001–£40,000. Families with two (33.7%) or three (33.1%) children were most common. Ethnicity data revealed White British participants as the largest group (50.6%), followed by White Other (20.9%) and Black African (15.6%). Most respondents (71.9%) reported their child as a firstborn. Mothers made up the largest share of parental relationships (38.2%). Political and social ideologies were measured on a 0–10 Likert scale, with most participants clustering in the higher range (6–10), indicating stronger ideological leanings. The IQR reflects variability within these responses. This table provides an essential overview of the participants' demographic and ideological profiles, offering critical context for understanding factors influencing vaccine hesitancy in the studied population.

About half of the participants were females (49.5%), over one third were between the ages of 25-34 years (37.8%), while over one quarter of them had bachelor's degree (25.8%). Parental age was classified as 18-24, 25-34, 35-44, 45-54, 55-64, and greater than 64 years.

To ascertain if there were notable variations in participants' vaccine hesitancy due to differences in sociodemographic characteristics, analysis of variance (ANOVA) was used. The findings revealed that marital status, ethnicity, political ideology, and social ideology accounted for notable variations in participants' vaccine hesitancy. Married participants were significantly more vaccine hesitant than unmarried ones (P = 0.015). In comparison with other ethnic groups, respondents who were classified as White Other were the most vaccine hesitant (<0.001). Respondents who identified as being conservative politically (<0.001) or socially (<0.001) had greater inclinations to embrace vaccinations (Table 2a).

Table 2a: Summary of Analysis of Variance between Sociodemographic Characteristics and Vaccine Hesitancy (I)

Variables	Frequency	Mean	F stat (P value)
Marital Status			
Divorced	15	64.87_{ab}	
Living with a partner	89	60.09_{a}	
Married	369	65.73_{b}**	2.835 (0.015)
Separated	40	62.33_{ab}	
Single	201	64.07_{ab}	
Widowed	59	64.41_{ab}	
Annual household Income			
£20,000 or less	215	65.66_{a}	

£20,001-£40,000	310	63.42_a	1.971 (0.117)
£40,001-£60,000	186	63.54_a	
£60,001 or more	58	66.57_a	
Number of Children			
One	158	64.94	
Two	258	64.03	0.293 (0.831)
Three	253	64.06	
Four or More	96	65.09	
Ethnicity			
Black African	121	62.66_a	
Black British	52	58.15_a	
Black Caribbean	8	56.63_a	18.57 (<0.001)
Asian	9	53.76_a	
White British	392	63.23_a	
White Other	162	72.21_b***	
Others	30	58.05_a	
Child's Birth Order			
First Child	555	64.28	-0.313 (0.754)^t
Not First Child	216	64.62	
Relationship			
Father	211	63.74	
Mother	295	63.65	0.208 (0.813)
Other	265	61.64	
Political ideology			
0-4	150	59.28_a	
5	168	61.14_a	35.15 (<0.001)
6-10	445	67.80_b***	
Social ideology			
0-4	114	61.60	
5	176	58.92	25.13 (<0.001)
6-10	475	66.79*	

a, b = subscripts for indicating statistical significance within groups in a variable. t is p value for t statistic; **P<0.05, ***p<0.001.

The table presents ANOVA results analysing the relationship between sociodemographic characteristics and vaccine hesitancy. Significant differences are noted for marital status, ethnicity, political ideology, and social ideology, with White Other participants and those with higher ideological scores showing higher hesitancy (p<0.001). Other variables, including annual household income, child's birth order, and number of children, showed no significant differences. Subscripts indicate within-group differences, and asterisks denote

significance levels (*p<0.05, ***p<0.001). This summary highlights key demographic and ideological factors influencing vaccine hesitancy.

While substantial variations could not be seen in vaccine hesitancy due to gender and level of education, age accounted for a strong influence on vaccine hesitancy among the participants. Alternatively put, vaccine hesitancy varied in a statistically meaningful way based on observed differences in the age groups. Vaccine hesitancy was higher for older participants than for younger ones, as shown in Table 2b.

Table 2b: Summary of Analysis of Variance between Sociodemographic Characteristics and Vaccine Hesitancy (II)

Items and Response	Total sample n (%)	Mean (±SD)	P-value
Gender			
Female	379 (49.5)	49.0(±15.5)	0.170
Male	291 (38.0)	49.1.1(±15.7)	
Non-binary/Third gender	51 (6.7)	47.2(±18.3)	
Prefer not to say	44 (5.7)	54.7 (±13.3)	
Age			
18-24	129 (16.7)	48.0(±16.4)	0.001**
25-34	292 (37.8)	47.9(±16.2)	
35-44	216 (28.0)	47.9(±15.4)	
45-54	84 (10.9)	53.2(±14.5)	
55-64	38 (4.9)	56.0(±12.9)	
Greater than 64	13(1.7)	57.7(±13.9)	
Education Level			
GCE	80 (10.4)	49.9 (±16.8)	0.606
Some college, but not a graduate	85 (11.0)	48.0 (±17.1)	
Certificate of Higher Education	119 (15.5)	49.9(±16.4)	
Diploma of Higher Education	130 (16.9)	46.8(±16.4)	
Bachelor's Degree	199 (25.8)	49.3(±14.7)	
Master's Degree	107 (13.9)	49.3(±13.5)	
Doctorate Degree	50 (6.5)	50.8(±18.3)	

The table summarizes the results of the analysis of variance (ANOVA) examining the relationship between sociodemographic characteristics and vaccine hesitancy. Key variables include gender, age, and education level, with the mean and standard deviation (SD) of vaccine hesitancy scores presented for each category. Significant differences were observed for age (p=0.001), indicating that older age groups exhibit higher levels of vaccine hesitancy. No statistically significant differences were found for gender or education level. P-values indicate the statistical significance of observed differences, and the results highlight sociodemographic factors influencing vaccine hesitancy.

