Health Literacy as a Predictor of Vaccination Attitudes among Parents of Preschool Children

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Background and Objectives: We are increasingly encountering parental doubts, hesitancy, or even refusal regarding vaccination. Health literacy is a key component that can contribute to reducing parental vaccine hesitancy. However, some studies suggest a more complex, and even counterintuitive, relationship between health literacy and vaccination attitudes. The aim of this study was to examine the predictive role of parental health literacy in shaping negative attitudes toward vaccination.

Material and Methods: The research was conducted as a correlational study between April and May 2025 using an online questionnaire. All kindergartens in Serbia were contacted via email. A representative sample consisted of 379 parents of children aged 1 to 7 years.

Results: Parents of preschool children in the Republic of Serbia demonstrated low levels of health literacy. Health literacy was found to be a predictor of the following criteria: Mistrust of vaccine benefits [$F_{(1,377)}=11.85$; $p<.01$], Worries about unforeseen future effects [$F_{(1,377)}=17.57$; $p<.01$], Concerns about commercial profiteering [$F_{(1,377)}=29.10$; $p<.01$], Preference for natural immunity [$F_{(1,377)}=7.16$; $p<.01$], and Overall negative attitude towards vaccination [$F_{(1,377)}=24.38$; $p < .01$], explaining 2–8% of the variance. It was found that a higher level of parental health literacy contributed to a more negative attitude towards childhood vaccination.

Conclusion: The findings suggest that a higher level of health literacy does not necessarily correspond to more positive vaccination attitudes. This highlights the importance of considering additional factors such as institutional trust and exposure to misinformation. Future interventions should focus on improving health literacy, developing critical thinking and information appraisal skills.

Keywords: Childhood Vaccination, Vaccines, Vaccine Hesitancy, Vaccine Refusal, Health Literacy

Introduction

Vaccination is one of the most effective measures in the fight against infectious diseases. Mandatory immunization of children is the most efficient preventive measure against communicable diseases and mortality within this population group (1). Before the introduction of the MMR vaccine, the United States reported approximately 6,000 measles-related deaths annually (2).

Although mandatory vaccinations in early childhood are free of charge and proven to be effective, global childhood immunization coverage remains unsatisfactory. The 2023 report by the World Health Organization (WHO) and UNICEF shows that 2.7 million children were completely unvaccinated or had not received all the necessary doses. The number of children who had not received a single dose of the diphtheria, tetanus, and pertussis (DTP) vaccine rose from 13.9 million in 2022 to 14.5 million in 2023 (3).

We are increasingly encountering parental doubts, hesitancy, or even refusal regarding vaccination. Vaccine hesitancy is defined by the WHO as " the delay in acceptance or refusal of vaccines despite the availability of vaccination services" (4). Although hesitancy often involves doubt or questioning of certain vaccines, it can lead to delayed administration, missed opportunities for catch-up immunization, or complete refusal to vaccinate (5). The reasons why many parents are sceptical about vaccinating their children—or choose to delay or reject vaccination altogether—are diverse. These include concerns about vaccine safety, fear of adverse effects, religious beliefs [5], theories suggesting that vaccines cause autism or other conditions (6), and misinformation spread via social media and other media channels (7, 8).

For easier understanding of the reasons behind vaccine hesitancy, the 7C concept is applied, which includes the following factors:

- **Confidence** – Trust in the safety of vaccines and the healthcare system as a whole
- **Complacency** – The belief that vaccination is unnecessary because the risk of the disease is low
- **Constraints** – Physical, social, and economic barriers that hinder access to vaccination
- **Calculation** – Actively seeking information and weighing the risks and benefits of vaccination

- **Collective Responsibility** – The willingness to get vaccinated in order to achieve herd immunity
- **Compliance** – Following recommendations or mandates out of respect for authority and institutions
- **Conspiracy** – Belief in conspiracy theories that undermine trust in vaccines and the healthcare system (9).

One of the factors contributing to parental vaccine hesitancy may be health literacy (10, 11). Health literacy refers to an individual's ability to access, understand, evaluate, and apply health-related information (12). According to the WHO, health literacy encompasses the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways that promote and maintain good health (13).

Health literacy is an important concept in public health, particularly in the field of disease prevention. In modern society, where access to health information is greater than ever before, health literacy is a key factor in promoting and preserving the health of both individuals and entire community (14). It is especially important in the context of parenting, enabling informed decisions about children's health. Health literacy helps parents distinguish reliable information from misinformation, which is increasingly present, especially online and across social media platforms (15, 16).

