



## Vaccine hesitancy in adolescents regarding COVID-19 vaccination: A literature review

Meita Dhamayanti<sup>a,\*</sup>, Rita Andriyani<sup>a</sup>, Shycha Moenardi<sup>a</sup>, Permata Putri Karina<sup>b</sup>

<sup>a</sup> Department of Child Health, Hasan Sadikin Hospital, Faculty of Medicine, Universitas Padjadjaran, Jalan Pasteur No. 38, Bandung 40161, Indonesia

<sup>b</sup> Health and Social Behavior, Social Medicine, School of Public Health, The University of Tokyo, Japan

### ARTICLE INFO

**Keywords:**  
Adolescents  
Vaccine hesitancy  
COVID-19

### ABSTRACT

**Background:** Previous reviews on the cause of vaccine hesitancy (VH) have not included vaccine hesitancy related to the COVID-19 vaccination in adolescents, which is necessary for minimizing disruptions to education and the maintenance of their overall well-being, health, and safety. This review aims to provide an overview of vaccine-hesitant perspectives on the COVID-19 vaccination in adolescents and the factors that influence them. **Methods:** This review followed the Systematic Reviews and Meta-Analysis for Literature Review (PRISMA). Searches were carried out in the PubMed, Science Direct, and Google Scholar databases. Following data extraction, a thematic analysis of vaccine hesitancy in adolescents regarding COVID-19 vaccines was conducted. **Results:** Seven articles were included. Nine areas were identified as factors influencing vaccine hesitancy, namely gender identity, parental roles, vaccine safety and effectiveness, perceptions of COVID-19 as a disease, medical professionals' recommendations, health behavior, vaccination experience, adolescent ignorance, and religious concerns. Our findings suggest that the scientific knowledge of vaccines and the size of clinical trials during their development reduce vaccine hesitancy. **Conclusion:** Our findings build on those of previous research to suggest specific information that may help address vaccine hesitancy among adolescents.

### Introduction

The rate of infection of the SARS-CoV-2 virus in children and adolescents is lower and generally milder than in adults [1]. Throughout the pandemic, the emergence of various variants of SARS-CoV-2, the introduction of face-to-face learning, and the high number of family cluster cases, resulted in the confirmed cases of COVID-19 in children accounting for only 13.7 % of total confirmed cases of COVID-19 in Indonesia up to August 17, 2022. Child mortality from COVID-19 continues to rise, accounting for around 1.2 % of all COVID-19 death [2].

Mass vaccination against COVID-19 to achieve herd immunity, including in the adolescent population, is an option for overcoming the pandemic [3]. Some individuals were fully vaccinated without any doubts (complete acceptance), whereas others refused vaccination without exception (refusal with no doubts). The individuals who do not belong to either of these groups display vaccination hesitancy (VH), and this third group is estimated to be larger than the other two [4–6]. Vaccine hesitancy is defined by the Strategic Advisory Group of Experts (SAGE) Working Group of Vaccine Hesitancy as the delayed acceptance or refusal of vaccination, regardless of the availability of vaccination

services [4,6–8]. Vaccine hesitancy threatens to reverse progress made in tackling vaccine-preventable diseases. The reasons why people choose not to vaccinate are complex and understanding the problem is crucial for public health. In fact, vaccine hesitation is one of the ten health problems to which the WHO pays attention [9].

VH issues related to the COVID-19 vaccination have been widely reported across the world. Several studies of adults over 18 found that 24 to 42.4 % were hesitant or unsure about obtaining the COVID-19 vaccination. In Canada, as many as 26 % of residents over the age of 18 were vaccine hesitant [3]. Another study of parents/caregivers found that 33 % did not intend to give the COVID-19 vaccination to their children [10].

Concerns about immunization are not limited to the issue of vaccinations but have also been connected to individual and social problems [11]. The VH group is considered to have a greater willingness to adopt behavioral changes related to immunization, and intervention in vaccine misconceptions is expected to be easier in this group [5]. The majority of the existing literature focuses on adults. However, adolescents that are also included in the VH group need attention.. Because adolescents are more likely than adults to acquire information and adjust

\* Corresponding author.

E-mail address: [meita.dhamayanti@unpad.ac.id](mailto:meita.dhamayanti@unpad.ac.id) (M. Dhamayanti).

<https://doi.org/10.1016/j.jvacx.2024.100477>

Received 12 February 2023; Received in revised form 30 January 2024; Accepted 18 March 2024

Available online 19 March 2024

2590-1362/© 2024 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).

their vaccination behavior, early intervention measures for VH, such as in the case of the COVID-19 vaccine, are expected to be more effective [7]. Since World Health Organization (WHO) and many research gives some consideration to vaccinating adolescents [12–16], this literature review aims to provide an overview of the situation of VH in adolescents towards COVID-19 vaccination. Furthermore, it is expected to answer pertinent questions concerning adolescent perspectives on the COVID-19 vaccination and the factors that influence them.

