



PARENTAL VACCINE HESITANCY AND CHILDHOOD IMMUNIZATION OUTCOMES IN CHILDREN UNDER FIVE YEARS OF AGE: A SYSTEMATIC REVIEW AND THEMATIC SYNTHESIS

Paediatric Medicine

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ABSTRACT

Background: Parental vaccine hesitancy remains a major barrier to achieving optimal childhood immunization coverage worldwide. This systematic review aimed to synthesize evidence on the determinants of parental vaccine hesitancy and their association with immunization outcomes among children under five years of age. **Methods:** A systematic review of quantitative, qualitative, and mixed-methods studies was conducted across diverse geographic and healthcare settings. Studies examining parental vaccine hesitancy and childhood immunization outcomes among children under five years of age were included. Evidence was synthesized thematically and interpreted using the World Health Organization (WHO) 3Cs/5Cs Vaccine Hesitancy Framework and the socioecological model (SEM). **Results:** Twenty studies met the eligibility criteria and were included in the thematic synthesis. Common determinants of parental vaccine hesitancy included lower maternal education, low health literacy, socioeconomic disadvantage, concerns about vaccine safety, exposure to vaccine-related misinformation, institutional distrust, inadequate provider–parent communication, cultural and religious beliefs, and barriers to healthcare access. These factors were associated with delayed vaccination, incomplete immunization schedules, missed vaccine doses, reduced vaccination coverage, and an increased likelihood of zero-dose status. The findings indicate that vaccine hesitancy is shaped by interactions among individual, community, institutional, and structural influences. **Conclusions:** Parental vaccine hesitancy is associated with reduced childhood immunization uptake among children under five years of age. Addressing vaccine hesitancy requires context specific, multilevel interventions that improve health literacy, strengthen trust in healthcare systems, enhance provider communication, counter misinformation, and reduce barriers to healthcare access. Such strategies may improve vaccination coverage and promote more equitable immunization outcomes.

KEYWORDS

1. INTRODUCTION

Immunization is among the most cost-effective public health interventions, preventing an estimated 4.4 million deaths annually from vaccine-preventable diseases, including diphtheria, tetanus, pertussis, influenza, and measles [1]. Despite substantial progress through the Expanded Program on Immunization (EPI), global immunization targets remain unmet. UNICEF estimated that approximately 14.3 million children would be classified as zero-dose in 2024, having received no dose of a diphtheria–tetanus–pertussis (DTP)-containing vaccine, with many residing in low- and middle-income countries [2]. Regions with high numbers of zero-dose children continue to experience substantial gaps in childhood immunization coverage. The global distribution of selected countries represented in the included studies, alongside regions with high numbers of zero-dose children and low childhood immunization coverage, is illustrated in Figure 1.



Source: Adapted from UNICEF Immunization Data, 2024.

Note: Highlighted countries represent settings of the included studies in this systematic review: India [Sharma et al., 2019], Ethiopia [Lewin et al., 2019], Uganda [Kisumu et al., 2011], and USA [Shah et al., 2011]. These regions continue to experience substantial numbers of zero-dose children and suboptimal immunization coverage.

Figure 1. Global Distribution of Included Studies Investigating Parental Vaccine Hesitancy and Childhood Immunization Coverage. Note: Highlighted countries represent the settings of the included

studies in this systematic review: India [3], Ethiopia [4], Uganda [5], and the USA [6]. These regions continue to experience substantial numbers of zero-dose children and suboptimal immunization coverage.

Vaccine hesitancy, defined by the World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) as a delay in acceptance or refusal of vaccination despite the availability of vaccination services, remains a major challenge to childhood immunization programs worldwide [7]. Concerns regarding vaccine safety, exposure to misinformation, reduced trust in healthcare systems, and barriers to healthcare access contribute to delayed or missed vaccinations and may increase vulnerability to vaccine-preventable diseases [8–11].

Although vaccine hesitancy has been widely studied, its determinants vary across populations and healthcare settings. Quantitative studies have identified associations between vaccine hesitancy and immunization outcomes, whereas qualitative investigations have explored parental beliefs, experiences, and sociocultural influences affecting vaccination decisions [9–12]. Synthesizing evidence from these complementary approaches may provide a more comprehensive understanding of the factors influencing childhood immunization uptake.