Many studies indicate a positive relationship between higher levels of health literacy and vaccine acceptance, suggesting that individuals with higher health literacy tend to have more positive attitudes toward vaccination (17, 18). Research has shown that a higher level of health literacy does not always guarantee positive attitudes toward vaccination. A study conducted in the USA found that individuals with higher health literacy are more likely to develop vaccine skepticism, as they tend to analyze information that supports their existing beliefs (19).

Improving health literacy is essential to overcoming vaccine hesitancy and ensuring widespread immunization. However, limited research has examined whether higher levels of parental health literacy might be associated with counter-intuitive or negative attitudes toward childhood vaccination, particularly in the Serbia.

Research Aim and Objectives

The aim of this study is to examine the predictive role of health literacy in shaping negative attitudes toward vaccination among parents of preschool children. The study specifically seeks to determine whether, and to what extent, higher levels of parental health literacy predict negative attitudes toward childhood immunization.

The specific objectives of the study are to examine the influence of parental health literacy on various dimensions of attitudes toward vaccination, focusing on parents of preschool children in the Republic of Serbia. Based on the stated objectives, the following hypotheses were formulated: it is assumed that parental health literacy serves as a significant predictor of various dimensions of negative attitudes toward vaccination, namely:

1. mistrust in vaccine benefits,
2. concerns about potential future side effects,
3. perceptions of commercial profiteering related to vaccines,
4. preference for natural immunity, and
5. overall negative attitudes toward vaccination.

Materials and Methods

Study Design

The study was conducted as a cross-sectional correlational study between April and May 2025 using an online questionnaire. Questionnaires were distributed to kindergartens across Serbia via email, and subsequently shared with parents through parent communication groups. Data collection lasted for two months, until the end of May. Once the number of completed questionnaires reached the threshold required for adequate study power, the questionnaire was closed.

Sample

The sample consisted of 379 parents of children aged 1 to 7 years residing in the Republic of Serbia. A convenience sampling method was employed. Based on the statistical technique used (regression analysis with one predictor and five criteria), the required minimum sample size calculated with the G*Power program was 55 participants. Meanwhile, a representative sample size calculated based on the population of preschool children (235,344 according to the Statistical Office of the Republic of Serbia as of 17 June 2025) (20) was 374 participants, with a confidence level of 95% and a margin of error of ±5%. Therefore, the collected sample meets both requirements. Instructions specified that only one parent should complete the questionnaire per child. A convenience sampling method was used to recruit participants due to the accessibility and feasibility of reaching parents through kindergartens. Convenience sampling may have led to selection bias due to the higher participation of parents with strong pre-existing vaccination attitudes. While this approach was practical for data collection, it may introduce sampling bias and limit the generalizability of the results.

Inclusion Criteria

Participants were included if they:

- Were parents or guardians of a child aged 1 to 7 years;
- Provided informed consent to participate;
- Confirmed that the other parent had not already completed the questionnaire;
- Completed the questionnaire in full.

Exclusion Criteria

Participants were excluded if they:

- Had a questionnaire already completed by the other parent.

Research Instruments

Data were collected using the European Health Literacy Survey Questionnaire – short version (HLS-EU-Q16), the Vaccination Attitudes Examination (VAX) Scale, and a demographic questionnaire.

The European Health Literacy Survey Questionnaire (HLS-EU-Q16)

is a shortened version of the broader HLS-EU-Q47 instrument, developed as part of the European project HLS-EU (Health Literacy Survey – European Union) (7). This version consists of 16 items and is used for the quick yet reliable assessment of general health literacy in the general population. The Serbian version of this questionnaire was derived from the original English version (21), with permission from the original authors. The translation process followed the back-translation method: one of the article's authors translated the English version into Serbian, while another translated the Serbian version back into English. The two versions were then compared to ensure semantic equivalence.

Responses were rated on a five-point Likert scale, where 1=very easy, 2=easy, 3= difficult, 4=very difficult, and 5=don't know/no opinion.The responses to each of the 16 questions were dichotomized, so that "difficult" and "very difficult" were assigned 0 points, while "easy" and "very easy" were assigned 1 point. A summative score was then calculated, ranging from 0 to 16. Based on the total score, levels of health literacy are categorised as follows (22) :

- 0–8 points: Inadequate health literacy
- 9–12 points: Problematic health literacy
- 13–16 points: Adequate health literacy.