## Materials and methods

The literature review was carried out by collecting keywords for an article search and exploring academic search engine repositories within the specified literature of the study. Furthermore, the authors collected the information and analyzed the selected articles. This literature review follows the JBI methodology, using the Preferred Reporting Items for Systematic Review checklist guidelines and the Meta-Analysis Extension for Literature Review (PRISMA) as writing guidelines [17].

### Research methodology

Article searches were conducted in three databases: PubMed, Science Direct, and Google Scholar. The keywords were based on the PICO model, which includes: P (patient/population): adolescent aged 12 to 18; I (intervention/indicator): receiving the COVID-19 vaccination; C (comparator/control): unwillingness to receive the COVID-19 vaccination; O (outcome): adolescent VH perceptions about the COVID-19 vaccination. Keywords used by the author were (“ADOLESCENT”) AND (“VACCINE HESITANCY” “VACCINE ACCEPTANCE” “VACCINE REFUSAL” OR “VACCINE BEHAVIOUR”) AND (“COVID-19” OR “COVID-19 VACCINATION”).

### Inclusion and exclusion criteria

The search was limited to articles published in the last two years (August 2020–October 2022), written in English, and involving adolescent subjects aged 12–18 years. This literature review excluded articles in the form of abstracts from national and international conferences, guidelines, case reports, comments, editorials, and articles.

### Data screening

After identifying all articles that fulfilled the requirements using the chosen keywords, a title screening was conducted, followed by an abstract review. The screening process was divided into two stages. The first step was completed by 3 authors (RA, SM and PPK) who selected articles that fulfilled the criteria. Moreover, the screening outcomes were assessed and discussed with the primary researcher (MD).

### Data extraction

The data were extracted in Excel form to collect the information required in this research article. The data obtained from each article assessed include the study’s location, the characteristics of the adolescents studied (number, age), the instruments applied, the factors that influence the uncertainty or rejection of the COVID-19 vaccine in adolescents, and the final results of each study.

## Results

### Search result

The search resulted in 2561 articles from Google Scholar, 168 from PubMed, and 153 from Science Direct. After excluding articles with duplicate titles, a total of 2462 articles were collected. After screening the article titles and abstracts, 21 articles were initially retrieved, and

then 14 entire texts that fulfilled the requirements were selected after a complete article analysis (two journals were not research articles, one journal did not contain the required data, and eleven journals had samples that did not comply with the population requirements).

Ultimately, seven articles fulfilled the criteria were selected and included in this literature review. All seven articles used a cross-sectional design study. Six studies presented quantitative results. The seven papers in question also included research with multiple data outcomes and quantitative and qualitative data on VH concerning COVID-19 vaccination in adolescents. Moreover, some of the studies used self-administered questionnaires to identify VH or measure adolescents’ willingness to receive the COVID-19 vaccination. This literature review follows the JBI methodology, using the Preferred Reporting Items for Systematic Review checklist guidelines and the Meta-Analysis Extension for Literature Review (PRISMA) as writing guidelines (see Fig. 1).

Finally, 7 articles fulfilled the criteria were selected and included in this literature review. All of seven articles were using a cross-sectional design study.

### Research characteristics

A detail of included seven journal articles in this systematic review is shown in Table 1. Four studies were conducted in Asian countries, namely Korea [18], China [19], Hong Kong [20], and Israel [21], and the two remaining studies were carried out in Europe, specifically England [22] and Sweden [23], and in sub-Saharan Africa [24]. All of the studies aimed at identifying adolescent hesitancy regarding the COVID-19 vaccination.

### Research sample characteristics

The seven research samples involved adolescents aged between 12 and 18 years. The study by Lee et al. included parents as well as adolescents; however, we only reviewed the data taken from the adolescent subjects [18]. The percentages of different gender identity in the seven studies were not significantly different. In the study by Rehati et al., the number of male and female adolescents was the same [19]; however, in the study by Wong et al., there were more men than women [20]. In the other four studies, female adolescents dominated. Fazel et al. [22] included not only adolescents identifying as male and female but also other genders (comprising 5 % of participants).

### Quality assessment

A quality assessment was carried out on the seven articles reviewed. The quality assessment results can be seen in Table 2. The assessment results show that the seven articles are “excellent” (satisfying studies for at least 75 % of the quality criteria).