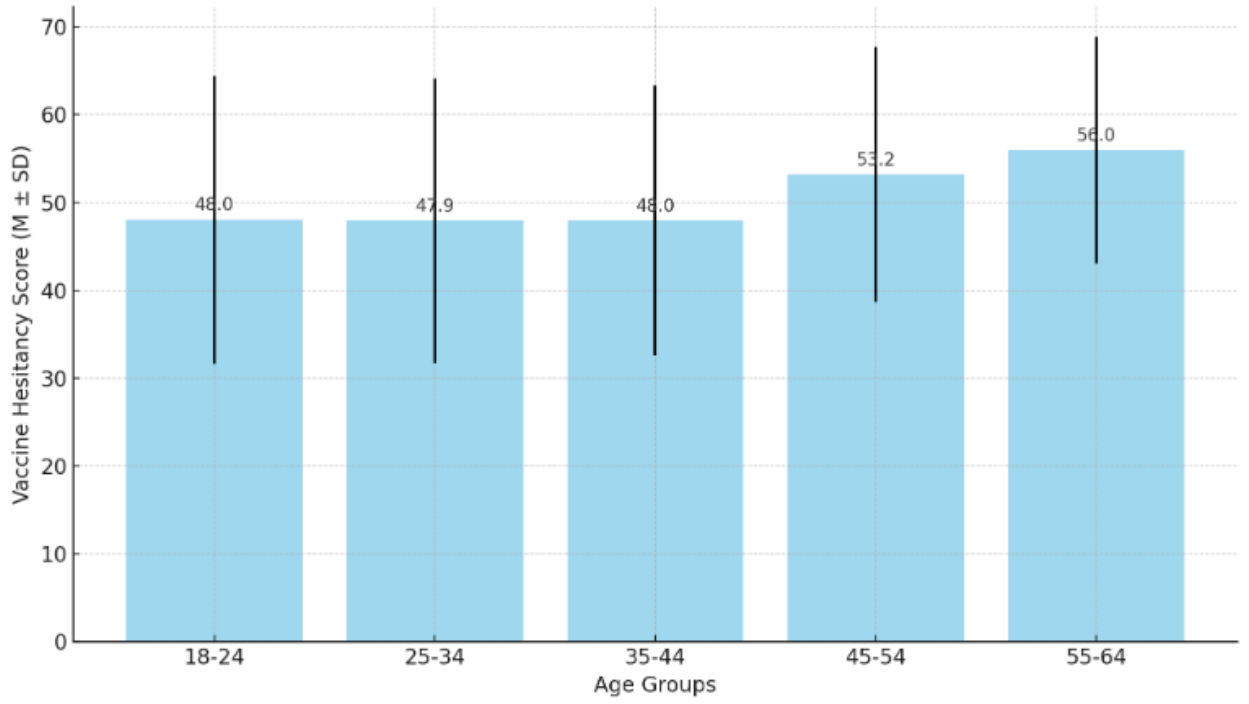
A Post Hoc analysis further conducted to determine the source of the difference revealed that participants between the ages of 45-54, 55-64, and above 64 years were more hesitant than those younger than them (P<0.05) (see Table 3 and Figure 1).

Table 3: Post Hoc Analysis of the difference in level of Vaccine Hesitancy by Age

Age	M(±SD)	B	C	D	E	f
a. 18-24	48.04(±16.4)	0.12	0.09	-5.17**	-7.95**	-9.64**
b. 25-34	47.92(±16.2)	.	-0.32	-5.29**	-8.08**	-9.77**
c. 35-44	47.95(±15.4)			.-5.26**	-8.05**	-9.73**
d. 45-54	53.21(±14.5)				-2.78	-4.47
e. 55-64	56.00(±12.9)					-1.69

The table presents mean vaccine hesitancy scores (M ± SD) across five age groups: (a) 18–24, (b) 25–34, (c) 35–44, (d) 45–54, and (e) 55–64 years. Post hoc comparisons were conducted using a Tukey HSD test to determine differences in vaccine hesitancy between groups. The columns labelled B, C, D, E, and f denote the pairwise comparisons between the age group listed in the row (reference group) and other groups. Negative values indicate lower vaccine hesitancy in the reference group compared to the comparison group. Statistically significant differences are marked with ** ($p < 0.01$). For example, vaccine hesitancy in the 18–24 age group was significantly lower than in the 45–54 ($p < 0.01$) and 55–64 ($p < 0.01$) age groups.

Fig. 1: Vaccine Hesitancy by Age Group



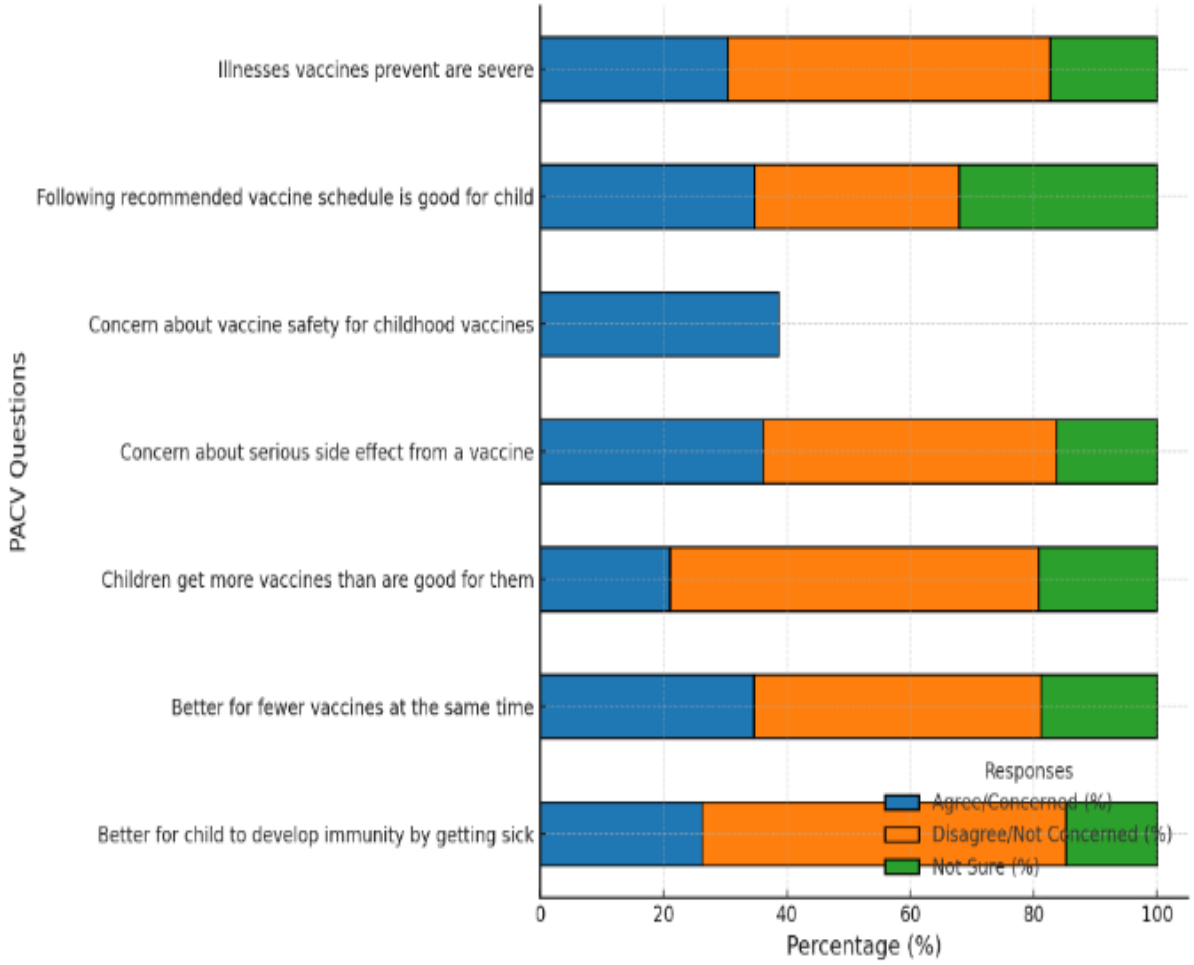
The figure presents the mean vaccine hesitancy scores (M ± SD) for each age group derived from post hoc analysis of the differences in vaccine hesitancy. The x-axis represents the age groups: (a) 18–24, (b) 25–34, (c) 35–44, (d) 45–54, and (e) 55–64 years, while the y-axis shows the vaccine hesitancy scores. Error bars denote standard deviations (±SD). The data highlight a trend of increasing vaccine hesitancy with age, with the highest mean score observed in the 55–64 age group.

