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Early HPV Vaccination as a Public Health Strategy to Promote Social Well-Being and Reduce Long-Term Health Issues

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Abstract: Low coverage of vaccination against the human papillomavirus in Bulgaria poses a significant threat to the effective prevention of cervical cancer among the country's female population. This study aimed to examine mothers' perceptions of vaccination as a preventive measure against cervical oncological diseases and to identify the factors influencing their decisions regarding the immunisation of their daughters. The research was conducted as a cross-sectional sociological survey using a structured questionnaire among 264 mothers of primary school pupils in Varna between March and October 2024. Findings revealed that only 52% of respondents correctly understood the concept of primary prevention, while 61% recognised the necessity of vaccination before the onset of sexual activity. A willingness to vaccinate their daughters was expressed by 57% of participants, whereas 34% were firmly opposed to immunisation. Opinions regarding the safety of vaccines were almost evenly divided: 48% considered them safe, while 43% regarded them as unsafe. The main barriers to vaccination were fear of side effects (39%) and fear of pain (36%), while financial constraints accounted for only 11% of the reasons for refusal. The results indicated that psycho-emotional barriers outweighed economic and informational factors in shaping decisions about vaccination. The findings may inform public health communication strategies, clinical counselling practices, and school-based educational interventions aimed at increasing early human papillomavirus vaccination uptake. The multilevel recommendations developed on the basis of the obtained data propose a differentiated approach to various segments of the parent audience, with emphasis on overcoming fears through empathetic counselling and validation of parental concerns. Such measures may contribute to increasing the coverage of human papillomavirus vaccination in Bulgaria.

Keywords: Cervical cancer; primary prevention; sociological survey; public health; multilevel approach; information gaps

List of abbreviations: HPV – human papillomavirus; CC – cervical cancer; EU – European Union; SMS – short message service; SPSS – Statistical Package for the Social Sciences; WMA – World Medical Association; COPE – Committee on Publication Ethics; WHO – World Health Organization; EMA – European Medicines Agency; OR – odds ratio; CI – confidence interval; CDC – Centers for Disease Control and Prevention; DALY – Disability-adjusted life years; HPV-FASTER – programme title: Human Papillomavirus – Feasibility and Acceptability of Self-collected samples for cervical cancer screening Trial with HPV testing and Expedited Results; Medicaid – United States health insurance programme.

1 Introduction

HPV remains one of the most widespread sexually transmitted infections and poses a serious public health threat due to its association with the development of CC and other oncological diseases. In Bulgaria, HPV types 16 and 18 are responsible for approximately 70% of CC cases,

while vaccination coverage remains critically low – only 6% of the population (Bruni et al., 2023). Early HPV vaccination is particularly important, as it provides reliable immunity before the onset of sexual activity, when the risk of infection is highest. The study by Plagens-Rotman et al. (2022) in Poland focused on the primary prevention of CC through early immunisation against oncogenic HPV strains, with particular emphasis on the role of healthcare professionals in raising awareness among adolescents and their parents.

In the systematic review conducted by Karakusevic and Foss (2024) in the United Kingdom, the acceptability of HPV vaccination was assessed. Although vaccination coverage officially exceeded 80% before the pandemic, a steady decline has been observed since 2020. One of the identified barriers was insufficient understanding among parents and adolescents of the risks posed by HPV compared with those of the vaccine. Similarly, the study by Donkoh et al. (2021) in Ghana reported significantly higher antibody levels against HPV types 6, 11, 16, and 18 at 36 months following three vaccine doses compared with unvaccinated individuals. The modelling study by Luttjeboer et al. (2023) in the Netherlands reassessed the effectiveness of the bivalent vaccine in a population of 100,000 twelve-year-old girls, showing a greater impact of vaccination on quality of life than previously estimated. At the same time, Hoes et al. (2021), in their Dutch review, highlighted the lack of consolidated data on the long-term immunogenicity of vaccines when using reduced-dose schedules.

Rathod et al. (2023) conducted a comprehensive review of the preventive role of vaccination in reducing the risk of invasive CC, emphasising the development of a long-lasting immune response when administered at an early age. González-Rodríguez et al. (2024) analysed the outcomes of vaccination programmes among adolescents, finding that vaccine coverage resulted in a 54-83% reduction in high-grade cervical abnormalities, with sustained protection lasting over nine years. In Israel, Chodick et al. (2021) established that women who received catch-up vaccination were 1.34 times more likely to undergo Pap tests, indicating a durable change in health-related behaviour. A promising direction is the use of single-dose vaccination schedules, which, according to the international technical report by Waheed et al. (2023), provide long-term protection for more than ten years, making the implementation of more cost-effective immunisation schemes feasible.

Yordanov et al. (2023) highlighted the critical situation in Bulgaria, with incidence rates of 28.2 cases and mortality of 11.9 deaths per 100,000 women, alongside extremely low vaccination coverage: in 2019, only 12.8% of twelve-year-old girls and 7.2% of thirteen-year-olds received the first dose. European Cancer Organisation (2025) reported the adoption of an expanded national vaccination programme for 2025-2030, which provides a free nine-valent vaccine for children aged 9-14 years; however, coverage in 2023 did not exceed 2%.

The sociological dimensions were examined by Getova-Kolarova et al. (2024), who found that only 35.6% of Bulgarian respondents were willing to be vaccinated, with trust in family doctors having a direct impact on vaccination readiness. In their analysis of vaccination programme implementation across the EU, Miazga et al. (2024) identified Bulgaria's considerable lag, caused by insufficient coverage and the absence of a gender-neutral approach. A comprehensive study by Ruschukova et al. (2024) established that more than half of respondents did not consider vaccination to be an effective preventive method, a perception linked to inadequate communication by healthcare professionals and insufficient information for parents.

The main gaps include the absence of robust clinical data on the long-term immunogenicity of vaccines within the Bulgarian population, the need to identify clear correlates of protection to

confirm the effectiveness of reduced-dose schedules, unequal access to vaccination across countries, the lack of a harmonised national prevention strategy in Bulgaria, and a limited number of interventional studies aimed at increasing early vaccination coverage.

