



## Factors Influencing Childhood Vaccination Hesitancy Among Parents in Saudi Arabia: A Systematic Review

Najmah Ali Alotaibi<sup>1\*</sup>, Rawan Abdullah Alhumyani<sup>2</sup>, Bushra Ahmed Ali Alqahtani<sup>3</sup>, Najla Jaber Alkhaldi<sup>4</sup> and Rawan Ali Algarni<sup>5</sup>

<sup>1,4</sup>Department of Paediatrics, Alhada Armed Forces Hospital, 26522 Taif, Saudi Arabia

<sup>2,3,5</sup>Department of Paediatrics, Taif Children Hospital, 26561 Taif, Saudi Arabia

Author Designation: <sup>1,4</sup>Senior registrar, <sup>5</sup>Consultant

\*Corresponding author: Najmah Ali Alotaibi (e-mail: najmah-ali@outlook.sa).

©2025 the Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)

**Abstract Objective:** This systematic review aimed to assess childhood vaccine hesitancy among parents in Saudi Arabia and explore the perceptions of pediatric healthcare professionals regarding vaccine-hesitant parents (VHPs). **Methods:** Following PRISMA guidelines, a search was conducted in Scopus, PubMed and Web of Science for studies published between January 2015 and December 2024. Studies were selected using the PEO framework. Data were extracted independently by two reviewers and quality was assessed using the AXIS tool. **Results:** From 823 initial records, 26 studies were included in the final analysis. Vaccine hesitancy rates varied from 7.1% to 72.2%. Factors influencing hesitancy included parental education, fear of side effects, lack of reliable information, social media misinformation and limited trust in healthcare providers. **Conclusion:** Demographic, social and healthcare-related factors contribute significantly to vaccine hesitancy among Saudi parents. Targeted public health interventions, improved health literacy and effective physician-parent communication are essential to address this growing concern.

**Key Words** Childhood vaccine hesitancy, parental perception, Saudi Arabia, pediatric vaccination, immunization compliance

### INTRODUCTION

Vaccination, a potent tool against vaccine-preventable infectious conditions, spares several million lives worldwide [1]. Despite the availability of gratuitous medical care and accessible vaccines, a considerable percentage of children worldwide do not obtain their immunizations, with the issue exacerbated in countries with limited resources [2]. The obligation to vaccinate children rests with their parents and caretakers. Consequently, parents' attitudes, knowledge and beliefs regarding vaccination are crucial since they influence their actions for prompt and comprehensive immunization. Previous research suggests a deficiency in insight and knowledge among Saudi parents is related to their negative attitudes toward childhood vaccinations [3]. A further study evaluating parents' vaccination knowledge revealed that 20-40% of respondents have an inadequate understanding of the subject [4,5].

Saudi Arabia is a developing nation that has executed its comprehensive vaccination program since 1984 as a fundamental and cohesive component of primary healthcare. This immunization program has significantly lowered

mortality and disability among children from the targeted ailments in Saudi Arabia [6]. Saudi Arabia, like other nations, confronts the difficulty of inconsistent vaccination completion among its population, attributed to restricted healthcare access in rural regions, moderate parental levels of literacy and prevailing societal prejudices [7]. Although non-compliance with children's vaccination has been documented in every nation, developing countries have a significant incidence of incomplete child immunization rates [8]. Compliance rates of childhood vaccination (CV) in Saudi Arabia differ by province, with certain regions exhibiting significantly higher non-compliance rates [9].

Due to the scarcity of studies in this domain, especially in Saudi Arabia, it is essential to investigate vaccination compliance rates in both urban and rural regions of the country, along with the causes contributing to non-compliance [6]. This systematic review analyses Vaccine Hesitancy (VH) among parents in Saudi Arabia and insights of pediatric healthcare professionals concerning the perception of Vaccine-Hesitant Parents (VHP). It

emphasizes its prevalence and the related factors that influence public health actions and policy formulation. The review aimed to assess the level of VH and to determine the underlying causes to address and mitigate this issue.

Several studies have already examined this matter in Saudi Arabia yet systematic synthesis of regional data, population differences and parental vaccination perceptions remains scarce. Changing parental attitudes demand greater assessment and understanding because of the COVID-19 pandemic. The research review addresses an essential knowledge gap through its analysis of studies from the last ten years which provides an extensive view of vaccine reluctance factors in Saudi Arabia.

## MATERIALS AND METHODS

### Reporting Guidelines

The review complies with the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)" requirements for transparent documentation [10]. Figure 1 illustrates the article selection procedure for review, therefore optimizing the transparency and reliability of the studies.

### Focused Question

The primary research question was "What are the prevalence rates of childhood vaccine hesitancy and the factors influencing parental immunization compliance across different regions of Saudi Arabia?"

### Search Strategy

A comprehensive search of the literature was conducted to investigate VH among parents in Saudi Arabia. Digital databases, such as Scopus, PubMed and Web of Science, were meticulously searched using the key search terms such as "childhood vaccine hesitancy," "vaccine-hesitant parents," "parental attitudes concerning childhood vaccination," "childhood immunization," and "Saudi Arabia." Boolean operators (AND, OR) were utilized to successfully integrate the search phrases. The search approach sought to locate pertinent studies regarding parental views towards CV in Saudi Arabia. Relevant "field tags," "truncation items," and "MeSH terms" were employed to conduct the research inquiry. The search was confined to research on childhood vaccines published in English from January 2015 to December 2024. The chosen time for source inclusion was established to guarantee the literature's relevancy. This time includes the latest advancements and patterns affecting vaccine hesitancy studies conducted in Saudi Arabia, offering a contemporary comprehension of the subject under consideration.

### Eligibility criteria

Employing the PEO framework (Population, Exposure, Outcome), several pertinent research were selected.

### Population

Saudi parents or guardians with at least one child under 18 years of age and the pediatric personnel responsible for immunizing children in Saudi Arabia.

### Exposure

Research conducted on the Saudi population about childhood vaccine hesitation or vaccine-hesitant parents.

### Outcome

Research undertaken in Saudi Arabia to evaluate the knowledge, attitudes, behaviours and perspectives of pediatricians and parents/caretakers regarding children's immunization.

We incorporated studies that examined the perspectives of Saudi Arabian parents or pediatric professionals regarding childhood vaccination, the causes of hesitancy and related factors. Studies that were not conducted on the Saudi population, studies that investigated vaccine safety and that involved the general population or healthcare professionals were excluded. This review excluded grey literature sources, including reports, conference papers and theses. Although these sources offer useful insights, emphasizing exclusively peer-reviewed literature guarantees more integrity and quality in the selected studies. To preserve consistency and focus, we removed articles that addressed VH in various other age groups, or regions.

### Study Selection, Data Extraction and Synthesis

Two study investigators independently evaluated the titles and abstracts, retrieving papers that met the inclusion criteria for full-text evaluation. The third investigator addressed the difference of opinion. We utilized a standardized extraction form for obtaining information from the selected studies, which included the research design, sample size, population demographics, VH prevalence and main themes of concern among parents in Saudi Arabia.

