Childhood Vaccine Hesitancy and Refusal in Türkiye: A Systematic Review and Meta-Analysis

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ABSTRACT

Objective: Childhood vaccination is a cornerstone of public health, significantly reducing morbidity and mortality from vaccine-preventable infectious diseases. However, vaccine hesitancy and refusal have emerged as growing global concerns that may undermine immunization efforts. This study aimed to synthesize the existing literature to provide a comprehensive overview of the prevalence, trends, and key determinants of childhood vaccine hesitancy and refusal in Türkiye.

Materials and Methods: This systematic review and meta-analysis was conducted in accordance with PRISMA guidelines and registered in PROSPERO (CRD 42024513557). A comprehensive literature search was performed in PubMed, Web of Science, Scopus, MEDLINE, and the Cochrane Library for studies published up to March 1, 2024. Risk of bias was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tool for Prevalence Studies.

Results: A total of nine studies involving 15,429 participants were included. The pooled prevalence of vaccine hesitancy was 15% (95% CI, 11%–20%), while the pooled prevalence of vaccine refusal was 3% (95% CI, 2%–6%). Substantial heterogeneity was observed among studies for both outcomes (vaccine hesitancy: I^2=96.9%, τ^2=0.2053, p<0.0001; vaccine refusal: I^2=97.8%, τ^2=0.8517, p<0.0001). Vaccine hesitancy was more pronounced in certain regions, particularly Central Anatolia, and was associated with factors such as misinformation, distrust in healthcare providers, and socioeconomic disparities.

Conclusion: Childhood vaccine hesitancy in Türkiye demonstrates marked regional variation but mirrors broader global challenges. Addressing this issue requires strengthening health literacy, enhancing trust in healthcare systems, and counteracting misinformation. The experience of Türkiye provides valuable insights for improving vaccine acceptance strategies worldwide.

Keywords: Childhood immunization, health literacy, healthcare mistrust, misinformation and vaccination

INTRODUCTION

Childhood vaccination is a cornerstone of public health, substantially reducing morbidity and mortality from vaccine-preventable infectious diseases. Nevertheless, vaccine hesitancy and refusal have emerged as growing global challenges, threatening immunization coverage and increasing the risk of disease outbreaks. Vaccine hesitancy is defined as a continuum between full acceptance and complete refusal, encompassing delayed acceptance or acceptance accompanied by doubts, whereas vaccine refusal refers to the outright rejection of all vaccines (1).

In 2023, global childhood immunization coverage stagnated, leaving 2.7 million more children unvaccinated or under-vaccinated compared with pre-pandemic levels in 2019, according to the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) (2). Similar trends have been observed in Türkiye, where concerns regarding childhood vaccination have increased in recent years (3), despite relatively high reported national coverage rates ranging from 95% to 99% (4).

Understanding the prevalence and determinants of vaccine hesitancy is essential for developing effective public health interventions (5,6). The WHO defines vaccine hesitancy as a delay in acceptance or refusal of vaccines despite the availability of vaccination services, emphasizing its context-specific and dynamic nature across time, place, and vaccine type. The concept is commonly framed around three key determinants—complacency, convenience, and confidence—which together influence individual and community vaccination behaviors (7). In response, the WHO recommends that all countries integrate strategies to monitor and address vaccine hesitancy within their national immunization programs.

In Türkiye, childhood vaccines are provided free of charge to all children, including migrant populations; however, vaccine hesitancy and refusal have become increasingly prominent public health concerns. Factors contributing to this phenomenon include concerns about vaccine safety, misinformation, distrust in healthcare providers, religious beliefs, and the expanding influence of social media. The public health implications of declining vaccine acceptance have been underscored by recurrent measles outbreaks in 2013, 2018, and 2019, followed by renewed outbreaks in 2023 and 2024 after the COVID-19 pandemic (8,9). These events highlight the vulnerability created by even modest reductions in vaccination coverage and the urgent need for evidence-based strategies to counter vaccine hesitancy.