3.2. Descriptive Data on PACV Items

Descriptive analysis of PACV questions (see Supplementary Material) revealed that only about one

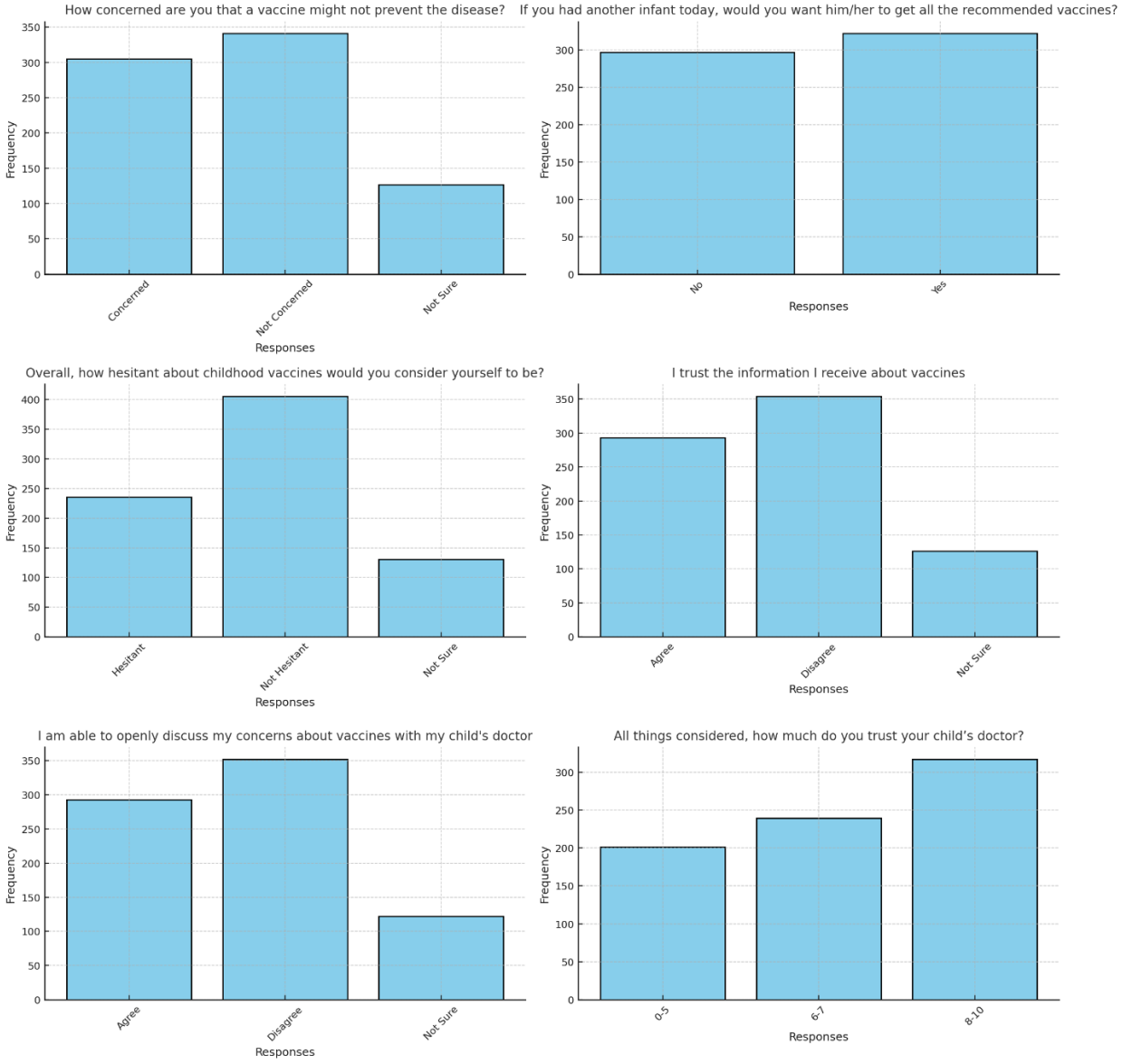
third of the participants strongly stated their belief that adhering to official immunisation guidelines was a wise decision (Figure 2 and Figure 3). About a third of them agreed that: “children get more vaccines than are good for them”; “many of the illness that vaccines prevent are severe”; “it was better for children to develop immunity by getting sick than to get a vaccine”; and “it was better for children to get fewer vaccines at the same time”. A third of the respondents could rely on the advice they had been given regarding vaccines and another third felt comfortable discussing their vaccination concerns with their children's doctor in an open manner. Similarly, about a third of participating parents expressed concerns that: the safety of any children immunisations is not guaranteed; their children could get severe adverse effects from vaccinations; and the illness might not be prevented by a vaccination. A little above half of the participants indicated that they would be happy to embrace vaccinations for their next baby if they had one, and similar proportion considered themselves not being hesitant about childhood vaccines. However, four out of every ten of them highly indicated that they trust their children’s doctor.

Fig. 2: PACV Questions: Response Proportions



The chart presents the distribution of responses to key items from the Parent Attitudes about Childhood Vaccines (PACV) questionnaire, reflecting parental attitudes and concerns regarding childhood vaccination. Each bar represents the proportion of participants who either agreed, disagreed, or were uncertain in response to specific statements about vaccine schedules, safety, and administration practices. The responses are categorized based on levels of agreement and displayed as percentages of the total participant pool (N = 818). This visualization underscores trends in parental attitudes toward vaccination by illustrating variations in perceived vaccine safety, the appropriateness of vaccine schedules, and concerns about potential side effects. The chart employs a color-coded scheme to facilitate clear differentiation between agreement, disagreement, and uncertainty, enabling a direct comparison of response patterns across the items presented.

Fig. 3: Parental Attitudes and Trust Toward Vaccines and Healthcare Providers



The chart presents the distribution of parental responses to questions related to vaccine hesitancy and trust in vaccination processes. Each subplot within the chart corresponds to a distinct question derived from the Parental Attitudes towards Childhood Vaccines (PACV) survey. The x-axis of each subplot represents categorical responses, such as levels of concern, agreement, or trust, while the y-axis quantifies the percentage of participants selecting each response category. For questions assessing trust and hesitancy, response categories include "Agree," "Disagree," and "Not Sure," while questions evaluating trust in medical professionals employ scaled responses (0–5, 6–7, and 8–10). The inclusion of scaled trust ratings provides a quantitative dimension to assess variations in parental confidence towards their child's doctor. The uniform presentation of subplots facilitates direct comparisons across variables, offering a comprehensive depiction of the factors influencing vaccine hesitancy.