### Vaccine hesitancy definition

There are several differences in the definitions of VH across the studied articles. Rehati et al. described VH as adolescents’ unwillingness to receive the COVID-19 vaccination, whereas vaccine resistance was defined as the refusal to be vaccinated against COVID-19 (VR) [19]. However, Lee et al. categorized adolescent acceptance/resistance of the COVID-19 vaccination in the forms of “pleased”, “undecided”, “maybe interested”, and “not interested” [18]. Wang et al. defined vaccine hesitancy as the dichotomous outcome of definitely not wanting to be vaccinated or being unsure [21]. Table 3 describes the definition of VH in each journal article and the instruments used. From the seven studies obtained, the percentage of VH or concerns about the COVID-19 vaccination ranged mainly from 4 to 61 % (4 % in Lee et al. [18], 27.5 % in Meydan et al. [21], 31.6 % in Rehati et al. [19], 45.7 % in Nilsson et al. [23], 49.9 % in Fazel et al. [22], and 61 % in Wong et al. [20]) but also included 88 % in Wang et al. [24].

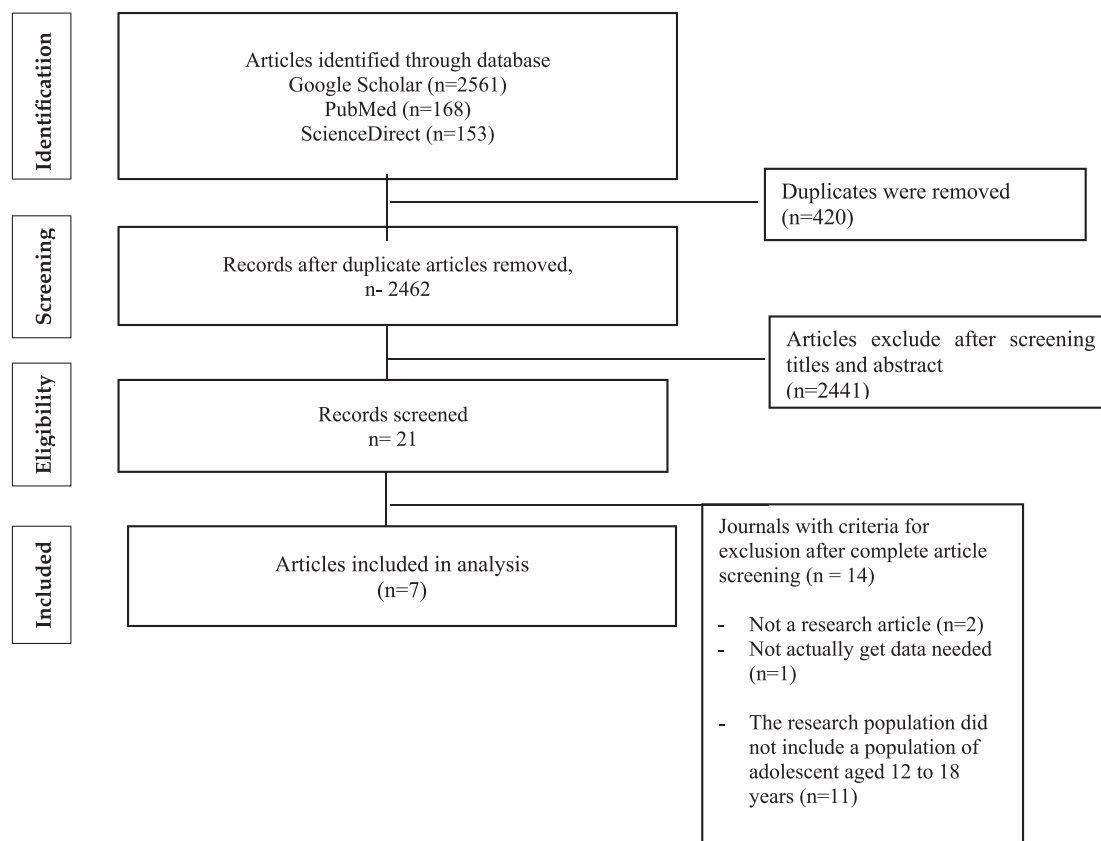


Fig. 1. PRISMA flowchart of the selection process [17].

### Factor affecting perspective of vaccine hesitancy

#### Gender identity

VH regarding the COVID-19 vaccination was influenced by adolescent gender in the selected studies. According to Rehati et al., adolescent females were more reluctant to receive the COVID-19 vaccine than males (OR = 1.21; 95 % CI 1.09–1.36; p 0.001) [19]. Similarly, according to Wang et al., when compared to girls, boys had an 8 % lower prevalence of vaccine hesitancy (aPR: 0.92; 95 % CI: 0.86, 0.99) [18]. Other studies have found no evidence about this.