Despite growing recognition of this issue, the relative contribution and interaction of these factors remain insufficiently characterized at the national level. Therefore, this systematic review and meta-analysis aimed to synthesize the existing literature to provide a comprehensive assessment of the prevalence, temporal trends, and key determinants of childhood vaccine hesitancy and refusal in Türkiye.

MATERIALS AND METHODS
Study Design, Registration, and Search Protocol
This systematic review and meta-analysis was registered in the International Prospective Register of Systematic Reviews (PROSPERO; registration No. CRD 42024513557) and conducted in accordance with PRISMA guidelines. A comprehensive literature search was performed in PubMed, Web of Science, Scopus, MEDLINE, and the Cochrane Library to identify relevant studies published between January 1995 and March 1, 2024.

An initial exploratory search was conducted to identify appropriate Medical Subject Headings (MeSH) terms and keywords related to vaccine hesitancy,

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HIGHLIGHTS

- Childhood vaccine hesitancy in Türkiye ranges from 9.0% to 30.9% across regions.
- Misinformation, low trust in healthcare systems, and digital illiteracy are key drivers of hesitancy.
- Vaccine refusal remains relatively low, with a pooled prevalence of approximately 3%.
- Findings from Türkiye offer insights applicable to global vaccine acceptance efforts.

vaccine refusal, and anti-vaccination movements in Türkiye. The complete search strategies for each database are provided in Supplementary Table 1.

Study Selection and Data Extraction

The inclusion and exclusion criteria applied in this meta-analysis are summarized in Table 1. To ensure reliable prevalence estimates, a minimum sample size of 450 participants was required. At this threshold, assuming an expected prevalence of 10%, the 95% confidence interval (CI) narrows to approximately ±2.8%, thereby improving precision and the robustness of pooled estimates compared with smaller studies.

Study selection was conducted in two phases. In the first phase, one reviewer (K.A.) independently screened titles and abstracts, while a second reviewer (O.O.D.) performed a parallel screening to ensure accuracy. Discrepancies were resolved through discussion. Studies were excluded if they did not meet the inclusion criteria, including those with fewer than 450 participants, preprints, or abstracts without available full texts. The reference list of eligible studies was also screened to identify additional relevant publications.

In the second phase, the full texts of selected studies were independently assessed by two reviewers (K.A. and O.O.D.). Any disagreements were resolved through consensus among the review team. Data extracted from each study included author information, study location, year of publication, sample size, study setting and design, and reported factors influencing vaccination decisions.

Risk of Bias Assessment

Risk of bias was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tool for Prevalence Studies, which consists of nine items evaluating methodological quality. Scores of 8–9 were considered indicative of low risk of bias, scores of 5–7 of moderate risk, and scores below 5 of high risk of bias (10).