Therefore, this systematic review aimed to synthesize evidence on the sociodemographic, psychological, informational, institutional, and structural determinants of parental vaccine hesitancy and their associations with childhood immunization outcomes among children under five years of age. The characteristics of the included studies are summarized in Table 1.

Table 1. Characteristics of Included Studies on Parental Vaccine Hesitancy and Childhood Immunization

Author (Year)	Country	Study Design	Sample Size	Population	Main Determinants Identified	Key Findings
Benin et al. (2006) [9]	USA	Survey	393	Parents of young children	Safety concerns, trust	Hesitant parents more likely to delay vaccination
Gust et al. (2008) [10]	USA	National survey	1,574	Parents	Vaccine safety concerns	Concerns associated with under immunization
Gilkey et al. (2016) [11]	USA	Cross-sectional	1,109	Parents	Vaccine beliefs, confidence	Beliefs significantly influenced uptake
Smith et al. (2011) [12]	USA	Cross-sectional	2,921	Parents	Vaccine refusal, safety concerns	Refusal associated with lower coverage
Opel et al. (2011) [13]	USA	Validation study	437	Parents	Hesitancy attitudes	PACV score predicted under immunization
Saeed & Hashmi (2021) [14]	Pakistan	Cross-sectional	450	Parents	Misinformation, distrust	Social media exposure linked to hesitancy
Kijjambu & Mulogo (2021) [15]	Uganda	Cross-sectional	410	Caregivers	Geographic barriers, provider interaction	Access barriers reduced vaccine uptake
Geweniger & Abbas (2020) [16]	Ethiopia	Population survey	1,250	Households	Wealth, ANC attendance	Disadvantaged households had lower coverage
Giambi et al. (2018) [17]	Italy	National survey	3,182	Parents	Confidence, safety concerns	Significant parental hesitancy detected
Brown et al. (2018) [18]	Brazil	Population survey	2,000	Parents	Vaccine confidence	Lower confidence associated with hesitancy
Voo et al. (2021) [19]	Malaysia	Cross-sectional	1,024	Parents	Knowledge deficits	Poor awareness predicted hesitancy
Chung-Delgado et al. (2021) [20]	Peru	Cross-sectional	500	Parents	Misinformation, access barriers	Hesitancy associated with delayed vaccination
Thapar et al. (2021) [21]	India	Cross-sectional	882	Parents	Education, misinformation	Significant predictors of vaccine hesitancy identified
Nguyen et al. (2022) [22]	USA	National survey	16,000	Parents	Hesitancy, confidence	Hesitancy contributed substantially to under vaccination
Alfieri et al. (2021) [23]	USA	Cross-sectional	2,000	Parents	COVID-era safety concerns	Increased hesitancy following pandemic-related misinformation
Alsubaie et al. (2019) [24]	Saudi Arabia	Cross-sectional	500	Parents/Caregivers	Confidence, trust	Generally, favorable attitudes but persistent hesitancy
Aldakhil et al. (2021) [25]	Saudi Arabia	Cross-sectional	700	Parents	COVID-related concerns	Safety concerns remained major predictor
Du et al. (2021) [26]	China	Cross-sectional	1,000	Parents	Information sources, confidence	Trust in healthcare strongly influenced uptake
Alwhaibi et al. (2025) [27]	Saudi Arabia	Cross-sectional	233	Parents of children aged 2 months–7 years	Safety concerns, vaccine overload concerns	9% reported delaying vaccination; hesitancy linked to fear of adverse effects
Demir Pervane et al. (2025) [28]	Türkiye	Cross-sectional	700	Parents	Education, socioeconomic status	Lower education associated with greater hesitancy

2. Methods

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines.

2.1 Search Strategy and Eligibility Criteria

A systematic literature search was conducted in PubMed, Scopus, Web of Science, and Google Scholar between May and June 2026. The search terms included combinations of “vaccine hesitancy,” “vaccine confidence,” “vaccination refusal,” “vaccination delay,” “parent,” “caregiver,” “child,” “under five,” “immunization coverage,” and “vaccination uptake” using Boolean operators (AND OR). The reference lists of eligible studies were also screened to identify additional relevant studies.