#### Parental role

The role of parents in vaccine decision making for adolescents can be seen in Rehati et al., where adolescents who attend boarding schools are less likely to engage in VH than adolescents who live with their parents (OR = 0.79; 95 % CI 0.68–0.92; p = 0.003) [19]. Accordingly, Maydan et al. showed that the decision to refuse the COVID-19 vaccination in 28 % of adolescents was the decision of the parents [21]. Wong et al. demonstrated that having one or more parents who received the COVID-19 vaccination was positively related to adolescents receiving the vaccine (OR = 5.022; 95 % CI 4.211–5.989; p 0.001) [20]. Thus, parental or familial will was the second most common driver regarding vaccination status [24].

#### Vaccine safety and efficacy

Almost all studies show that adolescents' vaccine perceptions and knowledge influence their acceptance of the COVID-19 vaccine. Rehati et al. demonstrated that the more adolescents trusted in the efficiency of the COVID-19 vaccine, the lower the probability of refusal (OR = 0.66; 95 % CI 0.52–0.83; p 0.001) and vaccine uncertainty (OR = 0.84; 95 % CI 0.72–0.98; p = 0.027) [19]. Meydan et al. also found that 34.1 % of subjects who refused the COVID-19 vaccination still doubted the vaccine's efficiency. One of the factors influencing adolescents' refusal to be

vaccinated is a focus on vaccine safety issues [21]. Wong et al. found that 79 % of the participants who did not plan to receive the COVID-19 vaccine had doubts about the safety of the vaccine [20]. Meydan et al. showed that 51.2 % of subjects who refused the COVID-19 vaccine doubted the effectiveness of the vaccine, and as many as 82.9 % of subjects who refused the COVID-19 vaccine also said they did not know enough about the long-term side effects of the COVID-19 vaccine [21]. According to Lee et al., adolescents who were aware of or had received sufficient information concerning vaccine safety (OR = 4.09; 95 % CI = 3.96–4.22; p 0.001), vaccine effectiveness (OR = 2.24; 95 % CI = 2.17–2.32; p 0.001), and the risks and benefits of vaccines (OR = 1.75; 95 % CI = 1.72–1.78; p 0.001) were more likely to accept the COVID-19 vaccine [18]. According to Wang et al., a perceived lack of safety and a perceived lack of effectiveness strongly predict greater vaccine hesitancy [24].

#### Perceptions of COVID-19 as a disease

The awareness and perception of COVID-19 plays a role as a VH factor in adolescents (OR = 0.96; 95 % CI 0.95–1.98; p 0.001) [18]. Adolescents who were not concerned about COVID-19 or thought that COVID-19 was not a problem for them were more likely to experience VH, as seen from results (OR = 1.72; 95 % CI 1.50–1.97; p 0.001) [19]. Adolescents who were still uncertain regarding the vaccination desired to know more about COVID-19; however, Nilsson et al. claim this is not a group that needs the COVID-19 vaccination [23].

#### Medical professionals' recommendations

Adolescents pay attention to the effectiveness of vaccines when deciding whether they are willing to receive the COVID-19 vaccine. Rehati et al. showed that the comfort of the vaccination procedure (OR = 0.84; 95 % CI = 0.73–0.96; p = 0.011) and a doctor's recommendation of vaccination (OR = 0.86; 95 % CI = 0.76–0.98; p = 0.025) were able to reduce VH rates in adolescents [19]. Healthcare providers are