3.3. Prevalence of Vaccine Hesitancy

Most of the participants had 0-14 PACV score (61.6%), with over half of them having their PACV transformed score below 50% (58.3%). This means that 41.7% of the participants were vaccine hesitant, since this proportion of people had PACV score ≥50 (Table 4).

Table 4: Summary Analysis of PACV Score

PACV raw score	Frequency	Percentage (%)
0-14	477	61.6
15-29	247	31.9
30 and above	50	6.5
PACV transformed Score		
<50	451	58.3
50 and above	323	41.7

The table provides a summary analysis of Parental Attitudes toward Childhood Vaccines (PACV) scores, presenting both raw and transformed score distributions. Raw PACV scores are categorized into three ranges: 0–14, 15–29, and 30 and above, with corresponding frequencies and percentages illustrating the distribution of vaccine hesitancy. Most participants (61.6%) scored between 0 and 14, indicating low hesitancy, while 6.5% scored 30 or above, reflecting high hesitancy. Transformed PACV scores were dichotomized into two categories: scores below 50, indicating non-hesitant participants (58.3%), and scores of 50 or above, indicating hesitant participants (41.7%). This analysis highlights the overall distribution of vaccine hesitancy within the study population.

3.4. Factors Associated with Vaccine Hesitancy

To identify variables associated with vaccine hesitancy, a hierarchical multiple linear regression analysis was conducted (Table 5). Sociodemographic factors like gender, age, and educational level were the independent variables entered for analyses, which explained 18% of the total variation in the level of vaccine hesitancy, R^2=0.18, F(3,756)=4.747, P<0.05. Age was the only factor that strongly influenced the model in which an increase in the age of a participant increases the likelihood of being hesitant to childhood vaccinations.

Table 5: Summary of Hierarchical Multiple Linear Regression Analysis predicting Vaccine Hesitancy

Model	B	SE	β
Gender	0.265	0.406	0.024
Age	1.835	0.505	0.131***
Level of Education	-0.087	0.270	-0.012

Model R^2 = 0.18**. ****P* < *0.001*.

The table summarizes the results of a hierarchical regression analysis examining predictors of vaccine hesitancy, including gender, age, and level of education. The regression coefficients (B), standard errors (SE), and standardized beta coefficients (β) are presented for each predictor. Age emerged as a statistically significant predictor of vaccine hesitancy (β = 0.131, ***P < 0.001), indicating a positive association. Gender and level of education did not significantly predict vaccine hesitancy in this model. The overall model explained 18% of the variance in vaccine hesitancy (Model R^2 = 0.18). These findings highlight the role of age as a key sociodemographic factor influencing vaccine hesitancy.

3.5. Vaccines That Prompted Doubt

Participants were asked which vaccines they were most worried about. COVID-19 vaccine topped the list, with over half of the participants ticking this option (Table 6). About one-fifth of participants were not worried about any specific vaccine. Varicella and MMR vaccines were also mentioned. Participants who identified 'Others' were asked to specify the vaccines, and they mentioned influenza and DTaP.

Table 6: Summary Analysis of Vaccines that Participants were Most Worried About

Vaccines of Concern	Frequency	Percentage
COVID-19	397	51.6
Measles, Mumps, Rubella (MMR)	71	9.2
No specific vaccine	151	19.6
Others (please specify)	20	2.6
Varicella	131	17.0
Total	770	100.0%

The table presents a summary analysis of the vaccines that participants expressed the most concern about. The data include frequencies and percentages of participants' worries regarding specific vaccines or vaccine categories. The COVID-19 vaccine was the most frequently cited source of concern, accounting for 51.6% of responses, followed by Varicella (17.0%) and Measles, Mumps, Rubella (MMR) (9.2%). Notably, 19.6% of participants did not specify a particular vaccine, while 2.6% identified other vaccines. The total number of responses was 770, reflecting participants' varied apprehensions about vaccines and highlighting the prominence of COVID-19 vaccine concerns.

3.6. Summary of Findings

This study evaluated differences among demographic groups in relation to vaccine hesitancy. Age accounted for important variations in vaccine hesitancy among the participants. Vaccine hesitancy was higher for older participants than for younger ones. Specifically, participants between the ages of 45-54, 55-64, and above 64 years were more hesitant than those younger than them. Regarding the number of children, parents/guardians who had three or more children had greater inclinations to follow childhood vaccine guidelines than parents who had fewer children. No difference in levels of vaccine hesitancy was observed among mothers and fathers. Married participants or those who lived with their partners were more prone to vaccine hesitancy. Less educated participants had no significant difference in levels of vaccine hesitancy in comparison with those who had higher education. No significant correlation was found between levels of income and vaccine hesitancy.

Ethnicity accounted for a significant difference in the level of parental vaccine hesitancy. In comparison with other ethnic groups, respondents who were classified as White Other were the most vaccine hesitant. Thus, the research validates the hypothesis that parents' sociodemographic characteristics will have significant positive relationship with childhood vaccine hesitancy.

There was a significant correlation between subjects' political and social ideology and vaccine hesitancy in this study. Respondents who identified as being conservative politically or socially had greater inclinations to embrace vaccinations. About two-fifth of participating parents expressed concerns that the safety of any children immunisations is not guaranteed and over one third were worried that their children could get severe adverse effects from vaccinations.

Most of the survey respondents were unsure about openly discussing their reservations regarding vaccines with their paediatricians. About a quarter of the parents had less than 50% trust in their paediatricians. Most could not rely on the vaccination information they were given and prefer to seek for information from sources other than their paediatrician. Most parents decide whether to follow vaccination guidelines or not after reading media stories.

4. DISCUSSION

This study identifies several key factors contributing to vaccine hesitancy among parents in the UK. Parental beliefs regarding vaccine efficacy, concerns about disease protection, and distrust in the NHS's capacity to deliver effective vaccinations emerged as significant barriers. These findings align with previous research,

which highlights distrust in healthcare organizations and pharmaceutical companies as critical drivers of vaccine hesitancy (Paterson, Chantler, & Larson, 2018; Kata, 2012). Concerns that pharmaceutical companies prioritize profit over public health further exacerbate distrust. These issues underscore the need for transparent and accessible public health communication to rebuild trust.

The study's findings also revealed a positive relationship between heightened anxiety levels and a willingness to vaccinate, consistent with research conducted in the UK, Australia, and the Netherlands (Rubin et al., 2009; Goodwin et al., 2010; Bults et al., 2011). Trust in government and healthcare institutions played a critical role in shaping vaccine acceptance. For example, during the H1N1 pandemic, increased trust in U.S. authorities was linked to higher vaccine uptake (Quinn et al., 2009). Trust influences public perceptions of risks and benefits and is crucial for fostering adherence to public health strategies (Khosravi, 2020; Siegrist et al., 2021; Obohwemu, 2024b).