Studies were eligible if they examined parental or caregiver vaccine hesitancy and reported childhood immunization outcomes among children under five years of age. Quantitative, qualitative, and mixed-methods studies published in peer-reviewed English-language journals were included. Studies focusing exclusively on adult vaccination, lacking relevant childhood immunization outcomes, or published as editorials, commentaries, conference abstracts, narrative reviews, or study protocols were excluded.

2.2 Study Selection and Data Extraction

After duplicate removal, titles and abstracts were screened for relevance, followed by full-text assessment using predefined eligibility criteria. The study selection process is presented in Figure 2. Data extracted from eligible studies included the author, year of publication, country, study design, sample size, determinants of vaccine hesitancy, and reported childhood immunization outcomes. Data extraction was performed using a standardized data extraction form to ensure consistency across the included studies.

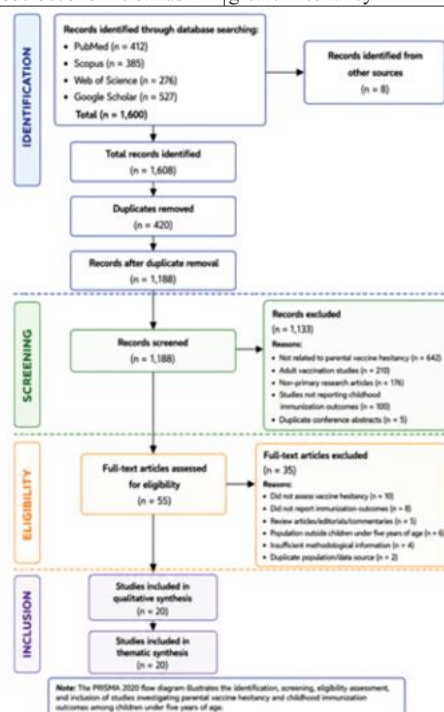


Figure 2. PRISMA 2020 Flow Diagram of the Study Selection Process

2.3 Data Synthesis and Quality Assessment

Given the methodological heterogeneity of the included studies, a meta-analysis was not performed. The findings were synthesized narratively using thematic analysis and interpreted through the World Health Organization (WHO) 3Cs/5Cs Vaccine Hesitancy Framework and the socioecological model (SEM). Methodological quality was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist appropriate for each study design. Quality assessment informed the interpretation of the findings but was not used as an exclusion criterion. The methodological quality of the included studies is summarized in Table 2.

Table 2. Summary of Methodological Quality Assessment of Included Studies Using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist

Quality Rating	Number of Studies (n)	Percentage (%)
High Quality	12	60.0
Moderate Quality	8	40.0
Low Quality	0	0.0
Total	20	100.0

2.4 Protocol Registration

The review protocol was not prospectively registered.

2.5 Methodological Considerations

According to the Joanna Briggs Institute (JBI) Critical Appraisal Checklist, 12 (60.0%) of the 20 included studies were rated as high quality and 8 (40.0%) were rated as moderate quality. No studies were classified as low quality. Common methodological limitations include cross-sectional study designs, a reliance on self-reported information, potential recall bias, and a limited ability to establish causal relationships. Despite these limitations, similar determinants of parental vaccine hesitancy were identified across diverse settings, supporting the overall consistency and robustness of the thematic synthesis.

3. Theoretical Frameworks for Thematic Synthesis

This review was guided by established theoretical frameworks to facilitate a structured analysis of parental vaccine hesitancy and its association with childhood immunization outcomes.

3.1 The 3Cs and 5Cs Models

The World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) developed the 3Cs model to explain vaccine hesitancy through three domains: confidence, complacency, and convenience [29]. Confidence refers to trust in vaccines and healthcare systems, complacency reflects a low perceived risk of vaccine-preventable diseases, and convenience relates to the accessibility and availability of vaccination services [29,30]. The framework was subsequently expanded to the 5Cs model by incorporating calculation and collective responsibility. Calculation refers to the active evaluation of vaccine-related information, whereas collective responsibility reflects the willingness to protect others through vaccination. Together, these frameworks provide a useful foundation for understanding the psychological and behavioral determinants of parental vaccine hesitancy [30].