### Quality Assessment

We employed the AXIS 20 tool to evaluate the quality of all reviewed studies. The AXIS tool is an essential evaluation instrument that determines quality and bias risk in cross-sectional investigations. The AXIS tool is a 20-item questionnaire that examines critical aspects of cross-sectional research, including the design of the investigation, sample size rationale, population of interest, sampling process, study validity and reliability and comprehensive methodology [11].

### Inter-Reviewer Agreement

Two separate researchers checked and obtained data from each study. The reviewers settled their differences through group consensus meetings or by requesting additional evaluation from a third expert. The review team established agreement by conducting preliminary testing and continuous meetings to discuss results.

### Justification for Exclusion of Grey Literature

Restained from the data collection were grey literature components such as conference abstracts and unpublished theses to prioritize peer-reviewed research materials of high quality. The selection process improves both the methodological strength and resultant comparability between researched materials.

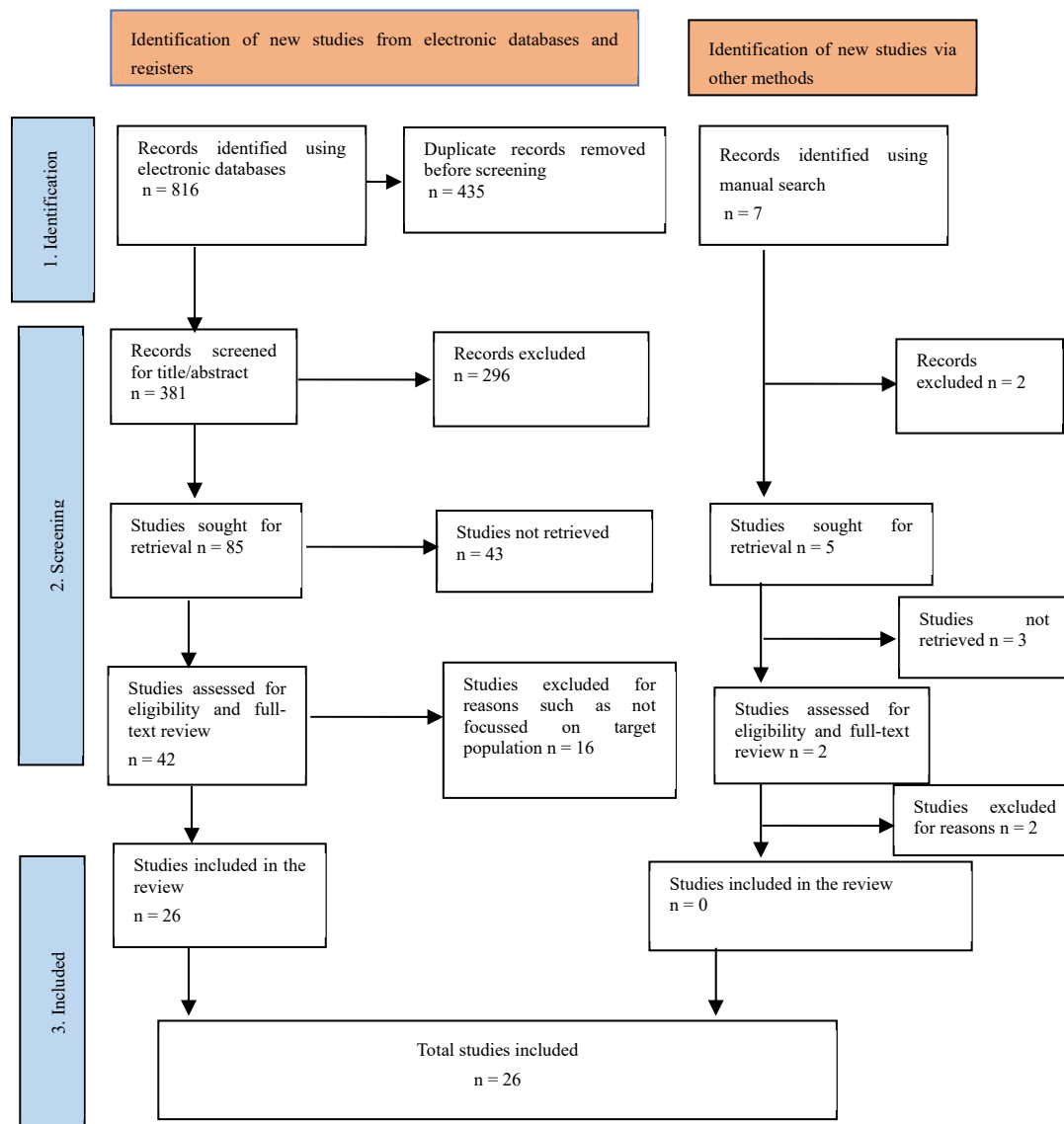


Figure 1: PRISMA (2020) flow chart of the reviewed studies

## RESULTS

From 823 original research publications found in electronic databases and manual searches, 381 were screened after deleting duplicate papers. Of them, 296 were discarded for not meeting search terms and 90 were chosen for retrieval. Following this, 46 selected research publications were identified as grey literature sources, when the full-text search was conducted. After exclusion, 44 papers were evaluated for full-text review and 18 studies were eliminated because they did not address VHP ( $n = 4$ ) and few other studies were conducted outside Saudi Arabia ( $n = 18$ ). Finally, 26 studies [12-37] satisfied the inclusion criteria and were chosen for the review. Figure 1 shows the PRISMA flow chart. Study heterogeneity regarding designs and populations alongside vaccine types (routine childhood drugs vs COVID-19 vs influenza) disallowed conducting a statistical analysis. A descriptive analysis of study results took place instead of a meta-analysis. The paper presents bar charts that show

hesitancy rates split by different regions and vaccine types in order to present findings range variability.

Nine of these studies [13-15,25,27,32,34,36,37] focused on childhood vaccine hesitancy, two on seasonal influenza [30,33] and 13 on the COVID-19 vaccine [12,16-24,26,28,35]. While Alnasser *et al.* [29] evaluated general vaccine hesitancy including Covid-19 vaccines, Temsah *et al.* [31] contrasted vaccine hesitancy for COVID-19 against childhood immunization. Cross-sectional observational techniques were employed in all the reviewed studies. The investigations were conducted in Saudi Arabia, with 11 being conducted in Riyadh [13-17,19,26,28-30,34], two studies were from Hail region [25,37], one each in the Taif [18], Central [20] and Eastern Saudi Arabia [21]. Najran [22], Jazan [27], Mekkah [32], Qassim [33], Jouf [35] and Jeddah [36]. Four of the reviewed studies were national cross-sectional surveys [12,23,24,31]. The age of the children varied across all the investigations. Table 1 summarises the reviewed studies.