Despite the substantial body of scientific literature dedicated to HPV, insufficient attention has been paid to a comprehensive assessment of the role of early vaccination in preventing long-term complications and HPV-related diseases, which underscores the relevance and necessity of the present study. This study aimed to examine mothers' attitudes towards vaccination as an essential component of CC prevention. Particular attention is given to attitudes towards early HPV vaccination as the most effective preventive strategy. The objectives were:

- to evaluate mothers' knowledge of primary prevention of CC;
- to assess awareness of the optimal timing of HPV vaccination;
- to examine mothers' willingness to vaccinate their daughters;
- to identify psycho-emotional and informational barriers influencing parental vaccination decisions.

2 Materials and methods

The study was conducted as a cross-sectional sociological survey using a structured questionnaire among mothers in Varna (Bulgaria) during 2024. The empirical data were collected between March and October 2024, providing a sufficient timeframe to ensure a representative sample and to minimise seasonal factors that could influence the results.

Primary data were collected through questionnaires administered to the target group of women who are mothers of pupils in general education schools in Varna. Mothers were selected as the target population due to their leading role in decision-making on children's health in the Bulgarian sociocultural context and their comparatively higher awareness of reproductive health issues. Sampling was carried out through random selection, with access facilitated by school administrations from different districts of the city to ensure geographical representativeness. The sample included participants from six general education schools located across different administrative districts of Varna. The study surveyed mothers of school-aged children, and questions referring to daughters reflect the current focus of HPV vaccination programmes on girls within the recommended vaccination age. The specific names of participating institutions remain anonymous to protect participant confidentiality.

Eligibility for participation required respondents to be female, to have children aged 10-14 years enrolled in general education schools, to have resided permanently in Varna for at least the past three years, and to provide voluntary consent to participate in the study. Respondents were excluded if they declined to participate in the survey, left more than 80% of the questionnaire incomplete, or had professional medical education that could potentially influence the objectivity of their responses. The total sample comprised 264 women, which ensured statistical significance with a 95% confidence level and a margin of error not exceeding 5%.

The primary tool for data collection was an original structured questionnaire, developed on the basis of previously published international survey instruments assessing HPV awareness, attitudes, and vaccination intentions (e.g., Hussein et al., 2024; Montalti et al., 2024; Kim et al., 2022) and adapted to the specific features of the Bulgarian sociocultural context. The

questionnaire consisted of five closed-ended questions designed to assess respondents' awareness of primary CC prevention, their understanding of the optimal timing of vaccination, their willingness to immunise their children, their perceptions of HPV vaccine safety, and the main barriers to making a positive decision about vaccination. Each question was accompanied by a set of answers (Table 1):

Table 1: Questionnaire items and response options

No.	Questions	Answers
1.	What does primary prevention of CC include?	a) vaccination against oncogenic HPV types; b) treatment of early infection symptoms; c) first visit to a gynaecologist; d) other.
2.	Should CC vaccination be administered to girls before the onset of sexual activity?	a) yes; b) no; c) difficult to answer.
3.	Would you vaccinate your daughter against HPV?	a) yes; b) no; c) difficult to answer.
4.	In your opinion, are vaccines against HPV safe?	a) yes; b) no; c) difficult to answer.
5.	Please indicate the reason why you would not wish to vaccinate your child against HPV.	a) fear of side effects; b) fear of pain; c) doubts about the vaccine's effectiveness; d) financial constraints e) other.

Source: compiled by the author.

Statistical processing of the data was carried out using Microsoft Excel 2019 (Version 16.0) for initial systematisation and descriptive statistics, and SPSS Statistics 29.0 for more advanced analysis of relationships between variables. Results are presented as frequency distributions with calculated percentages and confidence intervals. Pearson's chi-squared test was applied to assess the statistical significance of differences between groups, with the level of significance set at $p<0.05$.

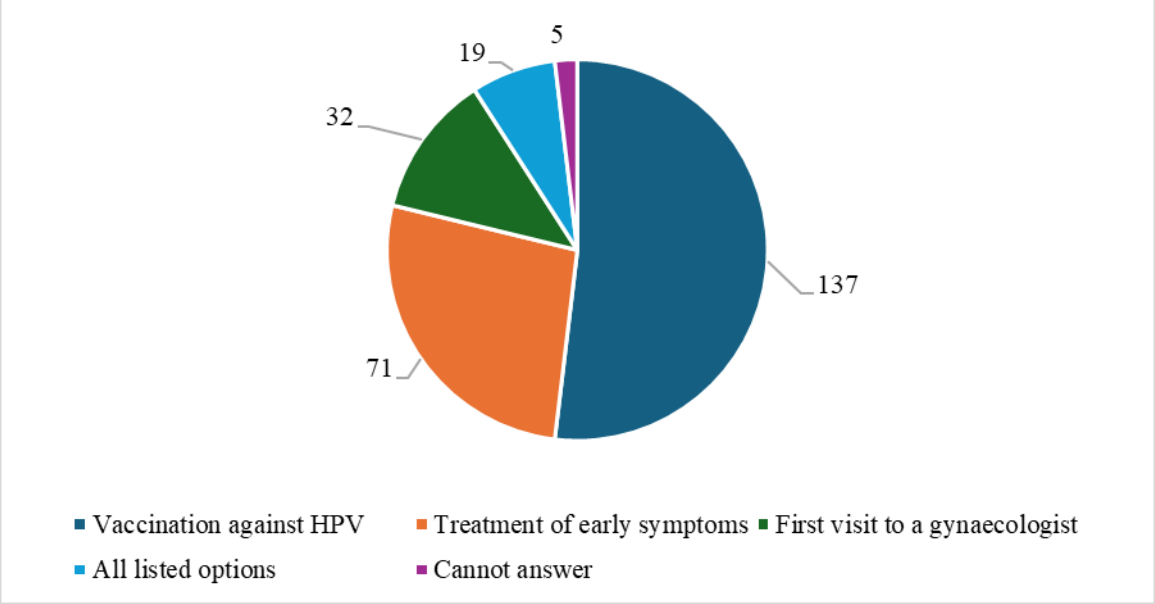
The study was conducted in accordance with the principles of the WMA's Declaration of Helsinki (2013) and the guidelines of the COPE (2019). All participants were informed about the purpose and procedures of the survey and provided voluntary informed consent. Full anonymity of respondents and confidentiality of the collected data were ensured.