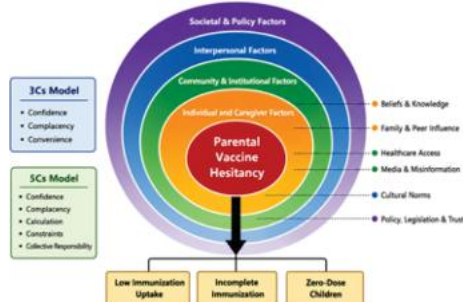


Figure 3. Integrated Conceptual Framework for Parental Vaccine

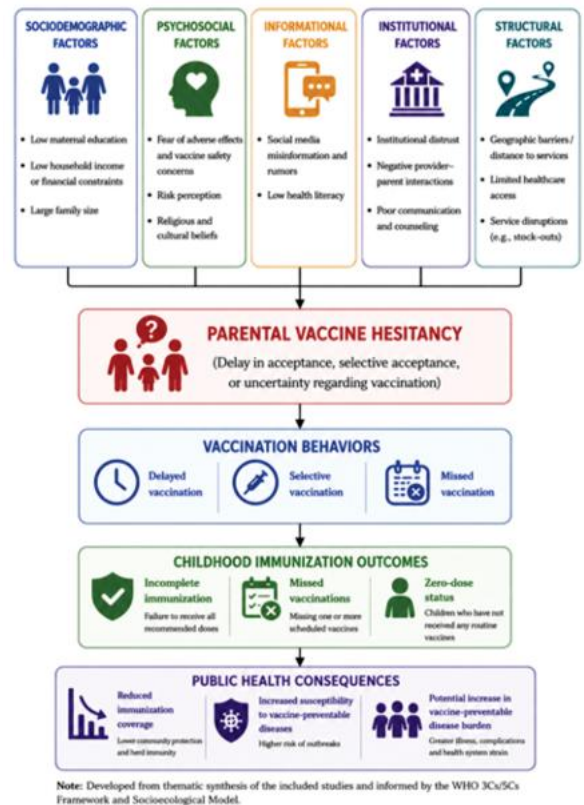
Table 3. Determinants of Parental Vaccine Hesitancy Mapped to the WHO 3Cs/5Cs Framework and Socioecological Model (SEM)

Determinant	WHO 3Cs/5Cs Domain	SEM Level	Reported Impact on Childhood Immunization
Low maternal education	Confidence	Individual	Reduced immunization uptake and vaccine acceptance
Low health literacy	Calculation	Individual	Increased vaccine hesitancy and delayed vaccination
Financial constraints	Convenience	Community/Institutional	Missed vaccination appointments and incomplete immunization
Fear of adverse effects	Confidence	Individual	Delayed vaccination and selective vaccine acceptance

Hesitancy Based on the WHO 3Cs/5Cs Framework and Socioecological Model (SEM).

3.2 The Socioecological Model (SEM)

The socioecological model (SEM) conceptualizes vaccine hesitancy as a multilevel phenomenon influenced by factors operating at the individual, interpersonal, community, institutional, and policy levels [31]. The model recognizes that vaccination decisions are shaped not only by individual beliefs but also by social relationships, healthcare systems, community norms, and broader policy environments. The integration of the WHO 3Cs/5Cs Vaccine Hesitancy Framework and the socioecological model enabled a multidimensional interpretation of the findings and informed the thematic synthesis of the determinants identified across the included studies. The integrated conceptual framework is presented in Figure 3, while the conceptual pathway linking the determinants of parental vaccine hesitancy with vaccination behavior, childhood immunization outcomes, and broader public health consequences is illustrated in Figure 4.



Note: Developed from thematic synthesis of the included studies and informed by the WHO 3Cs/5Cs Framework and Socioecological Model.

Figure 4. Conceptual Pathway Linking Determinants of Parental Vaccine Hesitancy, Vaccination Behaviors, Childhood Immunization Outcomes, and Public Health Consequences.