Data Analysis

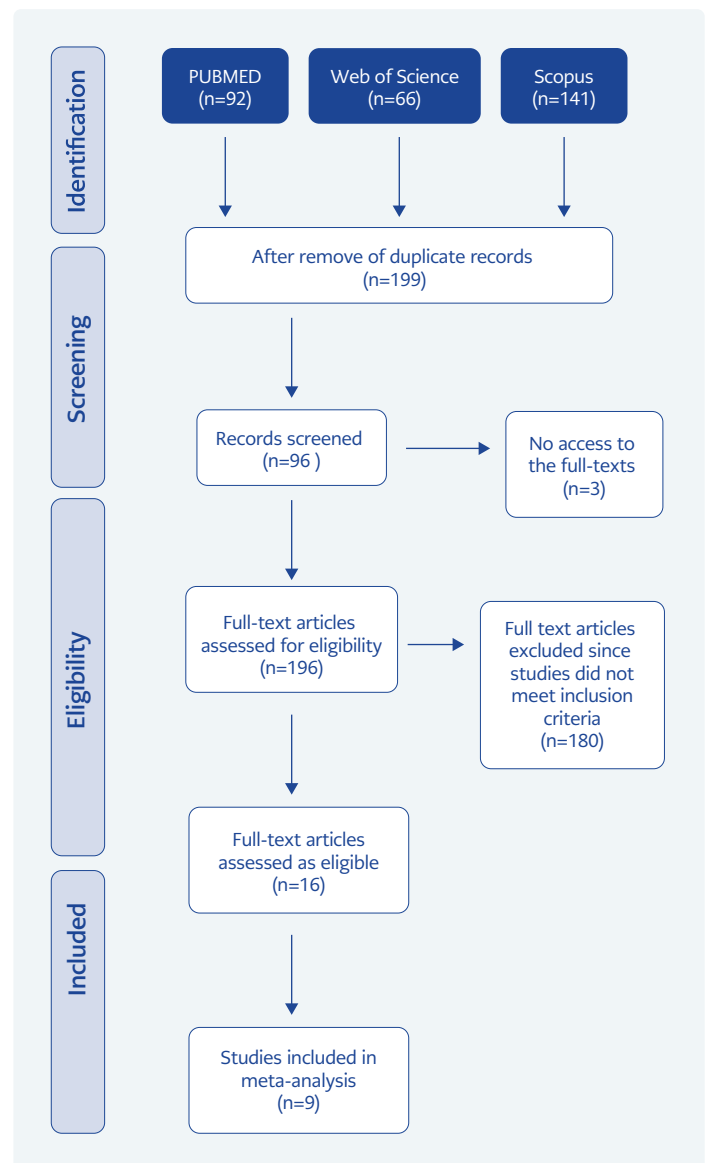Statistical analyses were performed using the 'meta' package in R, in which pooled prevalence rates were calculated using both fixed- and random-effects models with logit transformation. Statistical heterogeneity was assessed using the I^2 statistic, and forest plots were generated to visualize the results (11).

Figure 1. Flow diagram of the literature review process.

RESULTS

This meta-analysis included nine studies (5, 6, 12–18) conducted in Türkiye between 2020 and 2023, comprising a total of 15,429 participants, of whom 1882 reported vaccine hesitancy or refusal (Table 2). Sample sizes ranged from 557 to 4540 participants and included both national- and regional-level studies.

Table 1. Inclusion and exclusion criteria of the study.

Criteria	Inclusion criteria	Exclusion criteria
Study design	All cross-sectional or mixed-methods studies with a cross-sectional component assessing childhood vaccine hesitancy among adult participants responding to questions on childhood vaccine or parental concerns regarding vaccine safety and effectiveness*.	Studies involving questionnaire validation, testing, or adaptation; retrospective designs, qualitative studies; pretest-posttest designs; systematic reviews; meta-analyses; randomized controlled trials; cohort studies; or case-control studies were excluded.
Focus of vaccination	Studies were required to specifically assess childhood vaccination rather than general or adult vaccination.	Studies focusing only on COVID-19 vaccines, adult vaccination, or general vaccination not specific to childhood were excluded.
Geographic scope	Surveys were required to be conducted in Türkiye.	-
Language	English	-
Participant age	Only participants aged ≥18 years were included	-
Minimum sample size	Studies were required to include at least 450 participants, based on the expected precision of prevalence estimates.	-
Outcome of interest	The questionnaire was required to assess vaccine hesitancy and/or vaccine refusal.	-

A Vaccine Hesitancy

Study	Events	Total		Proportion	95% CI
Akbulut et al., 2023	888	4539		0.20	[0.18 0.21]
Durmuş Sarikahya et al., 2023	109	557		0.20	[0.16 0.23]
Ustuner Top et al., 2023	182	582		0.31	[0.28 0.35]
Durmaz et al., 2022	102	1087		0.09	[0.08 0.11]
Yörük et al., 2020	77	718		0.11	[0.09 0.13]
Akbas Günes et al., 2020	84	614		0.14	[0.11 0.17]
Soysal et al., 2021	118	1033		0.11	[0.10 0.14]
Aslantekin-Özçoban et al., 2021	229	1879		0.12	[0.11 0.14]
Random effects model		**11,009**		**0.15**	**[0.11 0.20]**