Sociodemographic factors also shaped vaccine hesitancy. Older parents exhibited higher levels of hesitancy compared to younger parents, mirroring findings from Latin America but differing from studies in Italy and the Eastern Mediterranean, where older parents were more likely to adhere to vaccination guidelines (Urrunaga-Pastor et al., 2021; Zona et al., 2021; Khatatbeh et al., 2022). Parents with three or more children were less hesitant, potentially due to greater experience with vaccinations. Gender differences in vaccine hesitancy were not significant, contrasting with prior studies from Canada, the U.S., and Europe, where mothers were more hesitant than fathers due to heightened risk perceptions (Gilkey et al., 2013; Bocquier et al., 2018). Education levels did not significantly influence vaccine hesitancy, a finding that contrasts with global studies showing varying trends between high- and low-income countries (Alsubaie et al., 2019; Wagner et al., 2021). Income levels similarly did not correlate with vaccine hesitancy, despite evidence from the U.S. and Europe suggesting a link between lower income and hesitancy (Reiter et al., 2020; Schwarzinger et al., 2021). The study did, however, find that parents identifying as "White Other"—primarily non-British Europeans (GOV.UK, 2021; ONS, 2021a; 2021b; 2021c)—exhibited the highest hesitancy levels, suggesting that cultural and systemic barriers play a role.

Parental concerns about vaccine safety were significant, with many expressing fears of severe side effects and preferring fewer simultaneous vaccinations. These concerns align with previous research emphasizing the role of safety perceptions in vaccine hesitancy (Marti et al., 2017; Idowu et al., 2024; Obohwemu, 2025). The spread of misinformation on social media further amplified hesitancy, highlighting the urgent need for health organizations to provide accurate, evidence-based information through trusted platforms (Tran et al., 2018; Hoffman et al., 2019).

The study's strengths include a large sample size, which enhances statistical robustness and supports more reliable inferences across subgroups. This breadth of participation also contributes to the generalisability of findings, particularly within the defined population. In addition, the use of mixed sampling techniques—while non-probability in nature—enabled access to a diverse cohort spanning various sociodemographic backgrounds, enriching the dataset with varied perspectives.

The online survey format facilitated efficient data collection and allowed participants to respond at their convenience, potentially increasing engagement and completion rates. The inclusion of validated instruments, such as the PACV scale, further strengthens the study's methodological rigour by ensuring consistency and comparability with existing literature.

Moreover, the study addressed a timely and socially relevant issue, enhancing its practical significance. By capturing attitudes and behaviours in a real-world context, the research offers insights that are not only statistically sound but also meaningful for public health policy and educational outreach.

However, the cross-sectional design limits causal interpretations, and the use of online surveys may have introduced selection bias—particularly excluding individuals with limited digital access. The study employed a combination of convenience and snowball sampling, both of which are non-probability methods. As such, the sample cannot be considered representative of the broader population, and findings should be interpreted with caution.

Furthermore, snowball sampling may have inadvertently reduced variability within the sample. Because participants were recruited through personal or professional networks, there is a risk that individuals with similar sociodemographic characteristics or attitudes were disproportionately included. This homogeneity can limit the diversity of perspectives captured and may skew the results. Finally, reliance on self-reported data introduces the potential for recall bias, particularly when participants are asked to reflect on past behaviours or attitudes.

It is important to note that while self-reported data has its limitations, the consistency between PACV scores and reported vaccination status adds credibility to the findings and reinforces the utility of the PACV tool in identifying attitudinal barriers to immunisation. Further research could explore this relationship longitudinally to assess how attitudes evolve and influence future vaccination decisions.

Addressing vaccine hesitancy requires tailored interventions that emphasize the community-wide benefits of vaccination, address safety concerns, and target specific demographic groups, including older adults and socioeconomically disadvantaged populations. Healthcare providers must adopt empathetic communication strategies, offering clear, evidence-based information to rebuild trust.

Looking ahead, longitudinal research is needed to monitor shifts in vaccine attitudes over time and to evaluate the effectiveness of tailored strategies across diverse populations. Such research would offer deeper insights into behavioural patterns and inform more inclusive, responsive public health approaches.

5. CONCLUSIONS

Many parents in the UK express concerns about the safety and potential side effects of vaccines, highlighting the need for targeted educational and preventive measures to counter the rising trend of vaccine hesitancy. Specific support should be provided to vulnerable groups, such as ethnic minorities and older residents, to improve compliance with vaccination schedules. Addressing these challenges requires a deeper understanding of parental attitudes and their socioeconomic and health circumstances, which can help mitigate discrepancies in vaccination uptake and distribution.

To achieve this, comprehensive and disaggregated data—categorized by race, ethnicity, and other relevant factors—must be collected to identify barriers and inform tailored interventions. Developing educational materials that directly address parents' specific concerns and lived experiences will be crucial for effective public health messaging. Additionally, structural reforms at the organizational level are essential to overcome barriers, reduce inequities, and address biases within healthcare systems.

Ultimately, this study underscores the importance of meaningful parental engagement and co-production strategies in tackling the complex and multifaceted concerns underlying vaccine hesitancy in the UK. Collaborative approaches that prioritize the voices and experiences of parents will be critical in building trust, enhancing vaccine confidence, and safeguarding public health.

ACKNOWLEDGEMNT

The author would like to acknowledge Floor Christie-de Jong and Jonathan Ling for their supervision and expert advice. Gratitude is extended to acknowledge the management and technical staff of PENKUP Research Institute, Birmingham, United Kingdom for their excellent assistance and for providing manuscript writing/editorial support in accordance with Good Publication Practice (GPP3) guidelines.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

COMPETING INTERESTS

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

1. Alsubaie, S. S., Gosadi, I. M., Alsaadi, B. M., et al., (2019) Vaccine hesitancy among Saudi parents and its determinants: Result from the WHO SAGE working group on vaccine hesitancy survey tool, *Saudi Medical Journal*, 40(12), p.1242.
2. Anastasiou, O.E. and Heger, D., (2021). Understanding the influence of individual and systemic factors on vaccination take-up in European citizens aged 55 or older. *Vaccines, 9*(2), p.169.
3. Azizi, M. F. S., Y. Kew, and F. M. Moy, (2017) Vaccine hesitancy among parents in a multi-ethnic country, Malaysia, *Vaccine*, 35(22): pp. 2955–2961.
4. Baumgaertner, B., Carlisle, J. E. and Justwan, F., (2018) The influence of political ideology and trust on willingness to vaccinate, *PloS One*, 13(1), p.e0191728.
5. Bocquier, A., L. Fressard, and S. Cortaredona, (2018) Social differentiation of vaccine hesitancy among French parents and the mediating role of trust and commitment to health: A nationwide cross-sectional study, *Vaccine*, 36, pp. 7666–7673.
6. Bults, M., Beaujean, DJMA, de Zwart O, et al., (2011) Perceived risk, anxiety, and behavioural responses of the general public during the early phase of the Influenza A (H1N1) pandemic in the

Netherlands: results of three consecutive online surveys, *BioMedCentral Public Health* 2011, 11:2.