4. Results: Determinants of Vaccine Hesitancy

Twenty studies met the eligibility criteria and were included in the thematic synthesis. The characteristics of the included studies are summarized in Table 1, the results of the methodological quality assessment are presented in Table 2, and the identified determinants are mapped to the WHO 3Cs/5Cs Vaccine Hesitancy Framework and the socioecological model (SEM) in Table 3. Overall, 12 studies (60.0%) were rated as high quality, and 8 studies (40.0%) were rated as moderate quality according to the Joanna Briggs Institute (JBI) Critical Appraisal Checklist. No studies were classified as low quality. The conceptual pathway linking the determinants of parental vaccine hesitancy with childhood immunization outcomes and broader public health consequences is illustrated in Figure 4.

Social media misinformation	Calculation	Community	Increased vaccine hesitancy and reduced vaccine confidence
Institutional distrust	Confidence	Institutional	Reduced vaccine acceptance and lower immunization coverage
Geographic barriers	Convenience	Community	Incomplete immunization and missed vaccine doses
Negative provider–parent interactions	Confidence	Institutional	Reduced utilization of vaccination services and lower vaccine uptake
Religious concerns	Confidence	Community	Delayed or selective vaccination
Low socioeconomic status	Convenience	Community	Lower childhood immunization coverage
Poor access to healthcare services	Convenience	Institutional	Missed or delayed vaccination appointments
Inadequate antenatal care engagement	Confidence/Convenience	Institutional	Reduced adherence to recommended immunization schedules
Cultural beliefs and norms	Confidence	Community	Increased vaccine hesitancy and delayed vaccination
Limited vaccine-related knowledge	Calculation	Individual	Reduced vaccine confidence and increased hesitancy
Weak provider recommendation	Confidence	Institutional	Lower vaccine acceptance and reduced uptake

Abbreviations: WHO, World Health Organization; SEM, socioecological model. Determinants were synthesized from the included studies and mapped according to the WHO 3Cs/5Cs Vaccine Hesitancy Framework and the socioecological model to facilitate interpretation of individual, community, institutional, and societal influences on parental vaccine hesitancy and childhood immunization outcomes.

4.1 Sociodemographic and Economic Determinants

4.1.1 Socioeconomic Status and Financial Constraints

Low socioeconomic status and financial constraints were consistently associated with parental vaccine hesitancy and lower childhood immunization coverage. Several studies reported reduced vaccination uptake among economically disadvantaged households, particularly where transportation costs, indirect healthcare expenses, and competing household priorities limited access to vaccination services. Socioeconomic disadvantage was associated with delayed vaccination, incomplete immunization schedules, and reduced adherence to recommended childhood vaccination schedules.

4.1.2 Maternal Education and Health Literacy

Lower maternal education and limited health literacy emerged as common determinants of vaccine hesitancy across multiple settings. Parents with lower educational attainment were more likely to express concerns about vaccine safety, report lower confidence in vaccination programs, and demonstrate reduced adherence to recommended immunization schedules. A limited understanding of vaccine benefits and vaccine-preventable diseases also contributes to delayed or incomplete childhood immunization.

4.1.3 Cultural and Religious Influences

Several studies have shown that cultural beliefs, social norms, and religious concerns influence parental attitudes toward vaccination. Misconceptions regarding vaccine ingredients, cultural beliefs surrounding childhood illness, and community-level skepticism toward vaccination contributed to vaccine hesitancy in some populations. These influences frequently interact with other determinants, including education, health literacy, and trust in healthcare systems.

4.2 Psychosocial and Informational Determinants

Psychological and informational determinants primarily reflected the confidence and calculation domains of the WHO 5Cs Vaccine Hesitancy Framework.

4.2.1 Fear of Adverse Effects and Vaccine Safety Concerns

Concerns regarding vaccine safety and potential adverse effects were among the most consistently reported determinants of parental vaccine hesitancy. Parents who expressed concerns about vaccine-related side effects were more likely to delay, refuse, or selectively accept recommended childhood vaccines. These concerns contributed to reduced vaccine confidence and lower childhood immunization uptake.

4.2.2 Social Media Misinformation and Information Sources

Exposure to vaccine-related misinformation, particularly through social media platforms and informal information networks, was associated with increased vaccine hesitancy. Unverified claims regarding vaccine safety, effectiveness, and long-term health consequences contributed to uncertainty and reduced parental confidence in immunization programs.