Heterogeneity: I^2= 96.9%
τ^2= 0.2053, p< 0.0001

Proportion of Vaccine Hesitancy

B Vaccine Refusal

Study	Events	Total		Proportion	95% CI
Akbulut et al., 2023	71	4539		0.02	[0.01 0.02]
Durmuş Sarikahya et al., 2023	43	557		0.08	[0.06 0.10]
Ustuner Top et al., 2023	53	582		0.09	[0.07 0.12]
Durmaz et al., 2022	38	1087		0.03	[0.02 0.05]
Yörük et al., 2020	77	718		0.11	[0.09 0.13]
Soysal et al., 2021	18	1033		0.02	[0.01 0.03]
Terzi et al., 2021	32	4428		0.01	[0.00 0.01]
Aslantekin-Özçoban et al., 2021	54	1879		0.03	[0.02 0.04]
Random effects model		**14,823**		**0.03**	**[0.02 0.06]**

Heterogeneity: I^2= 97.8%
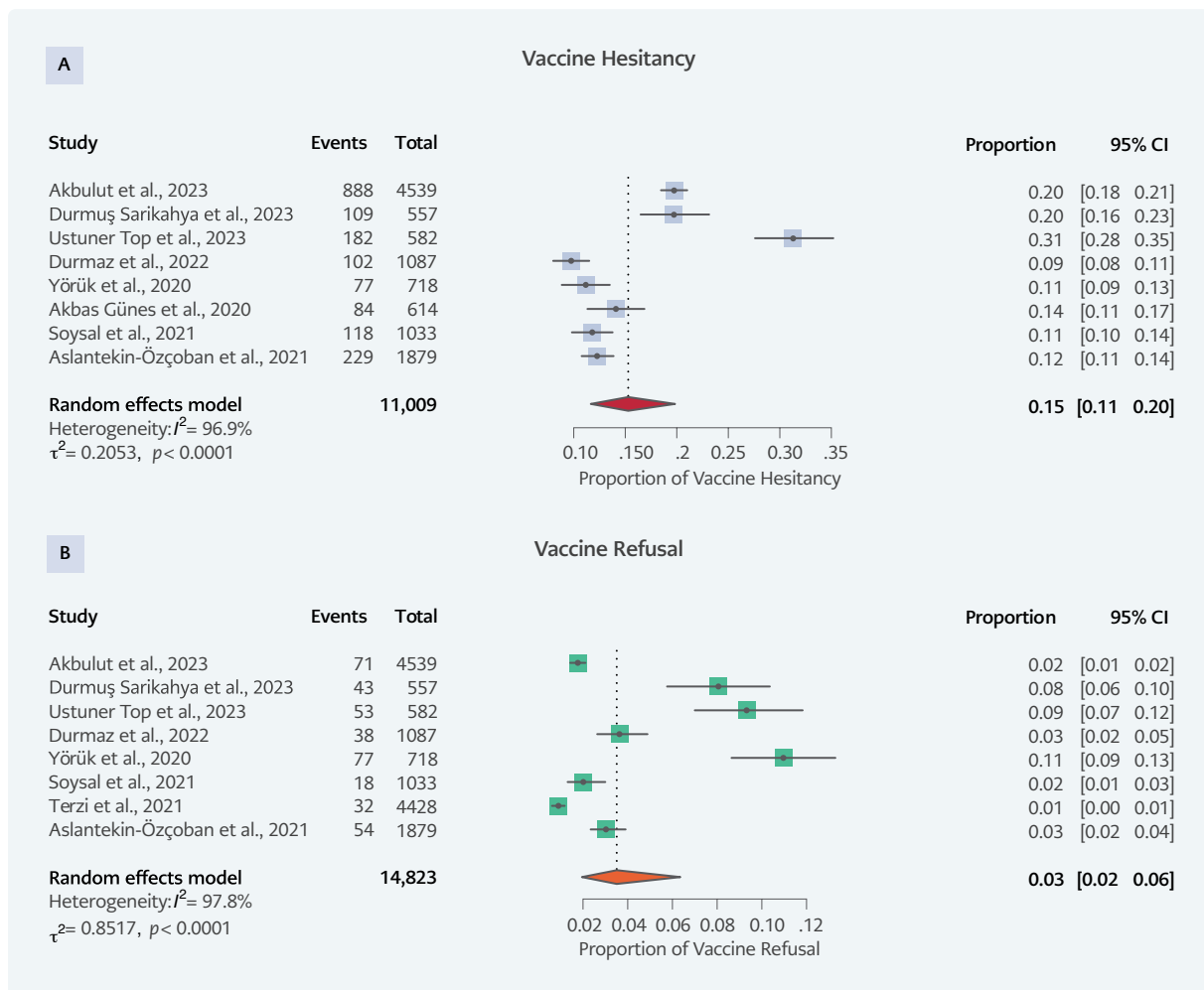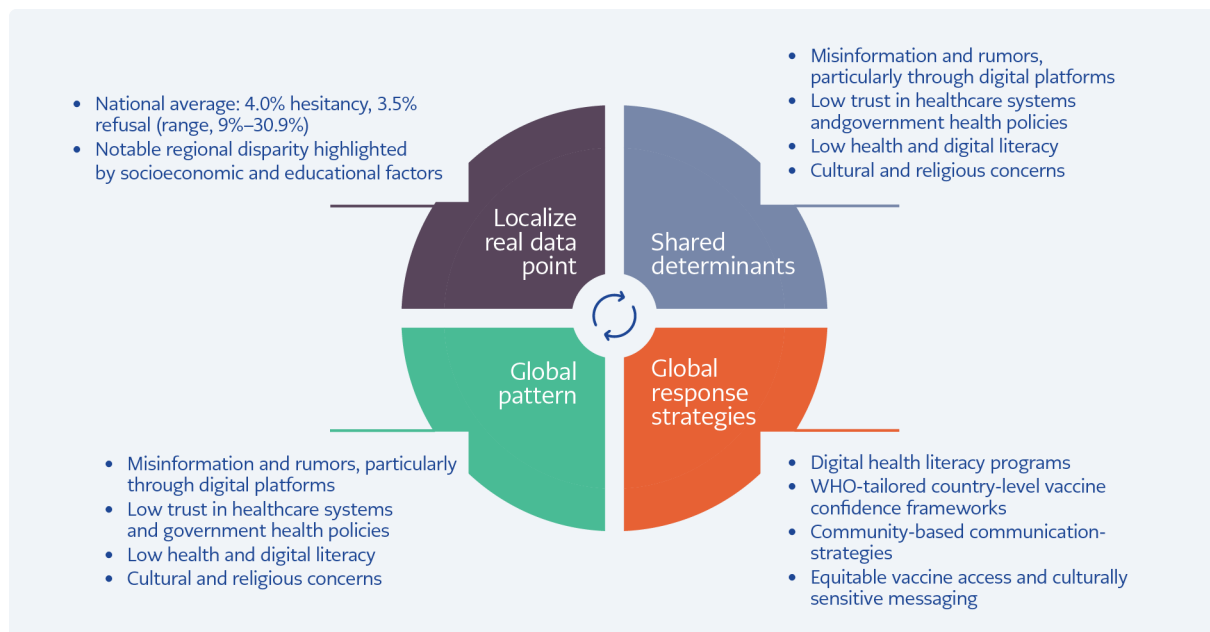τ^2= 0.8517, p< 0.0001

Proportion of Vaccine Refusal

Figure 2. Forest plots showing the pooled prevalence and between-study heterogeneity for vaccine hesitancy (A) and vaccine refusal (B).

Table 2. Characteristics of the studies included in the analysis of childhood vaccine hesitancy in Türkiye.