Since the questionnaire had not previously been standardised on a Serbian parent population, exploratory factor analysis (EFA) was conducted. The value of the KMO and Bartlett's test (3385.96; p<.01) was statistically significant, indicating that the data were suitable for factor

analysis. Based on eigenvalues and the scree plot method, two factors emerged, explaining 61.12% of the variance. However, as the item–factor correlation matrix showed that all items clustered around the first factor, the decision was made to retain a one-factor structure, which alone accounted for 52.49% of the variance. This solution also aligned with the original instrument structure used on the population for which it was developed.

Confirmatory factor analysis (CFA) was also performed and confirmed the unidimensional structure of the instrument. Internal consistency reliability of the scale, measured by Cronbach's alpha on this sample, was .90, indicating a high level of reliability.

The Vaccination Attitudes Examination (VAX)

scale is a 12-item questionnaire designed to assess general attitudes towards vaccination among adults. Attitudes are rated on a six-point Likert scale, ranging from 1="Strongly disagree" to 6="Strongly agree". Following the adaptation by Eisenblaetter and colleagues (23), who translated the scale into French, the response format was modified from a six-point to a five-point Likert scale (1="Strongly disagree" to 5="Strongly agree").The response range was from 1 to 5 for each question. In order to have a clearer overview of the average response values on the scales, the total score was divided by the number of items included in the respective scale or subscale. Therefore, the range for both the overall scale and the subscales was also from 1 to 5. The rationale for this modification is supported by literature suggesting that odd-numbered scales allow for a neutral midpoint, which may be more appropriate in cases where respondents lack sufficient knowledge to take a side (24).

The scale consists of four subscales, each containing three items:

Mistrust of vaccine benefit

Concerns about potential future side effects

Concerns about commercial profiteering

Preference for natural immunity (25).

The questionnaire was publicly available in Croatian and, with permission from the author L. Martin, was obtained from the official website and adapted into Serbian (25). Results from the VAX scale have successfully distinguished between parents who have vaccinated their children

and those who have not, as demonstrated in research conducted in the United Kingdom (26). A higher score on the scale indicates stronger negative attitudes toward vaccination.

However, since the factor structure had not previously been tested in populations from this linguistic region (the Western Balkans and former Yugoslavia), validation of the instrument was carried out. Exploratory factor analysis (EFA) extracted two factors, which explained 67.15% of the variance. Based on item groupings, these factors could be interpreted as "trust in vaccine efficacy" and "trust in the pharmaceutical industry". However, the results of confirmatory factor analysis (CFA) did not support this two-factor structure, but instead confirmed the original four-factor structure, and thus the original version was retained.

Internal consistency reliability measured by Cronbach's alpha in this sample was as follows: Mistrust of vaccine benefits – α=.94; Concerns about potential future side effects – α=.84; Concerns about commercial profiteering – α=.88; Preference for natural immunity – α = .86. These results indicate high internal reliability for all subscales.

The demographic questionnaire included items related to gender, level of education, place of residence, employment status, marital status, and number of children.

Data analysis
Statistical data analysis was performed using the Statistical Package for Social Sciences (SPSS), version 26 (trial version). Descriptive statistical methods and methods for testing associations were used in the data analysis. For descriptive statistics, categorical (nominal) variables were described using frequency distribution, while quantitative (numerical) variables were described using the arithmetic mean, standard deviation, minimum, and maximum values. To examine the predictive power of the model and to test the stated hypotheses, linear regression analysis was used. If the variables included in the regression analysis were not normally distributed, they were normalized prior to the analysis. The normality of the distribution of respondents' answers on the applied scales was tested using the Kolmogorov–Smirnov test. The validity of the instrument was assessed through exploratory and confirmatory factor analysis. Hypotheses were tested at a statistical significance level of p<0.05.

Results
Sample Characteristics
An analysis of the sample structure revealed that the majority of respondents were mothers (342; 90.2%), with fathers comprising a smaller portion of the sample (37; 9.8%). Regarding the highest level of education attained, 161 participants (42.5%) reported having completed college or

university-level education. A slightly smaller proportion had completed secondary school (139; 36.7%), while 63 participants (16.6%) held a master's degree. The smallest proportions were those with only primary education or a doctoral degree (8; 2.1%). In terms of place of residence, most participants reported living in an urban area (227; 59.9%), followed by rural areas (109; 28.8%), and small towns (43; 11.3%). The majority of participants were employed (329; 86.8%).