**Table 1**  
Details of included studies.

| Authors, Year         | Title   | Method, time and location of study  | Characteristic of subject/population                                    | Instrument of Vaccine Hesitancy screening                        | Result   | Conclusion/Opinion   |
|-----------------------|---|---|---|--|--|--|
| Fazel et al. (2021)   | <i>The willingness of children and adolescents to have a COVID-19 vaccination: Results of a large whole schools survey in England</i> <sup>15</sup>   | Cross sectional<br>14th May to 21st July 2021<br>England (United Kingdom) | 27,910 adolescents aged 12–18 years                                     | <i>Oxford COVID-19 Vaccine Hesitancy Scale filled out online</i> | <ul style="list-style-type: none"> <li>– 49.9% of adolescents showed a VH attitude</li> <li>– 37% doubtful</li> <li>– 12.9% chose not to register to receive the COVID-19 vaccine</li> </ul>   | Vaccine hesitant had greater indicators of social deprivation and felt a lack of community cohesion by not feeling a sense of belonging at their school                    |
| Nilsson et al. (2021) | <i>To be or not to be vaccinated against COVID-19 – The adolescents' perspective – A mixed-methods study in Sweden</i> <sup>17</sup>                  | 7 July to 8 November 2020.  | 702 adolescents aged 15–19 years  | Questionnaire online or offline                                  | Adolescent had not yet decided about getting a COVID-19 (30.5%: n = 214) 54.3% (n = 381) of the adolescents were willing to be vaccinated  | Participants felt they did not know enough about it  |
| Rehati et al, (2022)  | <i>COVID-19 Vaccine Hesitancy among Adolescents: Cross-Sectional School Survey in Four Chinese Cities Prior to Vaccine Availability</i> <sup>13</sup> | Cross sectional<br>8 to 30 December 2020<br>China                         | 9153 adolescents aged 12–17.5 years (mean age 14.2 years)               | Questionnaire was filled out online                              | <ul style="list-style-type: none"> <li>– 765 (8.4%) are not willing to get the COVID-19 vaccination (resistant),</li> <li>– 2891 (31.6%) are unsure about the COVID-19 vaccination</li> <li>– 5497 (60%) are willing to receive the COVID-19 vaccination</li> </ul>  | VH adolescents was associated with limited health literacy and lower risk perception   |
| Lee, et al, (2022)    | <i>Attitude and Acceptance of COVID-19 Vaccine in Parents and Adolescents: A Nationwide Survey</i> <sup>12</sup>                                      | Cross sectional<br>June 29 to July 8, 2021<br>Korea                       | 272,914 adolescents aged 12–17 years and 272,914 parents of adolescents | Questionnaire that filled out online                             | <ul style="list-style-type: none"> <li>- 69.1% of adolescents willingness to get the COVID-19 vaccine</li> <li>- 62% refused (48.9% not willing and 13.1% were very unwillingness),</li> <li>- 4% are unsure of their availability</li> </ul>  | Awareness and knowledge regarding the COVID-19 vaccine are associated with a reduced risk of VH in adolescent  |
| Wong et al. (2022)    | <i>Adolescents' attitudes to the COVID-19 vaccination</i> <sup>14</sup>   | Cross sectional<br>June 2021<br>Hong Kong                                 | 2609 adolescents aged 12–18 years (median age 14 years)                 | Questionnaire e filled out online                                | <ul style="list-style-type: none"> <li>– 39% adolescents are willing to get the COVID-19 vaccine.</li> <li>– adolescents were not willing to get a COVID-19 vaccine:</li> <li>• 79% concern about vaccine safety,</li> <li>• 52% about vaccine effectiveness, and</li> <li>• 26% the use of masks and the application of social distancing were sufficient</li> </ul>  | adolescents the vaccine hesitancy model is prominent with adolescents' intentions highly related to confidence in the vaccine and perception of disease risk               |
| Meydan et al. (2022)  | <i>COVID-19 Among Youth in Israel: Correlates of Decisions to Vaccinate and Reasons for Refusal</i> <sup>16</sup>                                     | Cross sectional<br>May to June 2021<br>Israel                             | 150 adolescents aged 12–18 years  | Questionnaire was filled out online                              | <ul style="list-style-type: none"> <li>– Decision not to/get the COVID-19 vaccine:</li> <li>• 17.8% personal decision</li> <li>• 65.7% joint decision youth and parents</li> <li>• 16.4% parental decision only</li> <li>– vaccination rate was related to the status of both parents having received the COVID-19 vaccine</li> <li>– the use of social media</li> <li>– the high concern about the side effects of the vaccine.</li> <li>– mistrust some youth have toward the drug companies (56.1%) and the government (41.5%)</li> </ul> | Variety of reasons why youth and families may be reluctant to get the COVID-19 vaccine   |
| Wang et al. (2022)    | <i>COVID-19 vaccine hesitancy and its determinants among sub-Saharan African adolescents</i>  | July to December 2021   | 2662 adolescents were interviewed                                       | Computer-assisted telephone interviewing among adolescents       | <ul style="list-style-type: none"> <li>– Adolescents with COVID-19 vaccine hesitancy is high across areas, ranging from 14% in Kersa to 88% in Dodoma</li> <li>– Over 40% of adolescents consider religious bodies or leaders a trusted source</li> </ul>  | Individual characteristics that potentially increase vaccine hesitancy are female sex, perceived lack of safety, and perceived lack of effectiveness of COVID-19 vaccines. |

(continued on next page)