3 Results

3.1 Mothers' awareness of CC prevention

In the course of the 2024 sociological survey of 264 mothers of pupils in general education schools, data were obtained on their awareness and attitudes towards vaccination against HPV as a method of CC prevention. The first stage of the study assessed respondents' understanding of the concept of primary CC prevention. These data are presented in Figure 1.

Figure 1: Responses to question 1 "What does primary prevention of CC include?"



Source: compiled by the author.

Although a slight majority of respondents (52%) demonstrated correct understanding by identifying primary prevention as vaccination against oncogenic HPV types, this proportion is insufficient to indicate a high level of public awareness. It shows that only one in two mothers in the study group possesses the basic knowledge required to make an informed decision regarding the immunisation of their child.

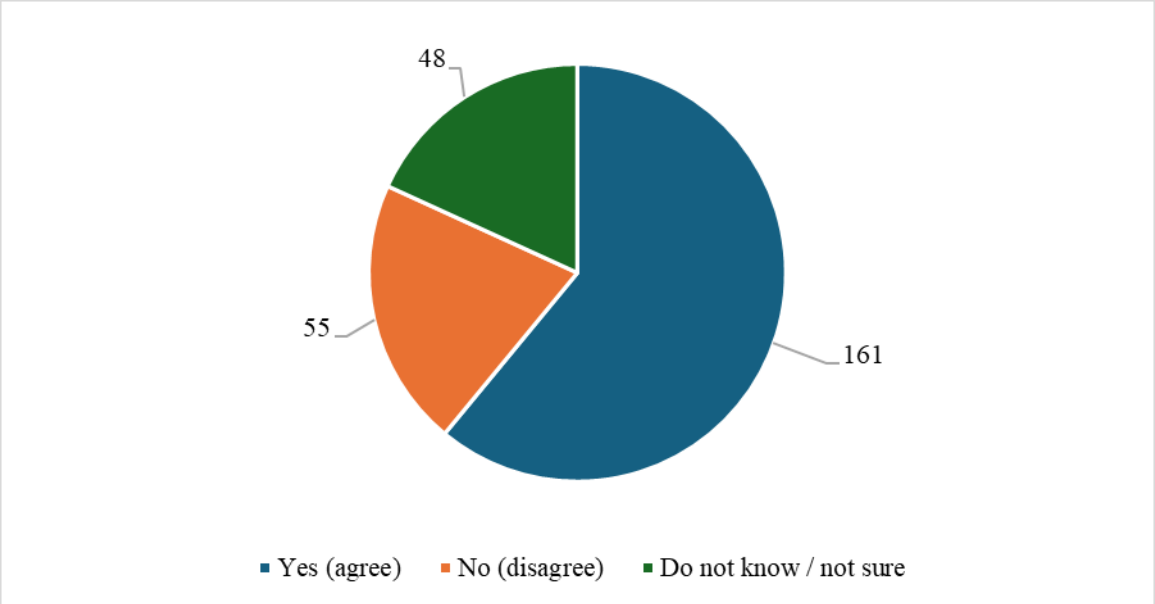
A more detailed analysis reveals concerning trends in the perception of preventive measures. The second largest group of respondents (27%) believed that primary prevention means "treating early symptoms of infection". This reflects a fundamental misunderstanding of the

very essence of preventive medicine and a conflation of primary prevention (avoiding disease onset) with tertiary prevention or treatment (managing an existing disease or its consequences). Such a misconception is highly problematic, as it shifts the focus from proactive actions (vaccination) to reactive ones (waiting for symptoms to initiate treatment), thereby undermining the core principle of cancer prevention (Latka et al., 2024).

A further 12% of respondents associated primary prevention with the first visit to a gynaecologist. While regular check-ups are an essential component of women's health, they belong to secondary prevention (early detection and screening), not primary prevention. This misunderstanding is particularly relevant in the context of the study, as it may create in parents an illusion of protection based solely on the expectation of future medical examinations, diminishing the role of vaccination as the only method capable of preventing infection. The findings reveal a mosaic and fragmented understanding of CC prevention among mothers. The fact that only 52% provided correct answers, while nearly half held false or inaccurate perceptions, represents a serious barrier to increasing vaccination coverage. This highlights the critical need for targeted educational campaigns that not only promote vaccination but, above all, clearly explain the hierarchy and essence of different levels of prevention. Without establishing this basic conceptual understanding, calls for vaccination risk being misinterpreted or disregarded by a significant proportion of the parent community (Ciancio & Cannone, 2010).

In addition to a general awareness of the concept of primary prevention, it is equally important for the target audience to know the optimal age for its application, as this determines the maximum effectiveness of vaccination (Ismail & Kornovski, 2014). Delayed immunisation can significantly reduce its preventive potential. For this reason, the next stage of the study assessed mothers' awareness of this critical aspect, with the findings presented in Figure 2.

Figure 2: Responses to question 2 "Should CC vaccination be administered to girls before the onset of sexual activity?"



Source: compiled by the author.

The majority of respondents (61%) confirmed this statement, indicating a relatively high level of awareness regarding a key condition for vaccine effectiveness. This outcome suggests that

the core messages of medical recommendations have been absorbed by a substantial part of the target audience, creating a favourable basis for further communication.