Regarding marital status, most respondents were married (346; 91.3%), while 22 (5.8%) were divorced, 8 (2.1%) were single, and 3 (0.8%) were widowed.

Family structure was also reflected in the number of children. The majority of participants had two children (207; 54.6%), followed by those with one child (96; 25.3%) and three children (64; 16.9%). Only 12 participants (3.2%) had more than three children.

Table 1 presents the descriptive statistics (mean, standard deviation, minimum and maximum values) for the scales used in the study, including the Health Literacy Scale (HLS-EU-Q16) and the Vaccination Attitudes Examination (VAX) scale with its four subscales.

Table 1. Descriptive statistics of the applied measurement scales

	Min	Max	Mean	SD	Sk	Ku	p K-S test
Health literacy	0	16	4.81	5	.92	-.41	.00
Mistrust of vaccine benefits	1	5	2.48	1.29	.49	.89	.00
Concerns about potential future side effects	1	5	3.01	1.11	.08	-.68	.00
Concerns about commercial profiteering	1	5	3.21	1.21	-.14	-.94	.00
Preference for natural immunity	1	5	2.70	1.18	.26	-.84	.00
Negative attitude towards vaccination	1	5	2.85	.97	.21	-55	.00

*Min-Minimum; Max-Maximum; SD-Standard deviation; Sk-Skewness; Ku-Kurtosis; p K-S test – Kolmogorov-Smirnov test

Table 2 presents the results of regression analyses in which health literacy was examined as a predictor of various dimensions of attitudes toward vaccination. Each regression model includes one of the VAX subscales (or the total VAX score) as a dependent variable, with health literacy as the independent variable.

Table 2. Overview of the regression models

Model 1 – Criterion: Mistrust of vaccine benefits	Standardized Coefficients Beta	p	$F_{1,377}$=11.85 R=.18 R^2=.03 p=.00
Health Literacy	.18	.00	

Model 2 – Criterion: Concerns about potential future side effects	Standardized Coefficients Beta	p	$F_{1,377}$=17.57 R=.21 R^2=.05
Health Literacy	.21	.00	p=.00
Model 3 – Criterion: Concerns about commercial profiteering	Standardized Coefficients Beta	p	$F_{1,377}$=29.10 R=.27 R^2=.08
Health Literacy	.27	.00	p=.00
Model 4 – Criterion: Preference for natural immunity	Standardized Coefficients Beta	p	$F_{1,377}$=7.16 R=.14 R^2=.02
Health Literacy	.14	.01	p=.01
Model 5 – Criterion: Total score – Negative attitude towards vaccination	Standardized Coefficients Beta	p	$F_{1,377}$= 24.38 R=.25 R^2=.06
Health Literacy	.25	.00	p=.00

*R – correlation coefficient of the model; R^2 – coefficient of determination; F – F statistic; p – statistical significance

Discussion

Preschool-aged children represent a vulnerable population in relation to numerous infectious diseases, and vaccination remains one of the most effective preventive measures. Understanding the effectiveness of vaccination, as well as the factors influencing parental acceptance, is essential to improving immunization coverage and preventing disease occurrence (1, 27). This study focused on the acceptance of routine childhood vaccinations by parents, with particular attention given to the predictive value of parental health literacy on attitudes toward immunization.

Table 1 presents descriptive data for the examined scales – the European Health Literacy Survey Questionnaire (HLS-EU-Q16) and the Vaccination Attitudes Examination (VAX) scale. Based on the empirical minimum, maximum, and mean scores, as well as established norms for health literacy, it can be concluded that parents of preschool children in Serbia demonstrate a low level of health literacy.

Regarding vaccination attitudes, measured by the VAX subscales Concerns about potential future side effects and Concerns about commercial profiteering, parents in Serbia exhibit a moderately

high level of concern about potential adverse effects of vaccines and the financial motives of pharmaceutical companies. Similar findings were reported in a study conducted in Spain (28). On the subscales Mistrust in vaccine benefits and Preference for natural immunity, as well as on the overall Negative attitude toward vaccination scale, respondents expressed slightly lower levels of concern.