4.2.3 Institutional Trust and Vaccine Confidence

Trust in healthcare systems, healthcare professionals, governments,

and vaccine manufacturers emerged as important determinants of vaccine acceptance. Lower levels of institutional trust were consistently associated with greater vaccine hesitancy, whereas positive experiences with healthcare providers and confidence in public health recommendations were associated with improved vaccination uptake.

4.3 Health System and Structural Determinants

4.3.1 Geographic Accessibility and Healthcare Access

Geographic accessibility and healthcare access significantly influenced childhood immunization outcomes. Families residing in rural or underserved areas frequently experienced barriers related to travel distance, transportation availability, and limited access to healthcare facilities, resulting in delayed or incomplete immunization.

4.3.2 Provider–Parent Communication

The quality of provider–parent interactions play a critical role in vaccination decision-making. Effective communication, respectful counseling, and strong healthcare provider recommendations were associated with improved vaccine acceptance and increased childhood immunization uptake. Conversely, negative healthcare experiences, poor communication, and inadequate counseling contributed to vaccine hesitancy and reduced the utilization of immunization services.

4.3.3 Health-System Barriers

Health system barriers, including vaccine stock-outs, limited-service availability, workforce shortages, and long waiting times, were reported as factors contributing to missed or delayed vaccination appointments. These barriers may reduce childhood immunization coverage even among parents with generally favorable attitudes toward vaccination.

5. Associations between Parental Vaccine Hesitancy and Childhood Immunization Outcomes

Evidence from the included studies suggests a consistent association between parental vaccine hesitancy and suboptimal childhood immunization outcomes among children under five years of age. Across diverse geographic settings, vaccine hesitancy was associated with delayed vaccination, incomplete immunization schedules, missed vaccine doses, reduced vaccination coverage, and an increased likelihood of zero-dose status. The conceptual pathways linking the determinants of parental vaccine hesitancy with childhood immunization outcomes and public health consequences are illustrated in Figure 4.

5.1 Quantitative Evidence

Several studies have reported significant associations between parental vaccine hesitancy and reduced childhood immunization uptake. Lower maternal education, limited health literacy, vaccine safety concerns, exposure to misinformation, and lower institutional trust were consistently associated with delayed or incomplete vaccination. Parents who expressed concerns regarding vaccine-related adverse effects or who demonstrated lower confidence in healthcare systems were more likely to delay, refuse, or selectively accept recommended childhood vaccines.

The included studies also highlighted the importance of parental knowledge, perceptions, and vaccine confidence in shaping vaccination behaviors. Lower levels of vaccine awareness and greater hesitancy were associated with reduced adherence to recommended childhood immunization schedules. Collectively, these findings suggest that parental beliefs, attitudes, and confidence play a critical

role in determining childhood vaccination status.

5.2 Antenatal Care Engagement and Healthcare Utilization

Maternal engagement with healthcare services may influence subsequent childhood immunization practices. Antenatal care provides opportunities for vaccine-related education, counseling, and the development of trust between caregivers and healthcare providers. Studies included in this review indicated that greater engagement with maternal healthcare services was associated with improved adherence to childhood immunization schedules and higher vaccination coverage.

These findings suggest that antenatal care and other routine maternal healthcare contacts represent valuable opportunities for addressing vaccine hesitancy, improving vaccine knowledge, and promoting timely childhood immunization.

5.3 Socioeconomic and Geographic Disparities

Substantial disparities in childhood immunization outcomes have been reported across different populations and settings. Lower vaccination coverage was frequently observed among socioeconomically disadvantaged households, families with limited healthcare access, rural populations, and communities experiencing geographic barriers to vaccination services.

Factors such as poverty, transportation difficulties, limited healthcare availability, lower educational attainment, and social marginalization contributed to disparities in childhood immunization uptake. These findings underscore the importance of considering socioeconomic, geographic, and healthcare system factors when interventions aimed at improving childhood immunization coverage and reducing vaccine hesitancy are designed.

6. Qualitative Insights into Parental Vaccine Hesitancy

Qualitative evidence provides important insights into the beliefs, perceptions, and experiences that influence parental vaccine hesitancy. These findings complement quantitative evidence by offering a deeper understanding of the social, cultural, informational, and health-system factors underlying vaccination decisions.