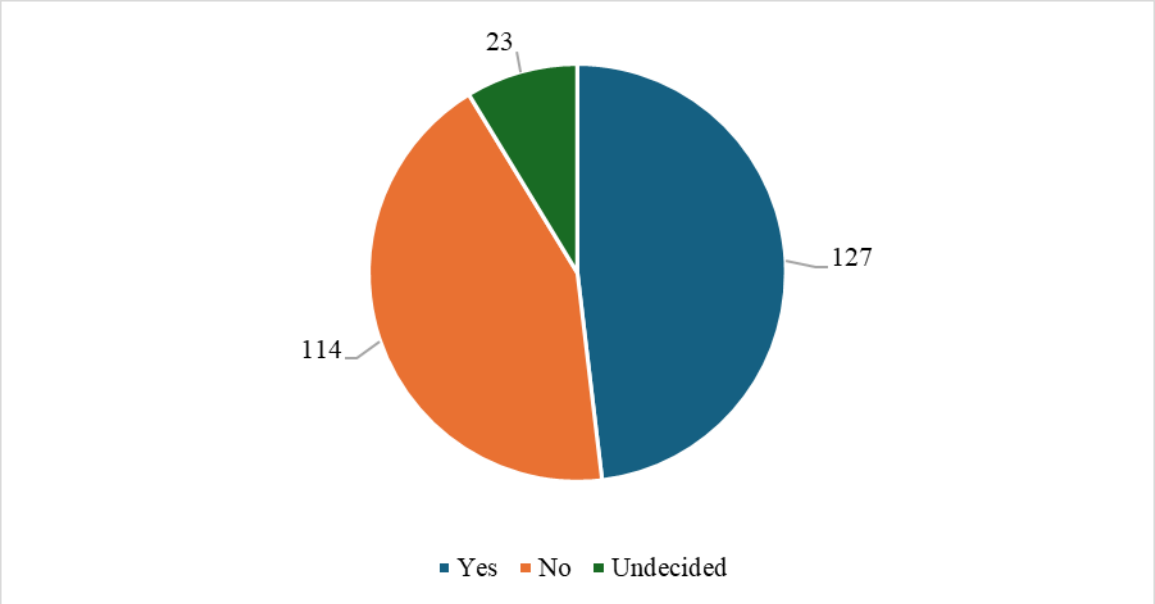
However, the data for the remaining respondents indicate a mixed attitude towards vaccination. One in five women (21%) disagreed with this fundamental principle of HPV vaccine prevention. This group is of particular interest for analysis, as their position does not simply reflect a lack of knowledge but likely results from an active misconception. It can be assumed that these mothers believe vaccination can be administered at any age with equal effectiveness or do not perceive a link between sexual activity and the risk of HPV infection. Such a stance constitutes a significant barrier, as it encourages postponement of the vaccination decision indefinitely, potentially resulting in the loss of the optimal "window of opportunity" for immunisation (Ciancio et al., 2024).

A further 18% of respondents were unable to provide a definitive answer. This group differs from the previous one in that it is characterised not by misconceptions but by a lack of information and uncertainty. These mothers are potentially more receptive to educational interventions, as they have not formed a negative attitude and are likely to benefit from additional explanation and the authoritative guidance of a healthcare professional to develop their own position. Thus, although more than half of the mothers correctly understand the importance of timely vaccination, a substantial minority (39% in total) either hold hazardous misconceptions or exist within an informational void. This creates a direct risk that parents, even if generally not opposed to vaccination, may postpone it, believing that "there is still time" (Mathevosyan, 2025). Information campaigns should be differentiated according to audience needs. For the group expressing disagreement (21%), efforts should focus on dispelling myths and clearly explaining the biological rationale for vaccine effectiveness before exposure to the virus. For the hesitant group (18%), it is necessary to provide clear, accessible, and persuasive information to help them overcome uncertainty and make an informed decision. Underestimating the importance of this aspect could significantly reduce the effectiveness of the national CC programme.

3.2 Attitudes towards vaccination and perceptions of vaccine safety

After assessing respondents' theoretical knowledge, the study focused on a key question aimed at identifying practical intentions and readiness to act. Responses to this question enabled a shift from analysing knowledge to examining behavioural attitudes, which are decisive for actual vaccination coverage (Figure 3).

Figure 3: Responses to question 3 "Would you vaccinate your daughter against HPV?"



Source: compiled by the author.

The results showed that a slight majority of mothers (57%) expressed a positive attitude and willingness to vaccinate their daughters. This figure represents the foundational potential for implementing the immunisation programme. It indicates that more than half of the parents in the study group have already reached a positive conclusion, likely based on existing knowledge, trust in the healthcare system, or personal experience.

