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ORIGINAL ARTICLE

Parental trust and the role of misinformation in childhood immunization decisions

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ABSTRACT

Aim Vaccine hesitancy challenges global public health, with parental attitudes significantly impacting childhood immunization. This study examined parental perceptions of vaccine safety, effectiveness, and decision-making factors in Bosnia and Herzegovina.

Methods A cross-sectional survey was conducted in March 2025 with 233 parents at the Primary Healthcare Centre in Gračanica. A structured questionnaire based on the Parent Attitude about Childhood Vaccines (PACV) assessed sociodemographic data, vaccination experiences, information sources, and attitudes toward vaccines using a Likert scale.

Results Among 233 participants, 195 (83.7%) fully vaccinated their children, 30 (12.9%) practiced selective vaccination, and eight (3.4%) refused all vaccines. Vaccine hesitancy was significantly associated with lower education, (26.3% vs. 5.1%; p<0.001), rural residence (76.3% vs. 48.2%; p=0.002), and having three or more children (34.2% vs. 12.3%; p=0.01). Trust in healthcare professionals strongly influenced behaviour, with 178 (91.3%) of parents who fully trusted doctors adhering to the immunization schedule. Concerns about autism were reported by 14 (36.8%) hesitant parents and were significantly associated with delayed or refused vaccination (p<0.001).

Conclusion Although overall confidence was high, vaccine hesitancy persisted due to perceived risks. Strengthening healthcare communication and addressing misinformation, particularly autism concerns, may help improve vaccine uptake.

Keywords: health knowledge, immunization program, public health, vaccination coverage

INTRODUCTION

Vaccination is one of the most outstanding and cost-effective achievements in modern medicine and public health, significantly reducing the burden of infectious diseases by preventing illness, disability, childhood morbidity, and mortality worldwide (1). The World Health Organization (WHO) estimates that vaccines prevent 3.5 to 5 million deaths annually, predominantly among children under five (2). However, despite decades of success, immunization coverage has plateaued or declined in various regions over the last decade, raising concerns about the resurgence of vaccine-preventable diseases (3). In 2019, the WHO declared vaccine hesitancy, a delay in accepting or refusing vaccines despite availability, among the top ten global health threats (4). Recent data underscore the growing urgency: the European Region reported over 127,000 measles cases in 2024, the highest in more than 25 years, primarily driven by declining immunization rates and misinformation (5). This trend is particularly concerning in the Balkan region. In Bosnia and Herzegovina (B&H), the measles vaccination rate remains critically low, at approximately 55%, significantly below the 95% threshold required to prevent outbreaks (6). Insufficient vaccination coverage, exacerbated by COVID-19, has contributed to a third major measles outbreak since 2014, with 141 confirmed cases reported by February 2024, originating in Tuzla Canton, where this study was conducted (7).

Although vaccination programs are universally implemented, their success depends on public trust (8). Previous studies have demonstrated that parental attitudes trust in healthcare providers, and exposure to misinformation play key roles in vaccination decisions (9). Understanding the local factors influencing vaccine acceptance in low-coverage countries, such as B&H, is crucial for designing effective interventions. Existing research has broadly addressed vaccine hesitancy; however, a limited number of recent studies have focused on the parental population in B&H. Moreover, the few available studies were conducted before the COVID-19 pandemic (10,11), making this post-pandemic investigation particularly valuable for understanding how recent global health events have shaped parental attitudes toward childhood immunization. The resurgence of

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measles in this region highlights the urgent need for updated, context-specific data, especially with the rise of vaccine-related misinformation.

The main goal of this study was to investigate parents' attitudes toward childhood vaccination, identify the primary drivers of vaccine acceptance or hesitancy, and examine how demographic variables influence immunization decisions. Understanding these factors can guide evidence-based strategies to improve vaccination coverage in vulnerable populations.

PATIENTS AND METHODS

Patients and study design

This cross-sectional study was conducted in March 2025 at the Paediatric Department, Primary Healthcare Center Gračanica, Bosnia and Herzegovina. The inclusion criteria comprised parents or legal guardians of children aged 0–6 years attending the clinic for routine check-ups or vaccinations, which were randomly approached by staff and voluntarily agreed to participate. Exclusion criteria included refusal to participate or submission of incomplete questionnaires.