**Table 1** (continued)

| Authors, Year | Title | Method, time and location of study | Characteristic of subject/population | Instrument of Vaccine Hesitancy screening | Result   | Conclusion/Opinion |
|---------------|-------|------------------------------------|--------------------------------------|---|--|--------------------|
|               |       |                                    |                                      |   | of information on COVID-19 vaccines<br>– religious leaders affect COVID-19 vaccine willingness for over 20% of adolescents<br>– 15% or more of adolescents in all areas is affected by the vaccine’s country of origin |                    |

**Table 2**

Quality assessment of included studies using the AXIS quality assessment tool.

| Questions                                 | Fazel, et al. (2021) | Nilson, et al. (2021) | Rehati, et al (2022) | Lee, et al (2022) | Wong, et al. (2022) | Meydan, et al (2022) | Wang,et al. (2022) |
|---|----------------------|-----------------------|----------------------|-------------------|---------------------|----------------------|--------------------|
| <b>Preliminary Assessment</b>             |                      |                       |                      |                   |                     |                      |                    |
| 1. Research objectives                    | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| <b>Methods of Project Research</b>        |                      |                       |                      |                   |                     |                      |                    |
| 2. Research Design                        | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 3. Number of samples                      | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 4. Target Population                      | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 5. Sample frame                           | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 6. Subject selection process              | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 7. Non-respondent                         | Yes                  | Yes                   | Yes                  | No                | Yes                 | Yes                  | Yes                |
| 8. Risk factors and outcome variables     | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 9. Instruments                            | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 10. Statistical Significance              | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 11. Methods                               | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| <b>Analyze the Research Results</b>       |                      |                       |                      |                   |                     |                      |                    |
| 12. Basic data                            | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 13. Response rate                         | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 14. Non-respondent information            | Yes                  | Yes                   | No                   | No                | Yes                 | Yes                  | Yes                |
| 15. Results Consistency                   | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 16. Result Presentation                   | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| <b>Discussion of Research</b>             |                      |                       |                      |                   |                     |                      |                    |
| 17. Discussion and conclusion             | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 18. Research limitations                  | Yes                  | Yes                   | Yes                  | Yes               | No                  | Yes                  | Yes                |
| <b>Others</b>                             |                      |                       |                      |                   |                     |                      |                    |
| 19. Financing sources/conflict of concern | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | Yes                  | Yes                |
| 20. Ethics approval                       | Yes                  | Yes                   | Yes                  | Yes               | Yes                 | No                   | Yes                |

adolescents’ most trusted sources for information on COVID-19 vaccines [24].

**Health behaviour**

The findings of Fazel et al. demonstrated that adolescents’ behavior affected the VH status regarding the COVID-19 vaccine. Adolescents who smoke (OR = 1.56; 95 % CI 1.3–1.87; p 0.001), do not exercise regularly (OR = 1.31; 95 % CI 1.16–1.48; p 0.001), or spend more than four hours per day on social media (OR = 1.49; 95 % CI 1.36–1.63; p 0.001) are thought to be more vaccine-hesitant [22].

**Vaccination experience**

The results of the multivariate analysis related to vaccination experience factors by Rehati et al. showed that never having received the influenza vaccination was associated with rejection (OR = 1.57; 95 % CI 1.25–1.98; p 0.001) and doubt about the COVID-19 vaccine (OR = 1.33; 95 % CI 1.14–1.55; p 0.0011) [19]. In addition, the study by Wong et al.

supported that having received the influenza vaccination in the past was a factor that increased the acceptance of the COVID-19 vaccine in adolescents (OR = 1.642; 95 % CI 1.355–1.988; p 0.001), and Lee et al. also stated that recent vaccination history was positively associated with receiving the COVID-19 vaccine in adolescents (OR = 1.25; 95 % CI 1.19–1.32; p 0.001) [18,20].

**Adolescent ignorance**

Among the 41 adolescent participants who refused the COVID-19 vaccination, there were some who displayed trust issues toward the COVID-19 vaccine manufacturers (56.1 %) as well as the local government who suggested or required COVID-19 vaccination for adolescents (41.5 %) [21].