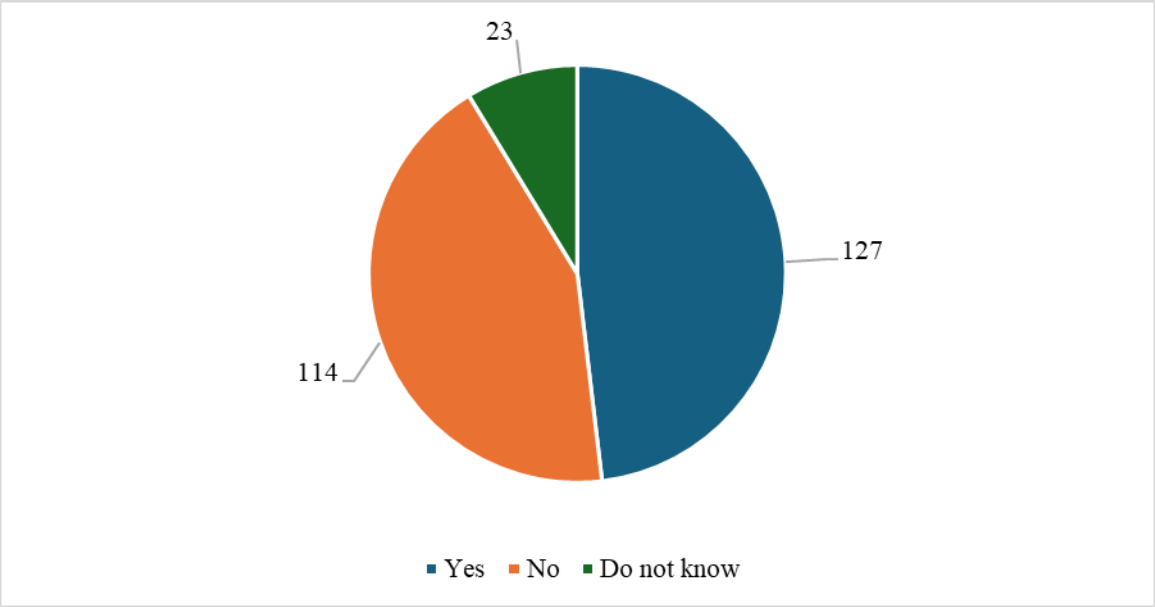
However, the most concerning finding is that more than one-third of respondents (34%) take a categorical negative stance, unequivocally refusing vaccination. This group forms the core of resistance to the immunisation programme. It is important to emphasise that this is not merely hesitation or uncertainty but a firmly established negative decision. Engaging with this audience is particularly challenging, as it requires not only providing information but also addressing deeply rooted beliefs, which are likely based on fear, distrust, or misinformation. This figure serves as a critical indicator of substantial obstacles to achieving high vaccination coverage.

Attention should also be given to the group of mothers who remain undecided (9%). Although relatively small, this group is strategically significant. Educational and informational interventions are likely to have the most immediate and effective impact on this audience. Their position is not yet fixed, and providing them with objective, scientifically supported information, along with consultation from a healthcare professional, could encourage a positive decision. Thus, the study reveals that the problem of low vaccination coverage in Bulgaria lies less in a lack of willing participants and more in the presence of a substantial, firmly opposed segment of the population.

The high proportion of categorical refusals (34%) combined with the hesitant group (9%) indicates the existence of significant barriers within parental perceptions. To understand the sources of these barriers, it was necessary to examine respondents' perceptions of a key aspect

of any medical intervention – its safety. These findings are presented in Figure 4. Perception of vaccine safety is one of the most influential factors affecting the final decision.

Figure 4: Responses to question 4 "In your opinion, are vaccines against HPV safe?"



Source: compiled by the author.

The data reveal an almost equal split of opinion, indicating profound societal polarisation regarding trust in HPV vaccines. Only 48% of mothers surveyed consider these vaccines safe. This figure is critically low and signifies that fewer than half of parents trust official data and recommendations from the medical community concerning the safety profile of the vaccine.

Conversely, 43% of respondents explicitly stated that they consider HPV vaccines unsafe. In comparison, 34% refuse vaccination. This allows a reasonable inference that the belief in vaccine danger is a principal driver of refusal. It reflects not merely a lack of information but a persistent negative attitude, likely reinforced by anti-vaccination movements, misinformation on social media, and other media sources.

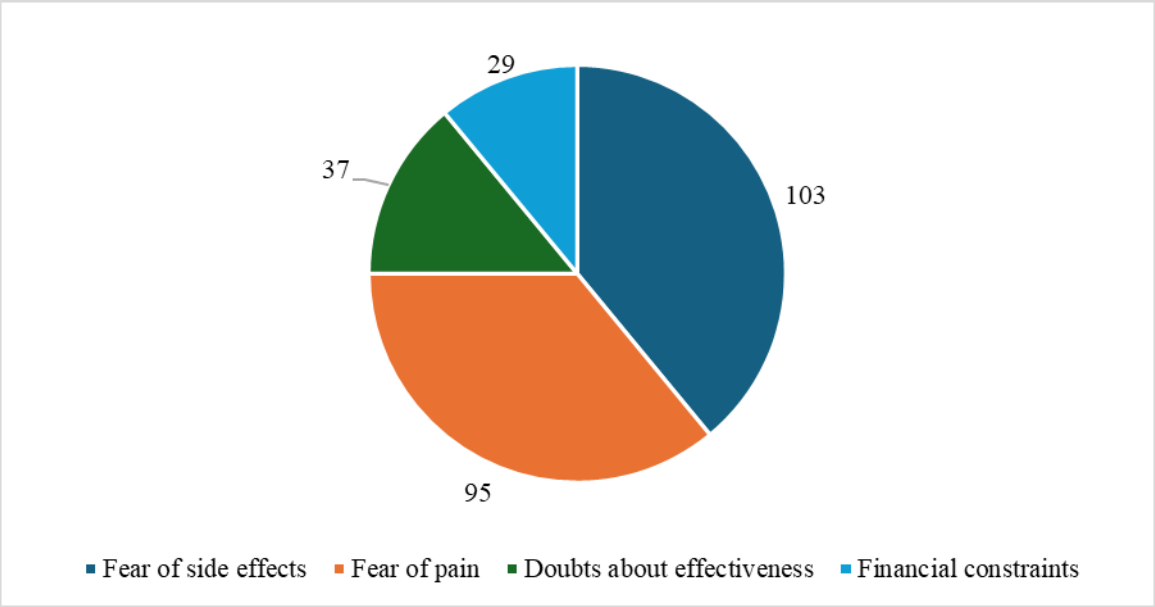
The group of respondents who were unable to answer the question (9%) coincides with the previously identified hesitant group. This supports the hypothesis that their indecision is directly linked to a lack of reliable information regarding vaccine safety. They possess neither established trust nor active distrust, making them an ideal target audience for educational and informative interventions. The fact that almost half of mothers do not trust the safety of vaccines also calls into question the effectiveness of communication at the "doctor–patient" level. This suggests that healthcare professionals either do not sufficiently address these issues or that their arguments are not persuasive for a substantial proportion of parents. Consequently, any strategy to increase vaccination coverage that does not prioritise addressing fears and restoring confidence in vaccine safety is likely to fail.