7. Centers for Disease Control and Prevention. (2023). Fast Facts on Global Immunization. Available at: https://www.cdc.gov/global-immunization/fast-facts/index.html, [Accessed: 14/01/2025]
8. Chow, M. Y. K., Danchin, M., Willaby, H. W., Pemberton, S., and Leask, J., (2017) Parental attitudes, beliefs, behaviours and concerns towards childhood vaccinations in Australia: A national online survey, *Australian family physician*, 46(3), pp.145-151.
9. Desmond, H. and Dierickx, K., (2021) Research integrity codes of conduct in Europe: Understanding the divergences, *Bioethics*, 35(5), pp.414-428.
10. Etikan, I., Alkassim, R. and Abubakar, S., (2016) Comparison of snowball sampling and sequential sampling technique, *Biometrics and Biostatistics International Journal*, *3*(1), p.55.
11. European Centre for Disease Prevention and Control, (2017) Catalogue of interventions addressing vaccine hesitancy. Stockholm: ECDC; 2017.
12. Fine, P., Eames, K., and Heymann, D. L., (2011) "Herd immunity": a rough guide. Clin Infect Dis. 2011;52:911–16.
13. Gilkey, M. B., McRee, A. L., and Brewer, N. T., (2013) Forgone vaccination during childhood and adolescence: findings of a statewide survey of parents, *Preventive Medicine*, 56:202–6.
14. Goodwin, R. D., Stanley, O., Gaines, J. R., et al., (2010) Initial psychological responses to swine flu, *International Journal of Behavioural Medicine* 2010.
15. GOV.UK (2021). *List of Ethnic Groups*. [online] GOV.UK. Available at: https://www.ethnicity-facts-figures.service.gov.uk/style-guide/ethnic-groups/, (Accessed: 18 August 2025).
16. Hoffman, B. L., Felter, E. M., Chu, K. H., et al., (2019) It's not all about autism: The emerging landscape of anti-vaccination sentiment on Facebook, *Vaccine*. 2019;37(16):2216–23.
17. Idowu, T.O., Obohwemu, K.O. and Iyevhobu, K.O., 2024. Knowledge, Attitudes and Practices of Mothers towards Childhood Vaccination in Lagos State, Nigeria. *International Journal of Medical Science and Public Health Research*, *5*(09), pp.69-100.
18. Karafillakis, E., Dinca, I., Apfel, F., et al., (2016) Vaccine hesitancy among healthcare workers in Europe: a qualitative study. *Vaccine*. 2016; 34(41): 5013-20.
19. Kata, A, (2012) 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.
20. Khatatbeh, M., Albalas, S., Khatatbeh, H., Momani, W., Melhem, O., Al Omari, O., et al. (2022). Children's rates of COVID-19 vaccination as reported by parents, vaccine hesitancy, and determinants of COVID-19 vaccine uptake among children: a multi-country study from the Eastern Mediterranean Region. *BMC Public Health*, 22, 1375. doi: https://doi.org/10.1186/s12889-022-13798-2.
21. Khosravi, M., (2020) Perceived risk of COVID-19 pandemic: The role of public worry and trust, *Electronic Journal of Geneal Medicine*, 2020; 17 (4): em203.
22. Lin, C., Tu, P., Beitsch, L.M., (2021). Confidence and receptivity for Covid-19 vaccines: a rapid systematic review. Vaccines 9, 1–32. Vaccines (Basel). 2020 Dec 30;9(1):16. doi: 10.3390/vaccines9010016.
23. MacDonald, N. E., SAGE Working Group on Vaccine Hesitancy, (2015) Vaccine hesitancy: definition, scope and determinants. Vaccine. 2015;33:4161–64.
24. Marti, M., de Cola, M., MacDonald, N. E., Dumolard, L., and Duclos, P., (2017) Assessments of global drivers of vaccine hesitancy in 2014-looking beyond safety concerns. PLoS One. 2017;12:e0172310.
25. Martinelli, M. and Veltri, G.A., (2022). Shared understandings of vaccine hesitancy: How perceived risk and trust in vaccination frame individuals' vaccine acceptance. *PloS one*, *17*(10), p.e0276519.
26. Moser, C. A., D. Reiss, and R. L. Schwartz, (2015) Funding the costs of disease outbreaks caused by non-vaccination, *Journal of the American Society of Law, Medicine & Ethics*, 43(3),633 – 647.
27. NHS Digital (2024) *Childhood Vaccination Coverage Statistics, England, 2023–24*. [online] NHS Digital. Available at: https://digital.nhs.uk/data-and-information/publications/statistical/nhs-

immunisation-statistics/england-2023-24 [Accessed 17 Sep. 2025].

28. Obohwemu, K., Christie-de Jong, F. and Ling, J., (2022). Parental childhood vaccine hesitancy and predicting uptake of vaccinations: a systematic review. *Primary Health Care Research & Development*, *23*, p.e68.

29. Obohwemu, K.O., (2024a). Improving Maternal Awareness and Childhood Vaccination Uptake in Delta State, Nigeria. *International Journal of Medical Science and Public Health Research*, *5*(12), pp.37-57.

30. Obohwemu, K.O., (2024b). Maternal Attitudes Towards Childhood Vaccination in Delta State, Nigeria. *Frontline Medical Sciences and Pharmaceutical Journal*, *4*(12), pp.43-66.

31. Obohwemu, K.O., (2025). Prevalence of Vaccine Hesitancy Towards Childhood Vaccinations Among Parents in the United Kingdom. *Frontiers in Medical and Clinical Sciences*, *2*(10), pp.11-27.

32. Office for National Statistics (ONS) (2021a) *Ethnic group, Census 2021.* [online]. Available at: https://www.ons.gov.uk/datasets/TS021/editions/2021/versions/1?showAll=ethnic_group_tb_20b#ethnic_group_tb_20b, (Accessed: 18 August 2025).

33. Office for National Statistics (ONS) (2021b). *Coronavirus and vaccine hesitancy, Great Britain: 13 January to 7 February 2021*. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandwellbeing/bulletins/coronavirusandvaccinehesitancygreatbritain/13januaryto7february2021#glossary, (Accessed: 18 August 2025).

34. Office for National Statistics (ONS) (2021c). *People identifying as 'Other White' has increased by over a million since 2001 - Office for National Statistics*. [online] Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/articles/peopleidentifyingasotherwhitehasincreasedbyoveramillionsince2001/2015-06-26, (Accessed: 18 August 2025).