6.1 Institutional Trust and Confidence in Vaccination Programs

The qualitative findings indicated that trust plays a central role in parental vaccination decisions. Concerns regarding healthcare systems, vaccine programs, public health authorities, and vaccine-related information sources were identified as important influences on vaccine acceptance. Trust in healthcare providers and public health institutions was consistently associated with greater confidence in the use of vaccines and improved acceptance of recommended childhood vaccines.

These findings suggest that vaccination decisions are shaped not only by perceptions of vaccine safety and effectiveness but also by broader levels of institutional trust and confidence in healthcare systems.

6.2 Provider–Parent Communication and Healthcare Experiences

Interactions between healthcare providers and caregivers substantially influenced parental attitudes toward vaccination. Inadequate communication, limited opportunities to discuss vaccine concerns, long waiting times, and negative healthcare experiences were reported as barriers to vaccine acceptance. Conversely, respectful counseling, effective communication, and strong provider recommendations were associated with improved vaccine confidence and greater adherence to recommended immunization schedules.

These findings highlight the importance of healthcare providers as trusted sources of vaccine information and emphasize the role of effective communication in addressing parental concerns.

6.3 Cultural Beliefs, Misinformation, and Vaccination Delays

Qualitative evidence has indicated that cultural beliefs, social norms, and exposure to misinformation contribute to vaccine hesitancy in several settings. Misconceptions regarding vaccine safety, effectiveness, and potential adverse effects often influence parental decision-making and contribute to delayed vaccination.

Importantly, vaccination delay does not necessarily reflect complete vaccine refusal. Some caregivers postpone vaccination because of concerns about their child's safety, vulnerability, or readiness to receive vaccines. These findings emphasize the importance of

providing clear, evidence-based information and supporting informed decision-making to improve vaccine confidence and promote timely childhood immunization.

7. DISCUSSION

7.1 Synthesis of Findings

This systematic review synthesized evidence from 20 studies examining parental vaccine hesitancy and childhood immunization outcomes among children under five years of age. These findings indicate that parental vaccine hesitancy is influenced by a complex interaction of sociodemographic, psychological, informational, institutional, and structural factors. Across the included studies, lower maternal education, limited health literacy, socioeconomic disadvantage, concerns regarding vaccine safety, exposure to misinformation, institutional distrust, and barriers to healthcare access were consistently associated with reduced childhood immunization uptake.

These findings further suggest that vaccine hesitancy is not driven by a single determinant but rather by multiple interacting influences operating across the individual, community, institutional, and structural levels. This observation is consistent with the socioecological model and highlights the multidimensional nature of vaccination decision-making. The consistency of these determinants across diverse geographic settings supports the global relevance of parental vaccine hesitancy as a public health challenge.

7.2 Comparison with Previous Literature and Public Health Implications

The findings of this review are broadly consistent with those of previous literature on vaccine hesitancy. Earlier reviews and conceptual frameworks have identified vaccine safety concerns, misinformation, reduced confidence in healthcare systems, and barriers to healthcare access as major determinants of vaccine hesitancy. The results of the present review support these observations while demonstrating that parental vaccine hesitancy among caregivers of children under five years of age is strongly influenced by socioeconomic disadvantage, healthcare accessibility, and provider–parent communication.

These findings reinforce the relevance of the WHO 3Cs/5Cs Vaccine Hesitancy Framework. Vaccine safety concerns primarily reflected reduced confidence, misinformation contributed to calculation-related uncertainty, and healthcare access barriers corresponded to the convenience dimension of vaccine hesitancy. Similarly, the findings support the socioecological model, which conceptualizes vaccination behavior as the result of interacting influences operating at the individual, interpersonal, community, institutional, and policy levels.

From a public health perspective, interventions focused solely on correcting misinformation are unlikely to be sufficient if structural barriers remain unresolved. The intervention strategies identified in this review suggest that improvements in health literacy, community engagement, healthcare accessibility, provider communication, and institutional trust should be implemented concurrently. Parent and caregiver education programs, community awareness initiatives, mobile vaccination services, vaccine counseling during antenatal care, and improved healthcare service delivery may collectively contribute to improved childhood immunization uptake.