3.3 Barriers to vaccination and strategies to overcome them

Having established that the primary barrier to vaccination is the belief that it is unsafe, it became necessary to examine these fears in greater detail. Understanding the specific reasons mothers

cite when refusing immunisation allows a shift from general conclusions to the development of targeted communication strategies that address particular concerns (Figure 5).

Figure 5: Responses to question 5 "Please indicate the reason why you would not wish to vaccinate your child against HPV"



Source: compiled by the author.

A detailed analysis of the reasons for refusal demonstrates that the decision to reject vaccination is driven primarily by psycho-emotional factors rather than rational-cognitive evaluation. The dominant barrier is the "fear of side effects", cited by 39% of respondents. The nature of this fear is typically diffuse and unspecified, suggesting a connection with widespread misinformation and a general lack of trust in medical interventions. This reflects a situation in which subjective risk perception far exceeds the objective data from clinical studies regarding the safety profile of vaccines.

A similarly significant reason is the "fear of pain" (36%). This result is indicative and may reflect a phenomenon of overprotectiveness among parents, characterised by a desire to avoid any, even minimal, physical discomfort for their child. It suggests a potential cognitive dissonance in which the priority given to the child's immediate emotional well-being outweighs a rational assessment of the long-term health benefits and the prevention of far more serious suffering in the future.

By contrast, rational arguments carry considerably less weight. Doubts about vaccine effectiveness (14%) are less influential than concerns about potential harm. The least significant factor is financial constraints (11%). This finding is of high practical relevance, as it empirically refutes the hypothesis that economic inaccessibility constitutes the primary barrier. Thus, the study demonstrates that the main obstacles to immunisation are predominantly psychological rather than economic.

The study highlights the complex nature of the problem of low HPV vaccination coverage, which extends far beyond a simple information deficit. Empirical data indicate a profound trust crisis and the predominance of affective (emotional) barriers, signalling the need for a radical

reassessment of current communication strategies and the implementation of a systematic, multi-level approach tailored to the psychological characteristics of the target audience.

At the macro level, concerning national health policy, the primary task is the development and implementation of a unified, evidence-based educational paradigm (Kornovski et al., 2016). The inaccuracies identified in the study regarding the understanding of primary, secondary, and tertiary prevention (48% of respondents held incorrect or imprecise views) constitute a critical barrier. Standardised informational modules must be created for all communication channels – from national media to the family doctor's office – clearly distinguishing the preventive role of vaccination (prevention of infection) from the screening role of cytological testing (early detection of consequences). Particular emphasis in this paradigm should be placed on the concept of the "therapeutic window", providing a reasoned explanation of the immunological and epidemiological rationale for the maximal effectiveness of vaccination prior to the onset of sexual activity (Valenti et al., 2023). This directly addresses the informational needs of the 39% of respondents who do not understand or are unsure of the importance of this factor.

At the meso level, encompassing the organisation of the healthcare system and community engagement, the key task is the implementation of a differentiated approach tailored to the target audiences identified in the study. For respondents with a positive attitude towards vaccination (57%), it is advisable to ensure maximum convenience of service, including the creation of a single digital portal providing information on vaccination centres and the implementation of an automated reminder system (SMS, messaging apps) regarding the timing of subsequent doses. Such measures minimise the risk of interruption in the vaccination course. For respondents whose indecision was correlated with a lack of knowledge about vaccine safety (9%), it is recommended to provide proactive consultative support. This requires the development and implementation of mandatory training programmes for primary healthcare professionals in motivational interviewing techniques. Medical personnel should be prepared not only to provide information but also to identify hidden fears, employ open-ended questions, and facilitate the formation of well-informed decisions (Donati et al., 2004). For respondents expressing strong distrust of vaccination (34%), the most effective approach is indirect influence. Instead of direct persuasive or pressure-based communication, it is advisable to engage respected opinion leaders, psychologists, and representatives of patient organisations in informational campaigns, alongside broad dissemination of positive personal stories and international experiences from countries that have achieved significant reductions in CC prevalence (Ottaiano et al., 2019; 2021).

At the micro level, encompassing direct clinical interaction between doctor and patient, a shift is required from a paternalistic model to a partnership-based, empathetic form of communication focused on overcoming affective barriers (Kornovski et al., 2012a; 2012b). The study demonstrated that the primary reasons for refusing vaccination are fear of side effects (39%) and fear of pain (36%), making these issues the priority in the consultation process. To address the fear of side effects, the use of visual materials – particularly infographics – is recommended, illustrating the ratio of statistically minimal vaccination risks to the high risks associated with HPV-related diseases. An additional tool is referencing data from international organisations, such as the WHO and EMA, which confirm the safety of vaccines based on extensive evidence from billions of administered doses (Picone et al., 2023). To reduce fear of pain, it is advisable to implement clinical protocols aimed at minimising procedural discomfort, including distraction techniques, psychological preparation of the child, and training medical personnel in proper injection techniques. Equally important is the development of doctors' competencies in empathetic listening, which involves acknowledging and addressing patients'

concerns rather than dismissing them, as well as constructively discussing the causes of anxiety (Thangavelu et al., 2025). This approach is fundamental to building trust in the doctor–patient relationship and enhancing adherence to vaccination.

Thus, an effective strategy to increase HPV vaccination coverage should be a comprehensive programme integrating educational, organisational, and psychological interventions. It must transform the healthcare system from a mere service provider into a reliable, competent, and responsive partner capable not only of providing information but also of reassuring, supporting, and guiding parents towards making scientifically informed decisions that safeguard their children's health in the long term.