35. Omer, S. B., D. A. Salmon, W. A. Orenstein, M P. deHart, and N. Halsey, (2009) Vaccine Refusal, Mandatory Immunization, and the Risks of Vaccine-Preventable Diseases, *New England Journal of Medicine*, 360, pp. 1981-1988.

36. Opel, D. J., et al. (2011a) Development of a survey to identify vaccine-hesitant parents: The parent attitudes about childhood vaccines survey, *Human Vaccines,* 2011;7(4):419–25.

37. Opel, D. J., et al. (2011b) Validity and reliability of a survey to identify vaccine-hesitant parents, *Vaccine* 2011;29(38):6598–605.

38. Opel, D. J., J. A. Taylor, C. Zhou, S. Catz, M. Myaing, and R. Mangione-Smith, (2013) The relationship between parent attitudes about childhood vaccines survey scores and future child immunization status: a validation study, *JAMA Paediatrics*, 167(11), pp. 1065–1071.

39. Parker, C, Scott, S and Geddes, A (2019) Snowball Sampling. SAGE Research Methods Foundations. Available at: https://core.ac.uk/download/pdf/211022791.pdf, [Accessed: 15/01/2015].

40. Patelarou, E., Galanis, P., Mechili, E.A., Argyriadi, A., Argyriadis, A., Asimakopoulou, E., Brokaj, S., Bucaj, J., Carmona-Torres, J.M., Cobo-Cuenca, A.I. and Doležel, J., (2021). Factors influencing nursing students' intention to accept COVID-19 vaccination: A pooled analysis of seven European countries. *Nurse education today*, *104*, p.105010.

41. Paterson, P., Chantler, T. and Larson, H.J., (2018) Reasons for non-vaccination: Parental vaccine hesitancy and the childhood influenza vaccination school pilot programme in England, *Vaccine*, 36(36), pp.5397-5401.

42. Public Health England, (2014) Why vaccinate? Public Health Matters, Available at: https://publichealthmatters.blog.gov.uk/2014/05/01/why-vaccinate/, (Accessed: 01/01/2019).

43. Public Health England. (2023). The complete routine immunisation schedule. Available at: https://www.gov.uk/government/publications/the-complete-routine-immunisation-schedule, [Accessed: 15/01/2025].

44. Quinn, S. C., Kumar, S., Freimuth, V. S., Kidwell, K., and Musa, D., (2009) Public willingness to take a vaccine or drug under emergency use authorization during the 2009 H1N1 pandemic, *Biosecurity and bioterrorism: biodefense strategy, practice and science*, 7:275-290.

45. Reiter, P. L., Pennell, M. L., Katz, M.L., (2020) Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated? *Vaccine*, 38:6500–6507.

46. Rubin, G. J., Amlôt, R., Page, L., and Wessely, S., (2009) Public perceptions, anxiety, and behaviour

change in relation to the swine flu pandemic: cross sectional telephone survey, *The British Medical Journal* 2009, 339:b2651.

47. Schwarzinger, M., Watson, V., Arwidson, P., Alla, F., & Luchini, S. (2021). COVID-19 vaccine hesitancy in a representative working-age population in France: A survey experiment based on vaccine characteristics. *The Lancet Public Health*, 6(4), e210-e221. doi: 10.1016/S2468-2667(21)00012-800012-8).

48. Siegrist, M., Luchsinger, L. and Bearth, A., (2021) The impact of trust and risk perception on the acceptance of measures to reduce COVID-19 cases, *Risk Analysis*, 41(5), pp.787-800.

49. Stewart, J. and Sayer, L., (2021). What factors influence measles, mumps and rubella vaccine hesitancy among parents? A systematic review. *British Journal of Child Health, 2*(3), pp.143-152.

50. Tran, B. X., Boggiano, V. L., Nguyen, L. H., et al., (2018) Media representation of vaccine side effects and its impact on utilization of vaccination services in Vietnam, *Patient Prefer Adherence*, 2018; 12: 1717–28.

51. Tsuzuki, S., M. Baguelin, R. Pebody, and E. van Leeuwen, (2020) Modelling the optimal target age group for seasonal influenza vaccination in Japan. *Vaccine.* 2020 Jan 22;38(4):752-762. Doi: 10.1016/j.vaccine.2019.11.001. Epub 2019 Nov 15.

52. UK Health Security Agency (UKHSA) (2025) *MMR2 coverage by year*. [online] UKHSA Data Dashboard. Available at: https://ukhsa-dashboard.data.gov.uk/metrics-documentation/mmr2-coverage-by-year [Accessed 17 Sep. 2025].

53. United Nations Children's Fund, (2019) Over 20 million children worldwide missed out on measles vaccine annually in past 8 years, creating a pathway to current global outbreaks – UNICEF. Press Release, 25th April 2019, Available at: https://www.unicef.org/press-releases/over-20-million-children-worldwide-missed-out-measles-vaccine-annually-past-8-years, (accessed: 12/12/2019).

54. Urrunaga-Pastor, D., Bendezu-Quispe, G., Herrera-Añazco, P., Uyen-Cateriano, A., Toro-Huamanchumo, C. J., Rodriguez-Morales, A. J., et al. (2021). Cross-sectional analysis of COVID-19 vaccine intention, perceptions and hesitancy across Latin America and the Caribbean. *Travel Medicine and Infectious Disease*, 41, 102059. doi: https://10.1016/j.tmaid.2021.102059.

55. Wagner, A. L., Masters, N. B., Domek, G. J., Mathew, J. L., Sun, X., Asturias, E. J., & Boulton, M. L. (2021). Comparisons of vaccine hesitancy across five low- and middle-income countries. *Vaccines*, 7(4), 155. doi: https://10.3390/vaccines7040155.

56. World Health Organization. (2019a). Ten threats to global health in 2019. Available at: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019/, [Accessed: 14/01/2025].

57. World Health Organization. (2019b). Vaccines: 2018 immunization coverage estimates. Available at: https://www.who.int/news-room/fact-sheets/detail/immunization-coverage, [Accessed: 14/01/2025].

58. World Health Organisation, (2019c) Immunisation, Available at: https://www.who.int/news-room/facts-in-pictures/detail/immunization, (Accessed: 26/05/2022).

59. World Health Organisation, (2019d) Measles cases spike globally due to gaps in vaccination coverage, Available at: https://www.who.int/news-room/detail/29-11-2018-measles-cases-spike-globally-due-to-gaps-in-vaccination-coverage, (accessed: 29/07/19).

60. World Health Organization. (2023). Vaccines and immunization. Available at: https://www.who.int/health-topics/vaccines-and-immunization/, [Accessed: 14/01/2025].

61. Zona, S., Partipilo, F., Zizza, A., Guido, M., & Quaranta, A. (2021). Vaccine hesitancy and trust in the health authorities in Italy. *Frontiers in Public Health*, 9, 770985. doi: https://doi.org/10.3389/fpubh.2021.770985.