Informed consent was obtained from all participants in the study. The Ethics Committee of the Primary Healthcare Centre Gračanica approved the study.

Methods

Anonymous, paper-based questionnaires were handed out in the clinic's waiting room by healthcare workers. A total of 250 surveys were sent out, and 233 (93.2%) were fully completed and included in the final analysis. The 20-item questionnaire was developed by incorporating existing literature and modifying validated instruments, such as the Parent Attitudes about Childhood Vaccines (PACV) (12). The administration was done in the official languages of Bosnia and Herzegovina (Bosnian, Croatian, and Serbian). An English version was made for dissemination purposes. The questionnaire consisted of two sections: demographic and socioeconomic information (e.g., gender, age, education, number of children, residence), and parental attitudes toward vaccination, prior behaviours, information sources, trust in healthcare professionals, and views on mandatory immunization. Responses were measured on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) (13).

Statistical analysis

Descriptive statistics were used to summarize the sample characteristics. Categorical variables were presented as frequencies and percentages, and differences between groups (fully vaccinated vs. vaccine-hesitant) were assessed using the test or Fisher's exact test, as appropriate. A $p<0.05$ was considered statistically significant. For attitudinal variables measured on a five-point Likert scale, responses were dichotomized into "agree" (combining "agree" and "strongly agree") and "not agree" (including "undecided," "disagree," and "strongly disagree") for comparative analyses between the groups. To identify independent predictors of vaccine hesitancy, variables that were statistically significant in univariate analyses were entered into a multivariable logistic regression model. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported. The model included sociodemographic factors (education level, place of residence, number of children), trust in healthcare providers, and belief-related variables (e.g., vaccine safety and perceived harm).

RESULTS

A total of 233 parents were included in the final analysis. Based on their self-reported vaccination practices, they were categorized into two groups: those who fully vaccinated their children, 195 (83.7%) and those who were vaccine-hesitant, 38 (16.3%). The vaccine-hesitant group encompassed both parents who partially vaccinated their childern and those who did not vaccinate them at all. Vaccine hesitancy showed a significant association with several sociodemographic characteristics. Parents with lower level of education, those living in rural areas, and those with three or more children were more likely to be hesitant (Table 1). A total of 10 hesitant parents (26.3%) had only completed primary education, compared to 10 (5.1%) parents in the fully vaccinated group ($p<0.001$). Rural residence was reported by 29 (76.3%) of hesitant parents versus 92 (48.2%) in the fully vaccinated group ($p=0.002$). Furthermore, having three or more children was more frequent among hesitant parents compared to those who fully vaccinated their children (34.2% vs. 12.3%; $p=0.01$). Gender was not significantly associated with the vaccination status ($p=0.62$), while age showed a modest but statistically significant association ($p=0.03$).

Table 1. Demographic characteristics of parents according to vaccination status

Variable	No (%) of participants		p
	Fully Vaccinated	Hesitant	
Gender			
Male	47 (24.1)	8 (21.1)	0.62
Female	148 (75.9)	30 (78.9)	0.62
Age (years)			
<20	1 (0.5)	4 (10.5)	0.03
20–29	83 (42.6)	13 (34.2)	0.03
30–39	92 (47.2)	22 (57.9)	0.03
40–49	19 (9.7)	2 (5.3)	0.03
Education			
Primary	10 (5.1)	10 (26.3)	<0.001
High school	116 (59.5)	22 (57.9)	<0.001
College	51 (26.2)	5 (13.2)	<0.001
Postgraduate	18 (9.2)	1 (2.6)	<0.001
No of children			
1	84 (43.1)	7 (18.4)	0.01
2	87 (44.6)	18 (47.4)	0.01
≥3	24 (12.3)	13 (34.2)	0.01
Residence			
Urban	82 (42.1)	8 (21.1)	0.002
Suburban	19 (9.7)	1 (2.6)	0.002
Rural	94 (48.2)	29 (76.3)	0.002

The source of vaccine information emerged as a major factor influencing parental behaviour (Table 2). Among parents who fully vaccinated their children, the majority cited healthcare professionals as their main source of information, 155 (79.5%).