4 Discussion

The current Bulgarian study revealed a moderate level of parental readiness to vaccinate daughters against HPV, with only 57% of respondents expressing willingness to vaccinate, while 34% categorically refused. This issue reflects a low level of trust in vaccination and the presence of significant barriers to making immunisation decisions. A study by Hussein et al. (2024) in Finland demonstrated markedly different outcomes in terms of vaccine acceptance. Among 883 parents of girls aged 10-14 years, 83% expressed the intention to vaccinate their daughters, and the actual coverage reached 88%, nearly 30 percentage points higher than the results observed in the Bulgarian study. Key factors contributing to the success of the Finnish programme included school-based vaccine delivery, the provision of information in 11 languages, and a high level of trust in the national vaccination programme. Fear of side effects in Finland was only 22%, approximately half the Bulgarian figure of 39%.

Similarly high acceptance rates were reported by Borena et al. (2016), who found an overall acceptance rate of 81.9% among 334 parents in the Austrian province of Tyrol. The Austrian model, offering a free school-based programme for both genders, revealed a fundamentally different structure of barriers compared with the Bulgarian results. There, fear of side effects was not the dominant concern; rather, the main obstacles were perceived lack of information and the belief that children were too young for vaccination. The Italian OBVIOUS project by Montalti et al. (2024), involving 1,266 parents, showed that 88% considered the HPV vaccine beneficial for cancer prevention. A key difference from the Bulgarian findings was that the primary barriers were not concerns about safety but rather insufficient awareness of children's entitlement to vaccination: 42.5% for boys and 49.8% for girls. This highlights information gaps rather than fundamental fears regarding vaccine safety.

In the Bulgarian study, 39% of parents identified fear of side effects as the main barrier to vaccination. Combined with fear of pain (36%), these concerns formed a strong safety-related block, accounting for more than three-quarters of all reported barriers. Asian studies, however, revealed a markedly different structure of obstacles. A study by Sitaresmi et al. (2020) in Indonesia among 506 parents found that 95.5% considered the free provision of the vaccine an important factor, while 98% emphasised the significance of the vaccine's halal status. Financial and religious factors were therefore far more influential than concerns over safety. Following an educational intervention, acceptance rates increased from 74.3% to 87.4%, demonstrating the effectiveness of targeted communication strategies – unlike in the Bulgarian context, where educational measures proved insufficient.

Thai studies by Grandahl et al. (2018), involving 301-331 parents, reported 85% acceptance when the vaccine was state-subsidised and 76.9% when provided free of charge, considerably higher than the Bulgarian figures. A key difference was that Buddhist religious beliefs

facilitated vaccination rather than hindered it, in contrast to Bulgaria, where religious factors were not reported as a positive influence. A Korean-Chinese study by Kim et al. (2022), involving 590 female university students, found that the main barriers were knowledge gaps (with an average score of less than 2 out of 8) and negative emotions towards HPV, rather than fears about vaccine safety as observed in the Bulgarian study. Korean university students demonstrated higher vaccination intentions when financial support was available, again highlighting economic rather than medical barriers.

The current study revealed an almost even split of opinions regarding vaccine safety: 48% of parents considered the vaccines safe, while 43% regarded them as unsafe. This polarisation reflects profound societal doubts concerning immunisation safety. Studies from the United States have demonstrated effective strategies for addressing similar concerns. Cunningham-Erves et al. (2023) developed a personalised mobile intervention, HPVVaxFacts, for parents with initial vaccination hesitancy. Following use of the programme, 94% of parents (29 out of 31) expressed an intention to vaccinate their children, in stark contrast to the Bulgarian findings, where 43% of parents remained convinced of the vaccines' danger. A key factor in the programme's success was the delivery of personalised content tailored to address each parent's specific concerns.

Data from the present study indicate that only 48% of mothers perceive the vaccine as safe. At the same time, 43% explicitly believe it to be unsafe, which closely aligns with the 34% of respondents who categorically refuse vaccination. This situation reflects a profound crisis of trust in vaccines, where affective factors – such as fear of side effects and distrust of information sources – play a decisive role. Research by Faqeeh et al. (2024) in Saudi Arabia found that over 85% of respondents recognised the serious consequences of HPV infection, and 63% acknowledged the effectiveness of the vaccine. However, among the main barriers cited were the cost of vaccination (22%) and lack of awareness (13%). Notably, in this context, the majority of participants held a positive attitude towards vaccination, with 70% willing to vaccinate their children, which stands in marked contrast to the Bulgarian sample. A possible explanation for this difference is the higher effectiveness of state-led information campaigns or greater trust in the healthcare system in Saudi Arabia, whereas in Bulgaria, scepticism prevails, fuelled by misinformation and socio-cultural biases. Thus, in different regions, the primary barrier may stem either from a lack of information or from active misinformation and distrust, necessitating fundamentally different approaches in communication strategies. A Danish study by Suppli et al. (2018) demonstrated the possibility of restoring trust following a crisis of confidence. Denmark overcame a dramatic decline in vaccination coverage – from historically high levels down to 20% in 2013-2015 – through a comprehensive "heart and mind" strategy that combined emotional narratives with scientific facts. A coordinated campaign involving healthcare professionals and CC survivors successfully restored coverage levels to over 80%, illustrating that trust can be rebuilt even in challenging circumstances.

The current results indicate the inadequacy of existing communication strategies, as high levels of fear and low acceptance point to the ineffectiveness of current information campaigns. An Argentine study by Chaparro et al. (2020) in the Chaco province, involving 347 parents of eleven-year-old girls, applied the theory of planned behaviour to identify key determinants. The study found that a positive attitude was the strongest predictor of vaccination intent (adjusted OR 4.67; 95% CI: 3.11-7.03), while social norms were also significantly associated with vaccination intent. This contrasts with the Bulgarian context, where negative attitudes predominated, highlighting the need to cultivate positive perceptions and leverage social influence rather than focusing solely on medical facts.