Table 1: Overview of the studies reviewed

Author-Year, and place of study	Study design	Sample characteristics and sample size	Children's age	Data collection tool	Vaccine under study	Vaccine hesitancy rate (%)	Factors influencing vaccine hesitancy
Algerian <i>et al.</i> [12], 2024; Kingdom of Saudi Arabia	Cross-sectional	Parent or guardian (n = 1209)	Up to 18 years	WHO questionnaire	COVID-19	30.9	Influence of negative social media posts, notably incorrect or deceptive vaccine complaints
Basham <i>et al.</i> [13], 2024; Riyadh	Cross-sectional	Parents of children visiting primary healthcare centers for vaccination (n = 402)	Below 2 years	Self-administered structured questionnaire	CV	20.9	Concerns of high-grade fever during immunization and traveling amid the process.
Albaker <i>et al.</i> [14], 2023; King Saud University Medical City, Riyadh	Cross-sectional	Attitudes, perceptions, and actions of physicians encountering vaccine-hesitant parents (n = 90)	NA	Electronic-based questionnaire	CV	NA	Insufficient vaccine discussion time, excessive amounts of other counseling topics, and insufficient vaccine knowledge
Alghofaili <i>et al.</i> [15], 2023; Riyadh	Cross-sectional	Parents of children visiting primary healthcare centers for vaccination (n = 593)	Below 2 years	Self-administered questionnaire	CV	7.1	Fear for the child getting sick on immunization day, parent's disregard, or protracted postponement.
Alhuzaimi <i>et al.</i> [16], 2023; King Saud University, Riyadh	Cross-sectional	Parents of children visiting the University for COVID-19 vaccination (n = 873)	NR	Electronic-based questionnaire	COVID-19	20.5	Fear of side effects and insufficient vaccine information regarding safety
Almuqbil <i>et al.</i> [17], 2023; Riyadh	Cross-sectional	Parents of children at malls, gardens, supermarkets, primary health centers, hospitals and health camps	5-11 years	Electronic-based questionnaire	COVID-19	66	Fear of negative effects and absence of COVID-19 vaccination safety data
Alzahrani <i>et al.</i> [18], 2023; Taif City	Cross-sectional	PACV who were visiting primary health care centers (n = 301)	Two months to seven years	Arabic- PACV questionnaire	COVID-19	10.6	Fear of negative effects (93.8%), vaccine insecurity (84.4%), and belief that fewer vaccines are required
Ashour <i>et al.</i> [19], 2023; Riyadh	Cross-sectional	Mothers attending primary healthcare centre at King Abdulaziz Medical City (n = 293)	NA	Self-administered questionnaire	COVID-19	39	Personal vaccination safety concerns, poor understanding, and media influence
Iqbal <i>et al.</i> [20], 2023; Central Saudi Arabia	Cross-sectional	Concerns, behaviors, perceptions, and vaccine hesitancy of COVID-19 among parents (n = 1507)	5-11 years	A close-ended questionnaire with 26 items	COVID-19	28.9	It is believed that vaccination could alter children's DNA
Majzoub <i>et al.</i> [21], 2023; Eastern region of Saudi Arabia	Cross-sectional	Parents' perspectives regarding the immunization of children (n = 399)	5-12 years	Electronic-based questionnaire	COVID-19	35	Fear of enduring negative consequences, including fever and injection-related pain.
Aedh <i>et al.</i> [22], 2022; Najran	Cross-sectional	Parents' attitudes, and acceptance towards CV (n = 464)	5-11	Electronic-based questionnaire	COVID-19	72.2	Insufficient safety information, possible future repercussions, and vaccine efficacy
Almalki <i>et al.</i> [23], 2022; Saudi Arabia	Cross-sectional	Parents' vaccination hesitancy of their children (n = 4135)	5-11 years	Electronic-based questionnaire	COVID-19	61.9	A conviction that there are minimal advantages or no safety concerns
Almansour <i>et al.</i> [24], 2022; Saudi Arabia	Cross-sectional	Parents' vaccination hesitancy of their children (n = 500)	Less than 12 years	Electronic-based questionnaire	COVID-19	42.2	Low levels of education, inadequate vaccine efficacy data, and deficient health education and promotion
Alnumair <i>et al.</i> [25], 2022; Hail	Cross-sectional	Parents of children visiting primary health center (n = 200)	NA	Self-administered questionnaire	CV	9	Fear of negative outcomes, including fever, pain, and seizures
Al-Qahtani <i>et al.</i> [26], 2022; Riyadh	Cross-sectional	Parental willingness to vaccinate their children (n = 528)	5-11	Electronic-based questionnaire	COVID-19	Highly hesitant: 55.9 Low hesitant: 44.1	Novelty of the vaccination and lack of safety data

Table 1: Continue

Alqassim <i>et al.</i> [27], 2022; Jazan	Cross-sectional	Parents of children visiting primary health center (n = 447)	Less than 12 years	Interview-based questionnaire	CV	13.4	A substantially favourable perspective towards child immunization was demonstrated by parents employed in the medical field.
Aldakhil <i>et al.</i> [28], 2021; King Abdullah University Hospital, Riyadh	Cross-sectional	Mothers of children attending outpatient clinics	7 years	A validated standard questionnaire designed by WHO SAGE Group	COVID-19	24.31	The mother's educational background and her lack of confidence
Alnasser <i>et al.</i> [29], 2021; Riyadh	Cross-sectional	The pediatric workforce at three tertiary centers (n = 119)	NA	Electronic-based questionnaire	General vaccine hesitancy including Covid-19 vaccines	General vaccine hesitancy: 80 Covid-19 vaccine hesitancy: 31	Customized training and novel teaching platforms are needed to overcome vaccine reluctance.
Hamadah <i>et al.</i> [30], 2021; Riyadh	Cross-sectional	PACV for children's vaccination (n = 388)	6 months to 14 years	Electronic-based questionnaire	Seasonal influenza vaccination	23.2	Negative perception towards vaccine
Temsah <i>et al.</i> [31], 2021; Kingdom of Saudi Arabia	Cross-sectional	Parents with the commencement of the national childhood COVID-19 vaccination program (n = 3167)	Under 18 years	Electronic-based questionnaire (8 vaccine hesitancy scale items, adopted from WHO's SAGE)	Comparison of vaccine hesitancy for COVID-19 against CV	52.4	Poor safety information and adverse effects were the main concerns. Conventional vaccinations are more positively received by parents than the COVID-19 vaccine.
Albarakati <i>et al.</i> [32], 2019; Makkah	Cross-sectional	Vaccine-hesitant parents from seven primary schools (n = 100)	2 months to 17 years	Electronic-based questionnaire	CV	31.3	The shortage of immunizations in primary care centers, vaccine safety concerns, and adverse occurrences
Alolayan <i>et al.</i> [33], 2019; Qassim	Cross-sectional	Parents' awareness, knowledge, and attitudes about their children's vaccination (n = 399)	Above 6 months	A questionnaire comprising 29 validated items	Seasonal influenza vaccine	5.3	The conviction that natural immunity is superior to immunizations and that influenza is a simple disease that does not need vaccination.
Alsaibaie <i>et al.</i> [34], 2019; King Khalid University Hospital, Riyadh	Cross-sectional	Parents visiting outpatient clinics (n = 500)	2 months to 7 years	A questionnaire with an 11-item VHS of the SAGE working group	CV	20	Concerns on vaccine safety, and negative attitudes towards vaccination
Khan <i>et al.</i> [35], 2019; Al-Jouf province	Cross-sectional	Perceptions of parents and barriers to vaccinating their children (n = 444)	Less than 12 years	Electronic-based questionnaire	COVID-19	57.7	Parents' concerns about the safety and efficacy of the COVID-19 vaccine were extensively cited as impediments to CV
Banjari <i>et al.</i> [36], 2018; Jeddah	Cross-sectional	Parents of children visiting primary health centers (n = 351)	Below 3 years	A semi-structured questionnaire with 28 items	CV	24.2	Concerns about traveling during the vaccine period, transportation challenges, and developing high-grade fever
Alshammari <i>et al.</i> [37], 2017; Hail	Cross-sectional	Parents of children (n = 467)	Below 5 years	18-item structured questionnaire	CV	13.8	Saudi parents seemed to trust CVs, perceive vaccine benefits, and have effortless access to immunizations.