Table 2. Sources of vaccine information by vaccination status

Source	No (%) of participants		p
	Fully vaccinated	Hesitant	
Doctor/healthcare worker	155 (79.5)	20 (52.6)	<0.001
Internet/social media	13 (6.7)	10 (26.3)	0.001
Family/friends	10 (5.1)	5 (13.2)	0.048
Government institutions	17 (8.7)	3 (7.9)	0.87

In contrast, only 20 (52.6%) hesitant parents reported relying on doctors or healthcare workers (p<0.001). Hesitant parents more frequently relied on less formal sources, including social media or friends and family.

Parental attitudes toward vaccination also differed sharply between the groups (Table 3). Parents of children who were fully vaccinated were significantly more likely to believe that vaccines are essential for health (91.3% vs. 57.9%; p<0.001) and that vaccination protects the wider community (93.3% vs. 55.3%; p<0.001). They were also more likely to trust the safety of vaccines and believe that side effects are rare, that vaccines do not weaken the immune system, and that their effectiveness is scientifically proven (all p<0.001). In contrast, vaccine-hesitant parents more often held beliefs linking vaccines to serious health conditions (36.8% vs. 10.3%) and showed greater distrust in medical professionals (42.1% v. 19.0%; p=0.002).

Table 3. Vaccine perception by vaccination status

Statement	No (%) of participants		p
	Agree (vaccinated)	Agree (hesitant)	
Vaccines are essential	178 (91.3)	22 (57.9)	<0.001
Vaccination protects the community	182 (93.3)	21 (55.3)	<0.001
Healthcare providers provide biased info	37 (19.0)	16 (42.1)	0.002
Vaccines cause autism/multiple sclerosis/cancer	20 (10.3)	14 (36.8)	<0.001
Side effects are rare	124 (63.6)	11 (28.9)	<0.001
Vaccine effectiveness proven	176 (90.3)	20 (52.6)	<0.001
Vaccination is safe	168 (86.2)	17 (44.7)	<0.001
Vaccines do not weaken immunity	162 (83.1)	16 (42.1)	<0.001

To determine which factors were independently associated with vaccine hesitancy, a multivariable logistic regression model was constructed, including all variables that reached statistical significance in the univariate analyses (Table 4). Four variables remained significant in the final model. Parents with lower educational attainment had nearly threefold higher odds of hesitancy. Attitudinal factors were also strong predictors: parental distrust in healthcare providers and the belief that vaccines are harmful both remained highly significant, with the latter showing the strongest association (aOR = 4.55; p<0.001).

Table 4. Multivariable logistic regression analysis of factors associated with vaccine hesitancy

Predictor	Adjusted OR (aOR)	95% CI	p
Lower education	2.85	1.30–6.28	0.007
Rural residence	2.67	1.40–5.12	0.003
Distrust in healthcare providers	3.21	1.58–6.52	<0.001
Belief that vaccines are harmful	4.55	2.15–9.62	<0.001

aOR, adjusted odds ratio; CI, confidence interval

DISCUSSION

This study explored parental attitudes toward childhood vaccination in Bosnia and Herzegovina, revealing that while a significant majority (83.7%) of parents reported full adherence to the national immunization schedule, vaccine hesitancy remains a concern.

Unlike earlier assumptions that widespread vaccine refusal is the main challenge (14), our data showed that full vaccine refusal remains low, while selective vaccination and vaccine delays driven by safety concerns are far more common. These findings support existing evidence that vaccine hesitancy lies on a behavioural spectrum and is primarily driven by uncertainty, misinformation, and fears related to vaccine safety, rather than by ideological opposition (15,16). Selective vaccination among some parents in our study points to partial hesitancy with less than 4% outright vaccine refusal, which is similar to data from Turkey (17) and Romania (18) and slightly exceeds the prevalence reported in China, where vaccine refusal was observed in 2.7% of the population (19).

The findings of this study identified four independent predictors of vaccine hesitancy: lower education level, rural residence, distrust in healthcare providers, and the belief that vaccines are harmful. These findings are consistent with global trends but also highlight unique contextual factors relevant to B&H (20). In our study parents with primary education had nearly threefold higher odds of hesitancy, while those living in rural areas were more than twice as likely to be hesitant.