Reference	National or city level	Sample size	Mean age (years)	Study design	Higher education (%)	Higher income (%)	Vaccine hesitancy (%)	Vaccine refusal (%)
Durmuş Sarıkahya et al., 2023 (5)	Kayseri	557	NA*	Cross-sectional survey	44	50.6	30.9	7.7
Ustuner Top et al., 2023 (6)	National	582	34.4	Cross-sectional survey	38.8	9.3	9	9.1
Akbulut et al., 2023 (12)	National	4539	NA	Cross-sectional survey	41.2	NA	19.3	2
Durmaz et al., 2022 (13)	National	1087	NA	Cross-sectional survey	37.9	10.9	9.3	3.5
Yörük et al., 2020 (14)	Balıkesir	718	20.6	Cross-sectional survey	100	NA	11.7	NA
Akbas Gunes et al., 2020 (15)	Eskişehir	614	37.2	Cross-sectional survey	31.9	22.1	13.7	2.9
Soysal et al., 2021 (16)	National	1033	21	Cross-sectional survey	84.4	1.8	11.4	3.1
Terzi et al., 2021 (17)	Giresun	4428	NA	Cross-sectional survey	NA	NA	NA	1.1
Aslantekin-Özçoban et al., 2021 (18)	National	1879	20.4	Cross-sectional survey	100	NA	12.1	NA

*NA: Not available

Figure 3. From local patterns to a global warning.

The prevalence of childhood vaccine hesitancy varied significantly across studies. The lowest hesitancy rate (9.0%) was reported in a national study (6), whereas the highest rate (30.9%) was observed in a regional study conducted in Kayseri (5). Overall, reported hesitancy rates ranged from 9.0% to 19.3%, while vaccine refusal rates were consistently lower, ranging from 1.1% to 9.1%.

Sociodemographic characteristics varied across studies. The proportion of participants with a university degree or higher ranged from 31.9% to 100%.

Table 3. Global public health messages derived from findings in Türkiye.

Key message	Insights from Türkiye	Global implications
Vaccine hesitancy is heterogeneous	Rates range from 9.0% to 30.9% across regions	Localized data are essential for designing targeted public health interventions
Education level influences trust	Higher education levels are associated with lower hesitancy	Health literacy campaigns are globally relevant
Misinformation undermines public confidence	Cyberchondria and social media influence parental decision-making	Global action on digital health literacy is critical
Vaccine access is not the only barrier	Distrust persists despite free vaccine availability ,	Addressing perceptions is as important as strengthening supply chains
Data from one country can inform many	Türkiye's experience mirrors broader global patterns	Cross-border collaboration is essential to combat vaccine hesitancy

The highest educational attainment was reported in studies conducted in Balıkesir (14) and at the national level (18) (both 100%), whereas the lowest proportion was reported by Akbas Gunes et al. (15) (31.9%). Income distribution also varied, with higher-income participants comprising between 1.8% and 50.6% of the study samples, the highest proportion again observed in Kayseri (5).

The pooled analysis demonstrated an overall childhood vaccine hesitancy prevalence of 15% (95% CI, 11%–20%) and a pooled vaccine refusal prevalence of 3% (95% CI, 2%–6%). Substantial heterogeneity was observed for both outcomes (vaccine hesitancy: I^2=96.9%, τ^2=0.2053, p<0.0001; vaccine refusal: I^2=97.8%, τ^2=0.8517, p<0.0001), justifying the use of a random-effects model.

Forest plot analyses (Figure 2) illustrate the wide variability among studies. Individual estimates of vaccine hesitancy ranged from 9.0% (13) to 31.3% (6), while estimates of vaccine refusal ranged from 1.0% (17) to 11.0% (14).

DISCUSSION

This systematic review and meta-analysis provides a comprehensive overview of childhood vaccine hesitancy and refusal in Türkiye, demonstrating substantial regional and methodological variability across studies (5,6,12-18). These findings are consistent with previous research showing that vaccine attitudes are shaped by a combination of socioeconomic, educational, and informational factors (19). Although vaccine refusal rates were consistently lower than hesitancy rates, the high heterogeneity observed reflects contextual differences related to geographic location, demographic characteristics, sampling strategies, and study design. Regional disparities in healthcare access, cultural norms, and exposure to misinformation are likely contributors to this variability.