PACV: Parent's attitude about childhood vaccine, SAGE: Strategic Advisory Group of Experts on Immunization, KSA: Kingdom of Saudi Arabia, CV: Childhood vaccination, NA: Not available, VHS: Vaccine hesitancy scale



### Prevalence Rate of Childhood Vaccine Hesitancy

The vaccination hesitancy in the publications reviewed ranged from 7.1% [15] to 72.2% [22]. In general, three studies [18,27,33,34] reported that Saudi Arabians possessed a high level of knowledge regarding child vaccination. Alolayan *et al.* [33] found 3.9% of a lack of compliance which indicates a good attitude towards childhood immunization. Alzahrani *et al.* [18] used the Parent Attitudes on Childhood Vaccines (PACV) questionnaire and found a median PACV score of 23.3 out of 100, indicating vaccine hesitation. Over half of the parents changed their minds owing to COVID-19 [18]. Alsubaie *et al.* [34] surveyed 500 parents and 20% of them had concerns about vaccinating their children. Higher education levels were associated with increased reluctance among parents. Vaccines were seen as redundant and ineffectual, which led to parents' reluctance and under-vaccination.

Almansour *et al.* [24] studied COVID-19 vaccinations for children under 12 and 38.6% of participants were reluctant to administer the vaccine to their children. Parental decisions are complicated, as side effects and vaccine safety were top concerns. In Riyadh, one-third of parents were unwilling to vaccinate their children against COVID-19 [19]. VH was considerably lower among the Saudi parents of 12-18-year-olds (23-31%) [12,30,32] than 5-11-year-olds (61.9-72.2%) [17,22,23].

### Demographic Factors

The investigations suggested demographic disparities in hesitating rates. Attitudes varied by parental age, education and socioeconomic condition. This necessitates tailored approaches that address specific demographic issues [18,22]. Like elsewhere, vaccine reluctance has many influential factors in Saudi Arabia. VHP had low educational levels [31,35], skepticism about vaccination [24,26] and limited health education [14,23,25]. Alsubaie *et al.* [34] and Alnasser *et al.* [29] employed the WHO SAGE working group on a VH survey and claimed that educated parents are at high risk of vaccine hesitation. Certain population groups are also hesitant due to vaccine safety, efficacy and previous experiences [32,35]. False information and distrust of vaccines and healthcare organizations undermine vaccine adoption [32]. Social media and other misleading information regarding vaccine safety and efficacy may threaten vaccination efforts [12]. Henceforth, targeted initiatives are needed to improve vaccination literacy and counteract misconceptions.

### Factors Influencing Childhood Vaccine Hesitancy

Online resources, social networking sites and healthcare providers were stressed as sources of trustworthy information. Social media misinformation and divergent opinions might increase VH, emphasizing the demand for reliable data sources [18,21,38]. The COVID-19 pandemic has markedly impacted the perspectives of parents such as changes in attitudes, uncertainties regarding the COVID-19 vaccine's safety and fear of possible negative effects have been common. All of these elements work together to

highlight the pandemic's widespread impact on vaccine choices [17,23,28]. As a rationale for refraining from immunizing their children against COVID-19, 36.2% of parents cited inadequate vaccine efficacy data [26]. Additionally, the parental belief that the child did not pose an elevated risk of contracting COVID-19 was yet another explanation for not immunizing the children. This finding was consistent with that of Aedh *et al.* [22] and Temsah *et al.* [31], indicating that 19% and 26.1% of parents respectively, viewed their child to be at a low chance of acquiring COVID-19 infection. With too many immunizations at short intervals, several parents found the regimen burdensome. Vaccine safety concerns, especially unfavourable consequences, were common grounds for hesitancy. These safety concerns must be addressed to promote vaccination acceptance [16,17,20,28].

Alshammari *et al.* [37] reported that 60% to 90% of parents acknowledged the need for vaccination for their children and that 86% of parents fully immunized their children. According to Alolayan *et al.* [33], 94.7% of the parents were in favour of the seasonal influenza vaccine. Women exhibited a more positive perspective than their male counterparts. Studies showed that good parental attitudes were linked to their higher education levels. Parents' awareness of immunization protocols differed across Saudi Arabia. Immunization delays were more common at certain stages of child development. The development of targeted interventions to resolve these delays at various stages is contingent upon this information. A prior study by Alghofaili *et al.* [15] underscored the significance of comprehending the precise vaccines and ages at which delays are frequently observed. It was reported that IPV, OPV and MCV were the most commonly delayed vaccines, followed by DTP, hepatitis B and HIB [15].

Banjari *et al.* [36] found that 21.3% of parents delayed immunization due to travel, followed by vaccine shortages in healthcare facilities (15.5%). Other possible causes were transportation challenges and lack of time to visit the healthcare providers. Some parents of partially vaccinated children contend that their children do not require vaccines for no longer prevalent ailments and that multiple doses in one visit are inappropriate [34]. Travelling to and from immunization centers also caused delays in receiving vaccinations [37]. However, different reasons were identified for decreased influenza vaccination uptake compared to normal children's vaccines. Parents believed that influenza was a simple health issue and that the natural immunity of their children and their communities was superior to the immunity provided by the vaccine. Consequently, they did not believe that their children required an influenza vaccine [30]. Further, some parents believed the influenza vaccine could induce influenza or other side effects [33]. Alshammari *et al.* [37] found that 86% of parents in the Hail region administered their children's mandatory immunization. Similarly, Alsubaie *et al.* [34] found that 20% of parents were unwilling to vaccinate their children and 36% were not properly immunized for their age.