A crucial factor in vaccine uptake is trust in healthcare professionals. The majority of parents who fully vaccinated their children identified healthcare workers as their main source of information, whereas hesitant parents relied more heavily on the internet and social media. Consistent with our findings, a study from the United States reported that lower trust in paediatricians was significantly associated with greater concerns about vaccines (21). Trust in healthcare providers plays a central role in shaping vaccine decisions, as transparent and evidence-based communication has been shown to reduce hesitancy and improve vaccine acceptance (22,23). Although parents seek balanced information, traditional campaigns often emphasize benefits while neglecting safety concerns. Social media and apps serve as key vaccine info sources, especially for new mothers who commonly consult online sources for health information (24).

The alleged link between vaccines and autism has been ever-present in public discourse since the 1990s; despite overwhelming scientific evidence disproving this link, the misconception remains widespread (25). In our study, this concern was more prevalent among hesitant parents and contributed to delayed or refused vaccinations, with similar findings reported in other studies, where fear of autism continues to be one of the most persistent drivers of vaccine hesitancy (25,26). The persistence of such misconceptions underscores the urgent need to address autism-related vaccine misinformation as a key step toward improving vaccine acceptance.

Despite the overall high trust in vaccines, concerns regarding safety and side effects were evident in our study.

To contextualize the findings, it is important to consider actual vaccination coverage in the local population. Unpublished data

from the Primary Healthcare Centre Gračanica indicate that the percentage of fully immunized children under six has fluctuated between 78% and 90% in recent years (Primary Healthcare Centre Gračanica, unpublished data). While these rates reflect relatively high vaccine uptake, they still fall short of the levels typically required to ensure herd immunity, especially for highly contagious diseases such as measles.

Bosnia and Herzegovina has seen a steady decline in routine immunization coverage over the past decade. According to WHO/UNICEF data, MMR1 coverage dropped from 89% in 2014 to below 70% by 2016-2019, with further declines during the COVID-19 pandemic, reaching a low of 58% by 2022 (27,28). This trend coincided with three major measles outbreaks: in 2014-2015 (over 5100 cases), 2019 (1332 cases), and most recently in 2023-2024, when 7445 cases were reported, primarily in Tuzla Canton (29-31). In all outbreaks, measles mainly affected unvaccinated or undocumented children, with a significant share among the youngest age groups (32-34).

With three measles outbreaks occurring within less than a decade, the Institute for Public Health of Federation B&H conducted a series of studies under the WHO Tailoring Immunization Programmes (TIP) that identified low confidence, complacency, and practical access barriers as key contributors to under-vaccination, particularly among parents with partially or non-vaccinated children (35). These findings are in line with our study results and confirm that the problem is not limited to global trends but has specific local determinants that require targeted public health strategies.

To strengthen vaccine confidence and accessibility in B&H, several awareness campaigns have been implemented to improve vaccination confidence, including awareness campaigns, healthcare worker communication training, and the introduction of a mobile app "My Calendar of Immunization" that tracks immunization status and sends reminders. Additional measures, like extended hours and walk-in sessions, have been recommended to improve service accessibility for working parents (36).

This study has several limitations. First, the sample was limited to parents from the municipality of Gračanica, which may restrict the generalizability of findings to other regions in Bosnia and Herzegovina with different demographic or socioeconomic profiles. Second, due to the cross-sectional design, the study cannot establish causal relationships between measured variables. Finally, data were based on self-reported vaccination behaviour and attitudes, which may be subject to recall bias or social desirability bias, particularly given the sensitive nature of the topic.

In conclusion, this study highlights the complex factors that shape parental vaccine decisions. While most parents recognize the benefits of vaccination, concerns about side effects and misinformation persist. Trust in healthcare professionals proved crucial for vaccine acceptance, underscoring the importance of clear and targeted communication. Strengthening confidence through transparent dialogue and addressing fears directly can improve vaccine uptake.

AUTHOR CONTRIBUTIONS

Conceptualization, E.M., and A.T.; Methodology, E.M; A.T.; Writing – review & editing, A.T., E.M.; Supervision, A.Ć., A.T.; E.B. ; Data curation A.T.; Writing – original draft preparation, A.T. E.M. M.B.; Software, E.M., E.B, M.B., Visualization, E.M., A.Ć.; E.B and M.B; Investigation, A.T. All authors have read and agreed to the published version of the manuscript.

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