The Australian national programme, described by Brotherton et al. (2019), demonstrated one of the most successful communication models globally, achieving coverage of 85.9% for girls and 83.4% for boys – 28-29 percentage points higher than the Bulgarian willingness rates. Key elements included school-based delivery, which normalised vaccination, an emphasis on cancer prevention rather than sexually transmitted infections, and transparent presentation of safety monitoring data. Australia became the first country to demonstrate population-level elimination of HPV infections among young women. The Swedish national elimination programme, reported by Dillner et al. (2021), achieved 90% coverage among girls and 85% among boys through innovative approaches, including partnerships with social media influencers and vaccination initiatives in cinemas. Sweden became the first country to set the goal of complete HPV elimination, demonstrating the potential to achieve universal uptake.

The conducted study revealed that financial constraints were the least significant barrier, cited by only 11% of respondents. This low importance of economic factors contrasts sharply with many international studies. A Chinese study by Xiang and Sun (2025) in Tianjin found that financial barriers were the primary driver of vaccine choice, with more than half of adolescents aged 9-14 opting for cheaper domestic vaccines due to financial constraints. The study also highlighted a clear urban-rural divide: 99.7% of recipients were urban residents versus 0.3% rural, largely due to transportation costs and out-of-pocket expenses. An American analysis of the CDC National Health Survey demonstrated marked disparities in vaccination based on income: children from families below the federal poverty level had a vaccination rate of 29.9%, whereas children from families earning over 400% of the federal poverty level had a rate of 45.7%. Insurance status also played a significant role: private insurance coverage corresponded to a 41.5% vaccination rate, Medicaid to 37.0%, and the uninsured only 20.7% (Villarroel et al., 2024).

The present Bulgarian study focused primarily on attitudes towards vaccination as the sole method of primary prevention, without considering integrated approaches or alternative strategies for CC prevention. A global analysis by Zhang et al. (2025), based on data from 204 countries spanning 1990-2021, showed that screening levels had a significant negative correlation with CC DALYs ($r=-0.56$, $p<0.01$), while HPV vaccination coverage demonstrated a more moderate correlation ($r=-0.35$, $p<0.01$). The study demonstrated that optimal prevention strategies must be adapted to resource availability, with low-resource regions requiring the development of basic infrastructure, while high-resource regions should transition towards precision public health approaches.

Comparative modelling by Prem et al. (2023), using three independent HPV transmission models, showed that a single-dose vaccination provides 82.4% of the effectiveness of a two-dose schedule, assuming lifelong protection at 80% efficacy. Single-dose regimens simplify delivery, reduce costs, and ease vaccine supply constraints, potentially increasing global uptake and addressing financial concerns while retaining most of the benefits of two-dose programmes (Meloni et al., 2023). Brisson et al. (2020) in The Lancet compared the effectiveness of various strategies across 78 low- and lower-middle-income countries. Vaccination alone achieved an 89.4% reduction in CC incidence by 2,120, whereas vaccination combined with lifetime biennial screening reached a 96.7% reduction. The combined approach achieved elimination in 100% of countries compared with 60% for vaccination alone, accelerating elimination by 11-31 years. The HPV-FASTER programme, described by León-Maldonado et al. (2019), demonstrated an innovative integrated approach, combining vaccination with HPV screening in a single visit. The Mexican study reported a 93% acceptance rate for the combined

vaccination-screening strategy, with patients valuing the convenience of integrated procedures and the increased confidence offered by dual protection.

The discussion of the current study's findings revealed a complex picture of Bulgarian mothers' readiness to vaccinate against HPV, characterised by a deep polarisation of opinions and the predominance of psycho-emotional barriers over rational considerations. The overall willingness to vaccinate (57%) was moderate compared with high levels reported in Finland (83-88%), Austria (82%) and Thailand (85%), indicating substantial potential for improvement. The structure of barriers differed markedly from international trends. While financial and religious factors dominated in Asian countries, and information gaps were prominent in other European contexts, the present study found that fears related to vaccine safety – specifically fear of side effects and pain – accounted for 75% of all barriers. The nearly equal split in perceptions of vaccine safety (48% supportive vs 43% opposed) further confirmed the profound polarisation within society. The low significance of financial barriers (11%) contrasts with experiences in developing countries, where economic factors are often decisive. Fragmented understanding of primary prevention (only 52% of responses were correct) and partial awareness of the importance of timely vaccination (61%) highlighted the insufficiency of existing educational programmes and the need for a systematic review of communication strategies.

5 Conclusions

The study established that public opinion within the Bulgarian socio-cultural context regarding HPV vaccination is sharply divided, with psycho-emotional barriers predominating over rational reasoning. A specific structure of obstacles to immunisation was identified, with safety-related fears constituting 75% of all barriers, distinguishing this pattern from other European countries, where information gaps are more prevalent. A moderate level of maternal readiness to vaccinate daughters was observed (57%), while one third of respondents (34%) expressed a categorically negative stance, constituting a significant barrier to achieving population-level protection against HPV-associated diseases.

The study revealed deficiencies in understanding the nature of preventive measures, with only 52% of participants correctly identifying primary prevention as vaccination against oncogenic HPV types, while 48% demonstrated a fragmented or erroneous understanding of preventive medicine. There was an almost equal split in perceptions of HPV vaccine safety (48% considered them safe versus 43% unsafe), indicating a crisis of trust in official medical recommendations. Financial constraints accounted for only 11% of reasons for vaccine refusal, whereas fear of side effects (39%) and fear of pain (36%) formed the principal block of barriers, highlighting the need to focus intervention efforts on overcoming psychological obstacles without prioritising economic accessibility.

Based on the survey results, comprehensive recommendations were developed to optimise the national strategy for immunoprevention of HPV-associated diseases, aiming to address identified barriers and increase vaccination coverage. The proposed recommendations adopt a multi-level approach: at the macro level – the development of standardised educational modules and the concept of the "therapeutic window of opportunity"; at the meso level – differentiated engagement with three segments of the target audience (supporters 57%, opponents 34%, and the undecided 9%); and at the micro level – the transformation of clinical interactions from a paternalistic to a partnership model, emphasising empathetic counselling and validation of parental concerns. A limitation of the study was the local nature of the sample, which was confined to the Varna region of Bulgaria.

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