Table 2: Quality assessment of reviewed studies using the AXIS tool

Figure 2: Quality assessment of reviewed studies using the AXIS tool																											
Components of the AXIS tool	Study 112	Study 213	Study 314	Study 415	Study 516	Study 617	Study 718	Study 819	Study 920	Study 1021	Study 1122	Study 1223	Study 1324	Study 1425	Study 1526	Study 1627	Study 1728	Study 1829	Study 1930	Study 2031	Study 2132	Study 2233	Study 2334	Study 2435	Study 2536	Study 2637	
Introduction																											
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Methods																											
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	X	X
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	X	✓	X	✓	X	X	✓	✓	✓	X	✓	X	✓	X	X	✓	✓	X	X	X	✓	✓	✓	✓	✓	✓	✓
8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Results																											
12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	✓
15	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Discussion																											
17	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
18	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other																											
19	X	X	A	X	B	C	X	X	B	X	X	C	X	X	E	X	F	X	X	A	X	G	D	H	D	X	
20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓: Yes, X: No, D: Do not know, A: Funded by Deanship of Scientific Research, King Saud University, B: Funded by the Deputyship for Research & Innovation, Ministry of Education in Saudi Arabia, C: Funded by the Researchers Supporting Project at King Saud University, Riyadh, E: Funded by Deanship of Scientific Research, Najran University, Najran, Saudi Arabia, F: Funded by the Deanship of Scientific Research at Princess Nourah Bint Abdulrahman University, G: Funded by the Deanship of Scientific Research, Majmaah University, H: Funded by the Deanship of Scientific Research at Jouf University

### Quality Assessment of the Reviewed Studies

AXIS 20 quality assessments of reviewed studies are shown in Table 2. The included studies explicitly defined their objectives and aims. Competent study designs with appropriate sample sizes were employed in most of the studies that were reviewed. However, studies by Albaker *et al.* [14], Almalki *et al.* [23], Temsah *et al.* [31], Banjari *et al.* [36] and Alshammari *et al.* [37] lacked justification for sample size estimation. Studies that were included in the analysis yielded consistent and well-defined outcomes. This systematic review found no conflicts of interest in any investigation. However, some of the studies [14,16,17, 20,23,26,28,31,33,35] had financial sources that could alter the authors' interpretations. All reviewed studies obtained ethical clearance and participants' consent.

### DISCUSSION

This systematic review examined the prevalence of childhood vaccine hesitancy and the factors influencing it. Low educational attainment, skepticism of vaccine knowledge and poor health education are the most typical factors influencing vaccine hesitancy among Saudi parents.

Additionally, the hesitation is influenced by a variety of factors, such as previous experiences with vaccination, concerns regarding negative effects, doubts regarding safety and efficacy, confidence in the healthcare system and the availability of free vaccines from government organizations. Globally, vaccine hesitancy and refusal have afflicted healthcare authorities [38,39]. Further, to mitigate the widespread transmission of COVID-19, it was imperative to immunize the greatest number of individuals possible to develop herd immunity [40]. Parental hesitation about immunizing children was a major issue worldwide [41,42]. Nevertheless, a prior study reported that parents were more positive and receptive to standard childhood immunization than COVID-19 vaccinations and they were more cautious about vaccinating their children [43]. The benefits of immunizations are well recognized, although certain studies may not provide this data [44].

The hesitancy rates observed in the Saudi population closely mirror global trends reported in Europe, South Asia and North America. However, certain unique regional challenges-such as low vaccine confidence in rural areas and

significant trust in traditional beliefs-exacerbate the issue. A similar trend was seen in studies from Bangladesh and Pakistan, while European studies showed relatively higher acceptance of pediatric COVID-19 vaccines.

Parental age adversely correlated with child immunization. This supports recent findings of lower vaccination knowledge and attitudes in elderly parents [45,46]. Parent-physician relationships affect parents' knowledge, attitude and practice of immunizing their children [47]. Young parents have a stronger interaction with practitioners regarding immunization expertise and safety than parents of older children [45]. These factors may partially explain the unfavourable relationship between parental age and child immunization. In contrast to parental age, the child's age was positively linked with vaccination frequency. That is, older children were more inclined to be fully immunized [48]. This is most likely contingent upon an additional time frame that permits the completion of the immunization schedule. Nevertheless, this does not guarantee that the immunizations were accomplished on time, or there might have been some delays.

Immunizing their children was more prevalent among parents who were employed in the private sector than among those who were either studying or unemployed [49]. Private employment provides financial security and usually demands higher educational requirements, which may eventually improve child immunization [50]. Previous studies by Zhang *et al.* [51], Shati *et al.* [52] and Chen *et al.* [53] have documented a well-established link between parents' occupation type and their children's vaccination status. These findings are further substantiated by the correlation between childhood vaccinations and the chosen means of transportation. As opposed to parents with moderate to low incomes, wealthy parents are considerably more inclined to travel to primary healthcare facilities. Additionally, increased PHC waiting time leads to reduced childhood immunization rates. The literature suggests that the under-immunization of children is partly attributable to parents' unfavourable health clinic experiences, including higher wait times [54]. This shows the need to improve healthcare services to shorten waiting times and increase childhood immunization.

The parental perception of vaccination is a critical factor in the decision they immunize their children, as parents who have a negative perception of vaccinations are considerably less inclined to be proactive in doing so. A recently published systematic review by Alabadi *et al.* [6] found a strong association between detrimental vaccine perception and lower child immunization. Our data confirms and expands these reports to multiple Saudi Arabian areas. The results of this investigation showed that most Saudi parents were unwilling to vaccinate their children against COVID-19. West *et al.* [55] found considerable parental vaccine hesitation for COVID-19 vaccination for children in Bangladesh. These findings contradict a European study by Alfieri *et al.* [41] that found a substantially higher parental COVID-19 vaccine acceptance frequency for their children. Similarly, Aw *et al.* [56] documented that Italian parents were

more likely to accept the COVID-19 vaccine for their children than in Arab nations. Goldman *et al.* [57] conducted a study in Asian nations such as India, Pakistan and Bangladesh, where parents displayed COVID-19 vaccine hesitation for both themselves and their children due to bogus information, convictions regarding religion and self-imagined fictitious ideologies.

The study elucidates the factors influencing childhood vaccine hesitancy, providing valuable information for policymakers and healthcare professionals to formulate focused policies aimed at enhancing vaccination acceptance rates among children in Saudi Arabia. However, the generalisability of the results to the Saudi population and any causal inferences are restricted by the cross-sectional design of the reviewed studies and the non-probability sampling method. Further, parents may underestimate or overestimate survey questions, generating a non-differential bias. Specific policy recommendations include the implementation of parent-targeted education campaigns, enhancement of communication skills among pediatricians and the use of digital health platforms to combat vaccine misinformation. Collaborative strategies with schools and local health centers may also improve outreach in underserved regions. Although this study has illuminated the complex causes of childhood vaccine hesitancy, a more targeted effort is needed to enhance immunization rates. It is imperative to provide specific recommendations to facilitate action in this domain. Strategies for fostering confidence in vaccination, combating misinformation and addressing safety concerns must be implemented. This involves making vaccine information transparent and accessible to comprehend the concerns of the community and partnering with reputable institutions to spread factual knowledge. Additionally, the resolution of vaccine hesitancy has wider repercussions for the attainment of expanded public health objectives. Increased vaccination acceptance and adoption can boost population immunity, minimize vaccine-preventable illnesses and thereby improve health outcomes.