SUPPLEMENTARY MATERIAL

Supplementary Material 1: The PACV Scale

20. What is the highest level of education that you have reached?

- ☐ 8th grade or less
- ☐ Some high school, but not a graduate
- ☐ High school graduate or GED
- ☐ Some college or 2 year degree
- ☐ 4-year college degree
- ☐ More than 4-year college degree

21. What is your approximate household income?

- ☐ $30,000 or less
- ☐ $30,001-50,000
- ☐ $50,001-75,000
- ☐ $75,001 or more

22. How many children are in your household?

- ☐ One
- ☐ Two
- ☐ Three
- ☐ Four or more

23. What is your race/ethnicity? Please check all that apply.

- ☐ White
- ☐ Black or African American
- ☐ Hispanic/Latino
- ☐ Asian
- ☐ Native Hawaiian or other Pacific Islander
- ☐ American Indian or Alaska Native
- ☐ Other: _____

Thank you!

Seattle Children's HOSPITAL • RESEARCH • FOUNDATION
Treuman Katz Center for Pediatric Bioethics

UW Medicine SCHOOL OF MEDICINE

Parent Attitudes about Childhood Vaccines

READ THIS FIRST:

We are interested in your opinions about childhood shots (vaccines). Your child's doctor or nurse gives shots like MMR (measles, mumps and rubella) or Polio at check-ups to help keep your child from getting sick.

THIS SURVEY IS NOT ABOUT SEASONAL FLU OR SWINE FLU (H1N1) SHOTS.

When filling out the survey, please answer each questions with the child whose appointment is today in mind. The answers to these questions will help us improve how doctors and nurses talk to parents about childhood shots.

Please check only one answer to each of the questions below.

1. Is this child your first born? ☐ **Yes** ☐ **No**

2. What is your relationship to this child? ☐ **Mother** ☐ **Father** ☐ **Other** _____

	Yes	**No**	***Don't Know***
3. Have you ever delayed having your child get a shot (not including seasonal flu or swine flu (H1N1) shots) for reasons other than illness or allergy?	☐	☐	☐
4. Have you ever decided not to have your child get a shot (not including seasonal flu or swine flu (H1N1) shots) for reasons other than illness or allergy?	☐	☐	☐

5. How sure are you that following the recommended shot schedule is a good idea for your child? Please answer on a scale of 0 to 10, where 0 is *Not at all sure* and 10 is *Completely sure*.

Not at all Sure 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ **Completely Sure**

	Strongly Agree	**Agree**	**Not Sure**	**Disagree**	**Strongly Disagree**
6. Children get more shots than are good for them.	☐	☐	☐	☐	☐
7. I believe that many of the illnesses that shots prevent are severe.	☐	☐	☐	☐	☐
8. It is better for my child to develop immunity by getting sick than to get a shot.	☐	☐	☐	☐	☐
9. It is better for children to get fewer vaccines at the same time.	☐	☐	☐	☐	☐

	Not at all Concerned	**Not too Concerned**	**Not Sure**	**Somewhat Concerned**	**Very Concerned**
10. How concerned are you that your child might have a serious side effect from a shot?	☐	☐	☐	☐	☐
11. How concerned are you that any one of the childhood shots might not be safe?	☐	☐	☐	☐	☐
12. How concerned are you that a shot might not prevent the disease?	☐	☐	☐	☐	☐

	Yes	**No**	***Don't Know***
13. If you had another infant today, would you want him/her to get all the recommended shots?	☐	☐	☐

	Not at all Hesitant	**Not too Hesitant**	**Not Sure**	**Somewhat Hesitant**	**Very Hesitant**
14. Overall, how hesitant about childhood shots would you consider yourself to be?	☐	☐	☐	☐	☐

	Strongly Agree	**Agree**	**Not Sure**	**Disagree**	**Strongly Disagree**
15. I trust the information I receive about shots.	☐	☐	☐	☐	☐
16. I am able to openly discuss my concerns about shots with my child's doctor.	☐	☐	☐	☐	☐

17. All things considered, how much do you trust your child's doctor? Please answer on a scale of 0 to 10, where 0 is *Do not trust at all* and 10 is *Completely trust*.

Do Not Trust at All 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ **Completely Trust**

The last questions are about you. Please check only one answer to each question.

18. How old are you?

- ☐ 18-29 years old
- ☐ 30 years or older

19. What is your current marital status?

- ☐ Single
- ☐ Married
- ☐ Living with a partner
- ☐ Widowed
- ☐ Separated
- ☐ Divorced

Supplementary Material 2: PACV Scoring Instructions

1. Score each of the 15 PACV survey items (Q3-Q17; see attached scored version of PACV). Hesitant responses are assigned a 2, 'don't know or not sure' a 1, and non-hesitant responses a 0. The two items in which the 'don't know' response was excluded

as missing data (Q3 and Q4) are scored as 2 for the hesitant response and 0 for the non-hesitant response.

2. Calculate the raw total PACV score by simply summing each item. The total raw score will range from 0 – 30 if all items have responses and Q3 and Q4 are not excluded as missing data. If there is at least one item without a response or Q3 or Q4 are answered as 'don't know' and therefore are excluded as missing data, the total raw score needs to be adjusted. For instance, if there is one response missing or excluded, the total raw score will range from 0 – 28; if there is two responses missing or excluded, the total raw score will range from 0 – 26; etc.

3. Convert the raw score to a 0 – 100 scale using simple linear transformation accounting for items with missing values (see attached score conversion chart).

Supplementary Material 3: PACV Conversion Chart

A		B		C	
If both Q3 and Q4 are Yes or No and items Q5-Q17 have no missing responses		If either Q3 or Q4 are Don't Know or Q5-Q17 has one missing response		If both Q3 and Q4 are Don't Know or Q5-Q17 has two missing responses	
Raw Score	Converted Score	**Raw Score**	Converted Score	**Raw Score**	Converted Score
0	0	**0**	0	**0**	0
1	3	**1**	4	**1**	4
2	7	**2**	7	**2**	8
3	10	**3**	11	**3**	12
4	13	**4**	14	**4**	15
5	17	**5**	18	**5**	19
6	20	**6**	21	**6**	23
7	23	**7**	25	**7**	27
8	27	**8**	29	**8**	31
9	30	**9**	32	**9**	35
10	33	**10**	36	**10**	38
11	37	**11**	39	**11**	42
12	40	**12**	43	**12**	46
13	43	**13**	46	**13**	50
14	47	**14**	50	**14**	54
15	50	**15**	54	**15**	58
16	53	**16**	57	**16**	62
17	57	**17**	61	**17**	65

18	60	**18**	64	**18**	69
19	63	**19**	68	**19**	73
20	67	**20**	71	**20**	77
21	70	**21**	75	**21**	81
22	73	**22**	79	**22**	85
23	77	**23**	82	**23**	88
24	80	**24**	86	**24**	92
25	83	**25**	89	**25**	96
26	87	**26**	93	**26**	100
27	90	**27**	96		
28	93	**28**	100		
29	97				
30	100				

.