7.3 Limitations

Several limitations should be considered when interpreting these findings. First, most of the included studies employed cross-sectional designs, limiting the ability to establish causal relationships between parental vaccine hesitancy and childhood immunization outcomes. Second, differences in study methodologies, measurement tools, and study populations may have affected comparability across studies.

Although 20 studies were included, substantial methodological heterogeneity precluded quantitative synthesis and meta-analysis. Publication bias cannot be excluded because unpublished studies and gray literature were not systematically assessed. In addition, the rapidly evolving nature of digital information environments and social media platforms may influence the continued relevance of some findings.

The review protocol was not prospectively registered, which may limit methodological transparency. Furthermore, most of the included

studies relied on self-reported information and observational study designs, introducing the potential for recall bias, reporting bias, and residual confounding. These limitations should be considered when interpreting the findings and their applicability across different settings.

7.4 Future Research Directions

Future research should employ longitudinal, prospective, and mixed-methods study designs to better understand the causal pathways linking parental vaccine hesitancy with childhood immunization outcomes. Additional research is needed in low- and middle-income countries and underserved populations where childhood immunization disparities remain substantial.

Greater standardization of vaccine hesitancy measurement tools would improve comparability across studies and facilitate future evidence synthesis. Further investigations examining digital misinformation, social media exposure, provider communication strategies, and targeted intervention programs may help identify effective approaches for improving vaccine confidence and increasing childhood immunization coverage.

8. CONCLUSION AND RECOMMENDATIONS

8.1 CONCLUSION

This systematic review synthesized evidence from 20 studies examining parental vaccine hesitancy and childhood immunization outcomes among children under five years of age. These findings indicate that parental vaccine hesitancy is a multifactorial phenomenon influenced by sociodemographic, psychological, informational, institutional, and structural determinants. Common factors associated with vaccine hesitancy included lower maternal education, limited health literacy, concerns about vaccine safety, exposure to misinformation, institutional distrust, socioeconomic disadvantage, and barriers to healthcare access.

Table 4. Evidence-Based Intervention Strategies to Address Parental Vaccine Hesitancy and Improve Childhood Immunization Uptake

Domain	Determinant Addressed	Proposed Intervention	Target Level
Health literacy	Low health literacy	Parent education programs	Individual
Provider communication	Negative provider–parent interactions	Motivational interviewing and vaccine counseling	Institutional
Misinformation	Social media misinformation	Community awareness campaigns and digital fact-checking initiatives	Community
Trust building	Institutional distrust	Engagement of community and religious leaders	Community
Accessibility	Geographic barriers	Mobile vaccination clinics and outreach services	Structural
ANC integration	Limited maternal engagement	Vaccine counseling during antenatal care visits	Health-system
Service delivery	Service availability barriers	Reduced waiting times and improved service availability	Health-system

Ethics Statement

Ethical approval was not needed because this study was based exclusively on previously published literature and did not involve direct patient participation, identifiable human data, or primary data collection.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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Across the included studies, parental vaccine hesitancy was associated with delayed vaccination, incomplete immunization schedules, missed vaccine doses, reduced vaccination coverage, and an increased likelihood of zero-dose status. These findings highlight the importance of addressing both behavioral and structural determinants of vaccination to improve childhood immunization outcomes and promote equitable vaccine coverage.

8.2 Recommendations

Addressing parental vaccine hesitancy requires coordinated, multilevel interventions targeting individual, community, institutional, and health-system determinants. Strengthening provider–parent communication through respectful counseling, motivational interviewing, and effective risk communication may improve vaccine confidence and acceptance. Public health initiatives should also address vaccine-related misinformation through culturally appropriate, evidence-based communication strategies and community engagement programs.

Antenatal care services provide valuable opportunities for vaccine education, caregiver engagement, and the development of trust in healthcare systems. In addition, interventions such as mobile vaccination clinics, community outreach programs, improved healthcare accessibility, and strengthened service delivery may help reduce structural barriers to childhood immunization.

The intervention strategies summarized in Table 4 support the implementation of comprehensive approaches that simultaneously improve health literacy, strengthen institutional trust, counter misinformation, enhance provider communication, and increase healthcare accessibility. Given the multidimensional nature of vaccine hesitancy, compared with isolated strategies, integrated interventions are likely to be more effective at improving childhood immunization uptake.

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