## CONCLUSION

This systematic review highlights key parental factors contributing to vaccine hesitancy in Saudi Arabia, including demographic disparities, misinformation, healthcare accessibility and attitudes toward vaccine safety. The findings support the need for culturally tailored public health initiatives and strengthened healthcare communication to increase immunization uptake. Further longitudinal studies and interventional research are needed to understand long-term patterns and develop effective solutions.

## Ethical Considerations

As this study is a systematic review of previously published data, ethical approval was not required. All included studies had documented ethical clearance and participant consent. There are no conflicts of interest to declare.



## Funding Disclosure

This review was not supported by any external funding. The authors declare no potential conflict of interest related to the study.

## Components of the AXIS tool

### Introduction

1. Did the study have a clear aim or objectives?

### Methods

2. Was the research design satisfactory for the specified aim(s)?
3. Was the sample size justified?
4. Was the target/reference population explicitly stated?
5. Did the sampling frame accurately correspond to the target/reference population under inquiry?
6. Was the selection method expected to choose subjects/participants representative of the target/reference population?
7. Were non-responders addressed and categorized?
8. Were the risk factors and outcome variables evaluated consistent with the study aims?
9. Were risk factors and outcome parameters accurately quantified using pretested, piloted, or published instruments?
10. How were statistical significance and precision estimations determined? (CIs, p-values)
11. Were the approaches well detailed for repeatability, including statistical methodologies?

### Results

12. Was the basic results well-presented?
13. Does the response rate indicate non-response bias?
14. If applicable, was non-responder information provided?
15. Were the study results internally consistent?
16. Were the analysis results as indicated in the methods?

### Discussion

17. Did the result of the study support the authors' discussion and conclusion?
18. Were study limitations addressed?

### Other

19. Was there any financial support or conflicts of interest that could impact the authors' evaluation of the results?
20. Was an ethical clearance or permission obtained from participants?

## REFERENCES

- [1] Organization, World Health. *Assessment report of the Global Vaccine Action Plan*. Strategic Advisory Group Of Experts On Immunization. 2017, [https://terrance.who.int/mediacentre/data/sage/SAGE\\_Docs\\_Ppt\\_Oct2017/6\\_session\\_GVAP/Oct2019\\_session6\\_GVAP\\_2017\\_report.pdf](https://terrance.who.int/mediacentre/data/sage/SAGE_Docs_Ppt_Oct2017/6_session_GVAP/Oct2019_session6_GVAP_2017_report.pdf).
- [2] Hadjipanayis, Adamos *et al.* "Vaccine confidence among parents: Large scale study in eighteen European countries." *Vaccine*, vol. 38, no. 6, February 2020, pp. 1505-1512. <https://www.sciencedirect.com/science/article/abs/pii/S0264410X19316226>.
- [3] Siddiqi, Nazish *et al.* "Mothers' knowledge about EPI and its relation with age-appropriate vaccination of infants in peri-urban Karachi." *JPMA. The Journal of the Pakistan Medical Association*, vol. 60, no. 11, November 2010, pp. 940-944. <https://europepmc.org/article/med/21375199>.
- [4] Žagminas, Kęstutis *et al.* "Tėvų požiūris į vaikų skiepijimą." *Medicina*, vol. 43, no. 2, 2007, pp. 161-169. <https://epublications.vu.lt/object/elaba:6172025/>.
- [5] Alabadi, Marwa, and Zakariya Aldawood. "Parents' knowledge, attitude and perceptions on childhood vaccination in Saudi Arabia: A systematic literature review." *Vaccines*, vol. 8, no. 4, 2020. <https://www.mdpi.com/2076-393X/8/4/750>.
- [6] Alabadi, Marwa *et al.* "Exploring critical factors associated with completion of childhood immunisation in the eastern province of Saudi Arabia." *Vaccines*, vol. 10, no. 12, December 2022. <https://www.mdpi.com/2076-393X/10/12/2147>.
- [7] AlGoraini, Y.M. *et al.* "Confidence toward vaccination as reported by parents of children admitted to a tertiary care hospital in Riyadh, Saudi Arabia: A cross sectional study." *Vacunas (English Edition)*, vol. 21, no. 2, December 2020, pp. 95-104. <https://www.sciencedirect.com/science/article/abs/pii/S244514602030025X>.
- [8] Bangura, Joseph Benjamin *et al.* "Barriers to childhood immunization in sub-Saharan Africa: A systematic review." *BMC public health*, vol. 20, July 2020. <https://link.springer.com/article/10.1186/s12889-020-09169-4>.
- [9] Alruwaili, Ashwaq Arar S. *et al.* "Knowledge, attitude and practice of the parents regarding child vaccinations in Arar, Northern Saudi Arabia." *The Egyptian Journal of Hospital Medicine*, vol. 72, no. 9, July 2018, pp. 5178-5182. [https://ejhm.journals.ekb.eg/article\\_10738.html](https://ejhm.journals.ekb.eg/article_10738.html).
- [10] Page, Matthew J. *et al.* "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews." *Systematic Reviews*, vol. 10, no. 1, March 2021. <https://pubmed.ncbi.nlm.nih.gov/33781348/>.
- [11] Downes, Martin J. *et al.* "Development of a critical appraisal tool to assess the quality of cross-sectional studies (AXIS)." *BMJ Open*, vol. 6, no. 12, 2016. <https://bmjopen.bmj.com/content/6/12/e011458.short>.
- [12] Aljerian, Khaldoun *et al.* "Determinants of parental vaccine hesitancy during the COVID-19 era in Saudi Arabia: a cross-sectional survey." *Cureus*, vol. 16, no. 8, April 2024. <https://www.cureus.com/articles/255012-determinants-of-parental-vaccine-hesitancy-during-the-covid-19-era-in-saudi-arabia-a-cross-sectional-survey.pdf>.
- [13] Basham, Karam *et al.* "Exploring influential factors in childhood vaccine delays in Riyadh, Saudi Arabia." *Journal of Family Medicine and Primary Care*, vol. 13, no. 8, August 2024, pp. 3165-3172. [https://journals.lww.com/jfmpc/fulltext/2024/13080/exploring\\_influential\\_factors\\_in\\_childhood\\_vaccine.53.aspx?context=latestarticles](https://journals.lww.com/jfmpc/fulltext/2024/13080/exploring_influential_factors_in_childhood_vaccine.53.aspx?context=latestarticles).