Notably, the highest vaccine hesitancy rate was reported in Kayseri, suggesting the influence of localized factors such as community-level beliefs, trust in public institutions, or historical vaccine-related controversies. In contrast, national-level studies reported lower hesitancy rates, likely reflecting more heterogeneous and representative samples that attenuate regional extremes. These findings indicate that national averages may obscure important subnational differences and highlight the need for region-specific assessments and interventions.

Sociodemographic characteristics emerged as important determinants of vaccine hesitancy and refusal. Studies with higher proportions of university-educated participants generally reported lower hesitancy rates, supporting existing evidence that higher education and health literacy are associated with increased vaccine acceptance (20). Previous research has shown that socioeconomic status influences vaccine decision-making through its effects on healthcare access, trust in medical institutions, and exposure to reliable health information (21).

Compared with global data, Türkiye's pooled vaccine hesitancy prevalence appears lower than the global average reported in recent meta-analyses, as well as lower than the average for the WHO Eastern Mediterranean Region (27.9%) (22). This may reflect

the strength of Türkiye's national immunization program, widespread vaccine availability, and relatively high engagement with primary healthcare services. Nevertheless, the pronounced regional variation observed within Türkiye underscores the need for locally tailored strategies rather than reliance on national-level indicators alone.

The role of digital literacy and misinformation is particularly relevant in the current context. The widespread use of social media has facilitated the rapid dissemination of misleading or false vaccine-related information, undermining trust in vaccines and healthcare providers. Ustuner Top et al. (6) demonstrated associations between reliance on online health information, cyberchondria, and increased vaccine hesitancy. These findings emphasize the importance of strengthening digital health literacy and implementing evidence-based communication strategies to counter misinformation.

Given the substantial heterogeneity identified in this analysis, addressing vaccine hesitancy in Türkiye requires tailored public health interventions that consider regional, economic, and informational disparities. Effective interventions should include targeted educational campaigns for populations with lower health literacy, efforts to reinforce trust in healthcare providers, proactive engagement on digital platforms to counter misinformation, and policies that ensure equitable access to vaccination services. Such strategies should be designed to address the specific needs of high-risk populations while reinforcing vaccine confidence nationwide.

Although this study focuses on Türkiye, the identified determinants of vaccine hesitancy—misinformation, digital illiteracy, socioeconomic disparities, and declining trust in healthcare systems — mirror challenges reported worldwide (23). Localized increases in hesitancy, such as those observed in specific regions of Türkiye, may compromise herd immunity and pose broader public health risks beyond national borders (Table 3). Given the transnational nature of digital misinformation, countermeasures must also extend beyond national boundaries and involve multilingual, culturally sensitive strategies. Trust-building through transparent communication and community engagement has been consistently identified as a cornerstone of successful vaccination programs (1,24). Türkiye's experience, therefore, offers insights that are relevant to other countries facing similar challenges and underscores the importance of globally coordinated yet locally implemented strategies (Figure 3) (25).

Despite its strengths, this study has several limitations. The analysis was restricted to English-language publications indexed in the Web of Science database, which may have resulted in language and database bias and the exclusion of relevant Turkish-language studies. The exclusion of studies with smaller sample sizes and preprints may also have led to the omission of potentially informative data. In addition, the cross-sectional design of the included studies limits causal inference, and the bibliometric nature of the synthesis precluded in-depth qualitative evaluation of psychological and cultural drivers of vaccine hesitancy.

CONCLUSION

This meta-analysis demonstrates that childhood vaccine hesitancy in Türkiye remains a multifaceted public health challenge, characterized by regional and sociodemographic disparities despite relatively low national prevalence. Higher hesitancy observed in certain regions underscores the importance of localized assessments and targeted interventions. The determinants identified—such as misinformation, limited health literacy, and trust-related issues—reflect global patterns, indicating that vaccine hesitancy is not unique to Türkiye but part of a broader international concern. Addressing this challenge requires context-specific strategies that strengthen health communication, counter misinformation, and reinforce trust in healthcare systems through coordinated national and international efforts. Future research incorporating qualitative methods and longitudinal designs would provide deeper insight into the evolving dynamics of vaccine attitudes in Türkiye.

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