**Religious concerns**

Only one study out of the six included religious concerns as a factor for adolescents refusing the COVID-19 vaccination, where 2.4 % of 41

**Table 3**

Definition of VH and instruments used for each journal article.

| Authors (year)                      | Vaccine hesitancy in a study is defined as  | Instruments used and questionnaire format (In addition questions on social/ demographic characteristics)  |
|-------------------------------------|---|---|
| Rehati et al. (2022) <sup>13</sup>  | VH is defined as an adolescent's inability to receive the COVID-19 vaccine. Vaccine resistance (VR) is a rejection of the COVID-19 vaccination. | - I will get the COVID-19 vaccine (Agree, not sure, disagree)- The main concerns that influence the decision on willingness to vaccinate against COVID-19 (safety, effectiveness, price, convenience, doctor's recommendation; answered using a 5-point Likert scale)   |
| Lee et al. (2022) <sup>12</sup>     | VH is defined as non-acceptance of receiving the COVID-19 vaccine   | - Are you willing to get the COVID-19 vaccine when it becomes available? (Definitely, Probably, Unlikely, Very Unlikely, Unsure)- Reasons for receiving the COVID-19 vaccine (answered using a 5-point Likert scale)  |
| Wong et al. (2022) <sup>14</sup>    | VH is defined as an unwillingness to receive a COVID-19 vaccine when it is available.   | - Are you willing to get the COVID-19 vaccine when it becomes available? (Yes/No)- Reasons for refusing the COVID-19 vaccine (concerned about the safety and efficacy of the vaccine, considering masks and social distancing to be sufficient)- Reasons for getting the COVID-19 vaccination (fear of infection, to protect family, return to normal conditions as before the pandemic)  |
| Fazel et al. (2021) <sup>15</sup>   | VH is defined as an opt-out or undecided option in answer to a willingness to get a COVID-19 vaccination when it was available.                 | - Are you willing to get the COVID-19 vaccine when it becomes available? (Oxford COVID-19 Vaccine Hesitancy Scale: Eager, Willing (opt-in); Not bothered, Don't know (undecided); Unwilling, Anti-vaccination (opt-out))<br>- History of being infected with COVID-19<br>- Health behavior (exercise habits, smoking, and use of social media)  |
| Meydan et al. (2022) <sup>16</sup>  | <b>Not identifying VH, but explaining why adolescents do not receive the COVID-19 vaccination</b>   | - Have adolescents already been vaccinated for COVID-19?- If not, answer the reasons for not receiving the vaccine (don't know the side effects, don't trust the manufacturer, COVID-19 is not a dangerous disease, don't believe in vaccine safety, reject chemicals in the body, don't trust the government, don't trust the effectiveness of vaccines, refuse to get vaccinated because someone else vaccinated, have gained immunity from COVID-19 infection, most friends are not vaccinated, religious reasons, etc.)COVID-19 vaccination decision-making (own decision, parental decision, joint decision) |
| Nilsson et al. (2021) <sup>17</sup> | VH is defined as unwillingness and hesitation to receive a COVID-19 vaccine when it becomes available   | <i>Open-ended questions (qualitative analysis)</i><br>- Thoughts on vaccination for COVID-19Question (quantitative analysis)<br>- Are you willing to get the COVID-19 vaccine when it   |

**Table 3 (continued)**

| Authors (year)                   | Vaccine hesitancy in a study is defined as  | Instruments used and questionnaire format (In addition questions on social/ demographic characteristics)  |
|----------------------------------|---|---|
| Wang et al. (2022) <sup>18</sup> | Vaccine hesitancy was defined as definitely not getting vaccinated or unsure/ undecided | becomes available?<br>- Socio-demographic characteristics, anxiety, social refraining behavior, history of cohabitation with COVID-19 sufferers.<br>How much do you agree with this statement? "If a vaccine for COVID-19 were available now, I would definitely get it."<br>Which of the following are reasons for why you would get the COVID-19 vaccine? If 6.1.2 = Yes, Maybe, or Unsure/ undecided, or if 6.1.1 = 1<br>Vaccine knowledge, attitudes, practices<br>COVID vaccine awareness and perception<br>Willingness to get the COVID vaccine<br>Information sources<br>Benefits and expectations of the vaccine campaign |

subjects refused the COVID-19 vaccine for religious reasons [21].

**Discussion**

This literature review analyses VH toward the COVID-19 vaccination and the factors that impact this perspective in adolescents. As was seen in the article search, most VH research focuses on adult and elderly patients. However, all studies describe VH as unwillingness or doubt regarding the COVID-19 vaccination, which can be divided into uncertainty (as VH) and refusal (as vaccine resistance, VR) [19]. The SAGE Working Group on Vaccine Hesitancy defines VH as a delay in accepting or refusing vaccination despite the availability of vaccination services; thus, those who refuse vaccines are also vaccine-hesitant [4].

The majority of journal studies used basic questions about adolescent knowledge of receiving the COVID-19 vaccination to determine whether or not each subject displayed VH. Vaccine hesitancy is a condition that can be quantified, and several instruments, such as the Parent Attitudes about Childhood Vaccination (PACV), the Vaccine Confidence Scale, the Global Vaccine Confidence Index, and the Vaccine Hesitancy Scale, may be used to measure and quantify VH in an individual. The study by Fazel et al. [22] used the Vaccine Hesitancy Scale questionnaire. At the time of writing, there was no standardized instrument or questionnaire for the detection of VH in the adolescent population [25].