- [14] Albaker, Asma R. *et al.* "Physicians' knowledge, attitude and perceptions towards vaccine-hesitant parents: a cross-sectional study." *BMC Medical Education*, vol. 23, no. 1, September 2023. <https://link.springer.com/article/10.1186/s12909-023-04590-w>.
- [15] Alghofaili, Mooj A. *et al.* "Factors contributing to the delayed vaccination among children in Riyadh City, Saudi Arabia: a cross-sectional study." *Cureus*, vol. 15, no. 8, September 2023. [https://assets.cureus.com/uploads/original\\_article/pdf/174633/20230908-7692-yy0dun.pdf](https://assets.cureus.com/uploads/original_article/pdf/174633/20230908-7692-yy0dun.pdf).
- [16] Alhuzaimi, Abdullah N. *et al.* "Exploring determinants of COVID-19 vaccine acceptance, uptake, and hesitancy in the pediatric population: a study of parents and caregivers in Saudi Arabia during the initial vaccination phase." *Healthcare*, vol. 11, no. 7, March 2023. <https://www.mdpi.com/2227-9032/11/7/972>.
- [17] Almuqbil, Mansour *et al.* "Parental COVID-19 vaccine hesitancy for children and its influencing factors: a Riyadh-based cross-sectional study." *Vaccines*, vol. 11, no. 3, February 2023. <https://www.mdpi.com/2076-393X/11/3/518>.
- [18] Alzahrani, Asmaa A. and Abdulrhman N. Alghamdi "Vaccine hesitancy among parents and its determinants during the era of COVID-19 in Taif City, Saudi Arabia." *Cureus*, vol. 15, no. 6, July 2023. <https://www.cureus.com/articles/161568-vaccine-hesitancy-among-parents-and-its-determinants-during-the-era-of-covid-19-in-taif-city-saudi-arabia.pdf>.
- [19] Ashour, Hadeel A. *et al.* "Knowledge, attitude, and practice (KAP) of COVID-19 vaccine among Saudi mothers." *Cureus*, vol. 15, no. 3, March 2023. [https://assets.cureus.com/uploads/original\\_article/pdf/144904/20240111-20618-1wm5igy.pdf](https://assets.cureus.com/uploads/original_article/pdf/144904/20240111-20618-1wm5igy.pdf).
- [20] Iqbal, Muhammad Shahid *et al.* "Parents' concerns, behavior, perception, and hesitancy regarding COVID-19 vaccinations for children in central Saudi Arabia." *Vaccines*, vol. 11, no. 10, October 2023. <https://www.mdpi.com/2076-393X/11/10/1566>.
- [21] Majzoub, Rabab A. *et al.* "Parental hesitancy and attitude concerning COVID-19 vaccine and its side effects in Saudi Arabia, Eastern region." *Cureus*, vol. 15, no. 11, November 2023. <https://www.cureus.com/articles/193713-parental-hesitancy-and-attitude-concerning-covid-19-vaccine-and-its-side-effects-in-saudi-arabia-eastern-region.pdf>.
- [22] Aedh, Abdullah Ibrahim. "Parents' attitudes, their acceptance of the COVID-19 vaccines for children and the contributing factors in Najran, Saudi Arabia: a cross-sectional survey." *Vaccines*, vol. 10, no. 8, November 2022. <https://www.mdpi.com/2076-393X/10/8/1264>.
- [23] Almalki, Ohoud S. *et al.* "Parents' hesitancy to vaccinate their 5–11-year-old children against COVID-19 in Saudi Arabia: predictors from the health belief model." *Frontiers in public health*, vol. 10, March 2022. <https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2022.842862/full>.
- [24] Almansour, Ahd *et al.* "Acceptance and hesitancy of parents to vaccinate children against coronavirus disease 2019 in Saudi Arabia." *Plos one*, vol. 17, no. 10, October 2022. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0276183>.
- [25] Alnumair, Abdulaziz and Abdullah Almulifi. "Perceptions toward childhood vaccinations (side effects vs. benefits) among the parents living in Hail, Saudi Arabia." *Journal of Family Medicine and Primary Care*, vol. 11, no. 10, October 2022, pp. 6285-6290. [https://journals.lww.com/jfmpc/fulltext/2022/10000/Perceptions\\_toward\\_childhood\\_vaccinations\\_\\_side.63.aspx](https://journals.lww.com/jfmpc/fulltext/2022/10000/Perceptions_toward_childhood_vaccinations__side.63.aspx).
- [26] Al-Qahtani, Awad Mohammed *et al.* "Parental willingness for COVID-19 vaccination among children aged 5 to 11 years in Riyadh City, Saudi Arabia: a cross-sectional study." *Vaccines*, vol. 10, no. 12, November 2022. <https://www.mdpi.com/2076-393X/10/12/1979>.
- [27] Alqassim, Ahmad Y. *et al.* "Knowledge and behaviors of parents towards child vaccination in Jazan, Saudi Arabia." *Tropical Journal of Pharmaceutical Research*, vol. 21, no. 1, March 2022, pp. 143-150. <https://www.ajol.info/index.php/tjpr/article/view/222570>.
- [28] Aldakhil, Haifa *et al.* "Vaccine hesitancy towards childhood immunizations as a predictor of mothers' intention to vaccinate their children against COVID-19 in Saudi Arabia." *Journal of Infection and Public Health*, vol. 14, no. 10, October 2021, pp. 1497-1504. <https://www.sciencedirect.com/science/article/pii/S1876034121002471>.
- [29] Alnasser, Yossef *et al.* "Preparedness of current and future Saudi Pediatricians to face vaccine hesitancy: Cross-sectional study within the capital city of Saudi Arabia, Riyadh." *Annals of Medicine and Surgery*, vol. 69, September 2021. <https://www.sciencedirect.com/science/article/pii/S2049080121006683>.
- [30] Hamadah, Reem E. *et al.* "Attitude of parents towards seasonal influenza vaccination for children in Saudi Arabia." *Journal of Family Medicine and Primary Care*, vol. 10, no. 2, February 2021, pp. 904-909. [https://journals.lww.com/jfmpc/fulltext/2021/10020/attitude\\_of\\_parents\\_towards\\_seasonal\\_influenza.51.aspx](https://journals.lww.com/jfmpc/fulltext/2021/10020/attitude_of_parents_towards_seasonal_influenza.51.aspx).
- [31] Temsah, Mohamad-Hani *et al.* "Parental attitudes and hesitancy about COVID-19 vs. routine childhood vaccinations: a national survey." *Frontiers in Public Health*, vol. 9, October 2021. <https://www.frontiersin.org/articles/10.3389/fpubh.2021.752323/full>.
- [32] Albarakati, Rana *et al.* "Investigating factors associated with vaccine hesitancy in Makkah, KSA." *World Journal of Vaccines*, vol. 9, no. 2, April 2019. [https://www.scirp.org/html/1-5100188\\_91609.htm](https://www.scirp.org/html/1-5100188_91609.htm).
- [33] Alolayan, Abdullah *et al.* "Seasonal influenza vaccination among Saudi children: Parental barriers and willingness to vaccinate their children." *International Journal of Environmental Research and Public Health*, vol. 16, no. 21, October 2019. <https://www.mdpi.com/1660-4601/16/21/4226>.
- [34] Alsubaie, Sarah S. *et al.* "Vaccine hesitancy among Saudi parents and its determinants: Result from the WHO SAGE working group on vaccine hesitancy survey tool." *Saudi Medical Journal*, vol. 40, no. 12, December 2019. <https://pubmed.ncbi.nlm.nih.gov/articles/PMC6969619/>.
- [35] Khan, Yusra Habib *et al.* "Parental perceptions and barriers towards childhood COVID-19 vaccination in Saudi Arabia: a cross-sectional analysis." *Vaccines*, vol. 10, no. 12, December 2022. <https://www.mdpi.com/2076-393X/10/12/2093>.