The table also includes data on skewness, kurtosis, and the significance of the Kolmogorov–Smirnov test. Although skewness and kurtosis values indicate that the distribution of participants' responses falls within the normal range, the Kolmogorov–Smirnov test showed statistically significant deviation ($p < 0.01$), so scale scores were normalized for further analyses.

Regression analysis results presented in Table 2, showed that parental health literacy significantly predicts the following aspects of vaccination attitudes: mistrust in vaccine benefits, concerns about potential future side effects, concerns about commercial profiteering, preference for natural immunity, and overall negative attitude toward vaccination. The models explain a small, but statistically significant, proportion of variance (2–8%).

Contrary to expectations, higher parental health literacy was associated with more negative attitudes toward childhood vaccination in Serbia. This finding contrasts with studies from China (10), Turkey (29), and Slovenia (17), where higher levels of parental health literacy were associated with more positive vaccination attitudes and lower vaccine hesitancy. Such differences likely reflect broader social and cultural contexts. For example, in Turkey, digital literacy and the ability to critically evaluate media content were highlighted as key factors enabling more accurate identification of reliable health information (29).

In the Serbian context, where trust in health institutions and media sources remains limited, higher health literacy does not necessarily translate into a greater capacity to distinguish accurate from inaccurate information about vaccination. This finding can be partly explained by the fact that lower levels of parental health literacy may limit their ability to critically evaluate health information, increasing the likelihood of exposure to and susceptibility to vaccination-related

misinformation. A study conducted in the Western Balkan countries, including Serbia, found that vaccine hesitancy in this region is associated with a global crisis of trust in science and institutions (30). The results of a study conducted on large representative sample of the Serbian adult population indicate three main reasons for high vaccine hesitancy among both children and adults: belief in vaccine conspiracy theories, a strong association between these beliefs and reduced trust in medical science and institutions, and a link between belief in conspiracy theories and low objective vaccine knowledge and weak vaccination intentions. These factors collectively influence vaccination behavior and may reduce vaccine coverage, thereby increasing the risk of outbreaks of preventable diseases and posing a threat to public health. The study also suggests that low medical literacy, the abundance of misinformation on social media and the Internet, and distrust in official institutions are strongly correlated with vaccine refusal (31). Another study conducted in Serbia (32), indicates that by identifying specific predictors of the decision not to vaccinate children, parent profiles can be created, enabling healthcare professionals to strategically tailor their approach to different groups of parents and thereby improve vaccination coverage.

Although health literacy emerged as a significant predictor, its limited explanatory power (2–8%) indicates that other variables—such as trust in institutions, exposure to misinformation, and social norms—may have a stronger impact on vaccination attitudes. Similar findings have been reported in Hungary, where general and digital health literacy were positively associated with vaccination confidence but not with concrete health behaviors (33). These results suggest that health literacy alone is insufficient to shape positive attitudes; in addition, it is essential to develop critical thinking and information analysis skills, especially in a digital environment with high exposure to misinformation.

Study Limitations and Strengths: Nonetheless, the study has certain limitations. As a self-report measure was used to assess health literacy, it is possible that participants provided socially desirable responses rather than an accurate reflection of their ability to understand and apply health-related information. One of the main limitations of this study is the use of convenience

sampling, which may have affected the representativeness of the sample and, consequently, the generalizability of the findings. It is also possible that parents with strong pre-existing opinions about vaccination—either strongly supportive or opposed—were more motivated to participate, which could have introduced selection bias and influenced the overall pattern of responses. Additionally, the exact number of parents who received the survey invitation is unknown, which prevents assessment of the response rate and the potential for non-response bias, further limiting the generalizability of the findings. Future studies should consider using a random or stratified sampling method to enhance external validity. Future research should consider the role of sociodemographic variables, such as education, income, or urban/rural residence, relate to parental health literacy and vaccination attitudes, expand the sample to include parents of school-aged children, and employ more objective instruments to measure health literacy.

Conclusion

Health literacy represents an important factor in reducing parental vaccine hesitancy. However, the counterintuitive findings of this study suggest that other contextual and psychosocial variables may moderate this relationship, leading to a negative correlation and a low proportion of explained variance. Future interventions should focus not only on improving health literacy but also on developing critical thinking and information appraisal skills. The findings should be interpreted with caution due to the limitations of the convenience sample and cross-sectional design, while future research should aim to clarify the causal mechanisms and identify the threshold level of health literacy associated with more positive attitudes toward vaccination.

fabrication and/or fal-sification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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