- [36] Banjari, Maysaa A. *et al.* "How often do children receive their vaccinations late, and why?." *Saudi Medical Journal*, vol. 39, no. 4, April 2018. <https://pmc.ncbi.nlm.nih.gov/articles/PMC5938647/>.
- [37] Alshammari, Thamir M. *et al.* "Parental perceptions, attitudes and acceptance of childhood immunization in Saudi Arabia: A cross sectional study." *Vaccine*, vol. 36, no. 1, January 2018, pp. 23-28. <https://www.sciencedirect.com/science/article/pii/S0264410X17316146>.
- [38] Alaamri, Olfat *et al.* "Vaccine hesitancy in Saudi Arabia: a cross-sectional study." *Tropical Medicine and Infectious Disease*, vol. 7, no. 4, April 2022. <https://www.mdpi.com/2414-6366/7/4/60>.
- [39] Kocamaz, Elif Bilsin and Halil Kocamaz. "Awareness of Covid-19 and attitudes toward vaccination in parents of children between 0 and 18 years: A cross-sectional study." *Journal of Pediatric Nursing*, vol. 65, August 2022, pp. 75-81. <https://www.sciencedirect.com/science/article/pii/S088259632200077X>.
- [40] Pfattheicher, Stefan *et al.* "Information about herd immunity through vaccination and empathy promote COVID-19 vaccination intentions." *Health Psychology*, vol. 41, no. 2, February 2022, pp. 85-93. <https://psycnet.apa.org/fulltext/2021-85869-001.html>.
- [41] Alfieri, Nina L. *et al.* "Parental COVID-19 vaccine hesitancy for children: vulnerability in an urban hotspot." *BMC Public Health*, vol. 21, September 2021. <https://link.springer.com/article/10.1186/s12889-021-11725-5>.
- [42] Obregon, Rafael *et al.* "Vaccine hesitancy and demand for immunization in Eastern Europe and Central Asia: implications for the region and beyond." *Vaccine Communication in a Pandemic. Routledge*, vol. 21, September 2021, pp. 69-76. <https://www.taylorfrancis.com/chapters/edit/10.4324/9781003457268-14/vaccine-hesitancy-demand-immunization-eastern-europe-central-asia-implications-region-beyond-rafael-obregon-mario-mosquera-sergiu-tomsa-ketan-chitnis>.
- [43] Al-Qerem, Walid *et al.* "Parents' attitudes, knowledge and practice towards vaccinating their children against COVID-19: A cross-sectional study." *Human Vaccines & Immunotherapeutics*, vol. 18, no. 5, March 2022. <https://www.tandfonline.com/doi/full/10.1080/21645515.2022.2044257>.
- [44] Bin Alamir, Abdulrahman A. "Childhood vaccination hesitancy in Saudi Arabia: are we still facing a problem?." *Saudi Medical Journal*, vol. 45, no. 6, June 2024, pp. 551-559. <https://pubmed.ncbi.nlm.nih.gov/38830647/>.
- [45] Matta, Perla *et al.* "Parents' knowledge, attitude and practice towards children's vaccination in Lebanon: role of the parent-physician communication." *BMC Public Health*, vol. 20, September 2020. <https://link.springer.com/article/10.1186/s12889-020-09526-3>.
- [46] Sinuraya, Rano K. *et al.* "Parents' knowledge, attitude, and practice on childhood vaccination during the COVID-19 pandemic in Indonesia." *Patient Preference and Adherence*, vol. 16, January 2022, pp. 105-112. <https://www.tandfonline.com/doi/full/10.2147/PPA.S339876>.
- [47] Kundi, Michael *et al.* "The impact of the parent-physician relationship on parental vaccine safety perceptions." *Current Drug Safety*, vol. 10, no. 1, 2015, pp. 16-22. <https://www.ingentaconnect.com/content/ben/cds/2015/00000010/0000001/art00006>.
- [48] Kurosky, Samantha K. *et al.* "Completion and compliance of childhood vaccinations in the United States." *Vaccine*, vol. 34, no. 3, January 2016, pp. 387-394. <https://www.sciencedirect.com/science/article/pii/S0264410X15016163>.
- [49] Chen, Feifan *et al.* "Parents' and guardians' willingness to vaccinate their children against COVID-19: a systematic review and meta-analysis." *Vaccines*, vol. 10, no. 2, January 2022. <https://www.mdpi.com/2076-393X/10/2/179>.
- [50] Ali, Mohammad *et al.* "Parental coronavirus disease vaccine hesitancy for children in Bangladesh: a cross-sectional study." *F1000 Research*, vol. 11, March 2022. <https://pmc.ncbi.nlm.nih.gov/articles/PMC8837808/>.
- [51] Zhang, Ke Chun *et al.* "Parental acceptability of COVID-19 vaccination for children under the age of 18 years: cross-sectional online survey." *JMIR Pediatrics and Parenting*, vol. 3, no. 2, December 2020. <https://pediatrics.jmir.org/2020/2/e24827/>.
- [52] Shati, Ayed A. *et al.* "Perceptions of parents towards COVID-19 vaccination in children, Aseer Region, Southwestern Saudi Arabia." *Vaccines*, vol. 10, no. 8, July 2022. <https://www.mdpi.com/2076-393X/10/8/1222>.
- [53] Chen, Weiwei *et al.* "Employment and socioeconomic factors associated with children's up-to-date vaccination status." *Clinical Pediatrics*, vol. 56, no. 4, July 2022, pp. 348-356. <https://journals.sagepub.com/doi/abs/10.1177/0009922816660540>.
- [54] Stockwell, Melissa S. *et al.* "How parents' negative experiences at immunization visits affect child immunization status in a community in New York City." *Public Health Reports*, vol. 126, no. 2, July 2021, pp. 24-32. <https://journals.sagepub.com/doi/abs/10.1177/00333549111260S204>.
- [55] West, Heidi *et al.* "COVID-19 vaccine hesitancy among temporary foreign workers from Bangladesh." *Health Systems & Reform*, vol. 7, no. 1, November 2021. <https://www.tandfonline.com/doi/full/10.1080/23288604.2021.1991550>.
- [56] Aw, Junjie *et al.* "COVID-19 vaccine hesitancy—A scoping review of literature in high-income countries." *Vaccines*, vol. 9, no. 8, August 2021. <https://www.mdpi.com/2076-393X/9/8/900>.
- [57] Goldman, Ran D. *et al.* "National COVID-19 vaccine program progress and parents' willingness to vaccinate their children." *Human Vaccines & Immunotherapeutics*, vol. 17, no. 12, November 2021, pp. 4889-4895. <https://www.tandfonline.com/doi/full/10.1080/21645515.2021.1999144>.