Since the COVID-19 vaccination is new, adolescent acceptability may differ. In accordance with the lack of available data, concerns about vaccination safety and effectiveness are assumed to be factors that induce adolescents and adults to be hesitant about receiving the new vaccine [26]. Various factors that cause VH in adolescents were reviewed in seven journal articles [18–24]. Rehati et al. demonstrated that gender affects the willingness to accept the COVID-19 vaccine [19]. Female adolescents were more likely than male adolescents to have VH [19,24]. This is related to several other article results, including those involving adult/elderly populations, although the reasons remain unknown and may require more research. One of the reason female VH related to a fear of pain during injections, which may have led to higher doubt regarding vaccination among female adolescents [27].

Three studies (by Rehati et al. Meydan et al., and Wang et al.) showed the role of parents in adolescent vaccination decision making [19,21,24]. In some countries, including Israel, parental permission is

essential for adolescents to receive the COVID-19 vaccination, as Meydan et al. discovered [21]. This means that adolescents' acceptance of and VH toward the COVID-19 vaccine cannot be separated from their parents' vaccination views, such as VH, or their rejection of the COVID-19 vaccine. Adolescents should be involved in decision making. According to research on adolescents' willingness to receive the Human Papilloma Virus (HPV) vaccination, adolescents want to be involved in deciding HPV vaccine decisions with their parents or have the option to make their own decisions. The decision to receive the COVID-19 vaccination in boarding school students may be affected by teachers or may be influenced by vaccine regulations in their dormitories/schools [19,28]. Adolescents are more likely to acquire information regarding new vaccinations from school or the internet. These findings support the importance of school-based vaccination education programs, which include information about the advantages and potential risks of vaccines [27]. During the COVID-19 pandemic, all information about COVID-19 or the COVID-19 vaccine has been widely accessible on the internet. Unfortunately, this can be a two-edged sword, since a significant amount of disinformation about COVID-19 and the COVID-19 vaccination is also available [29]. This could explain the findings of the study by Fazel et al., which found that adolescents who spent more than four hours a day on social media had higher VH [22].

Vaccine safety is an important requirement that must be achieved before the vaccine is permitted for use. The COVID-19 vaccine research stage must confirm the safety of subjects who receive it, including dose certainty, particularly in children and adolescents [19]. Research conducted in Belgium found that a group of adolescents did not believe vaccination was a safe strategy to avoid sickness [27]. The safety and efficacy of the vaccination are known to be factors of VH in the adult population, therefore these two factors are presented in a different domain from the questions in one utilized questionnaire for detecting VH in the elderly [5]. Three of the selected studies (Fazel, Lee, and Rehati) emphasize the importance of inclusive and simple risk communication about vaccine content, potential vaccine side effects, and procedures (where and what the general public will be subjected to, as vaccine receivers, by the government, health authorities, and caregivers, as providers of COVID-19 vaccination services. Effective communication is critical for increasing student and public knowledge of vaccine safety and public trust in vaccination providers such as health care worker [21–30,31].

According to Rehati et al., adolescents who had previous vaccination experience were more likely to receive the COVID-19 vaccine and not become vaccine-hesitant [19]. These findings are consistent with those of previous adult population studies. A history of influenza vaccination relates to understanding the significance of the vaccination and being aware of the similar advantages that may be acquired through the COVID-19 vaccine [32].

Several factors, such as the influence of religious or cultural factors, received less attention in the six journal articles analyzed in this systematic review [21]. Only one of the seven research mentioned religious beliefs as a rationale for adolescents avoiding the COVID-19 vaccination. This might be because there was no religious/belief/cultural variety in any of the other studies and thus could not have provided diverse perspectives on the COVID-19 vaccination regarding that aspect.

Vaccine hesitancy's determinants vary widely in population heterogeneity, different subgroup populations, type of vaccine, and VH towards recommended vaccination as well as behaviors adopted in response to hesitancy itself [33–35].

As the limitation of this study, currently, studies regarding the Covid-19 vaccination among adolescent are still limited, since not all country in the world have policy to give this vaccine for adolescent. Furthermore, adolescents who have concerns regarding vaccine hesitant also limited, as well.

## Conclusion

The COVID-19 vaccine was implemented as a new vaccination program developed to counter the COVID-19 pandemic. Not all adolescents are willing to receive the COVID-19 vaccination, as there are still adolescents who have concerns about the COVID-19 vaccine. The rates of VH in adolescents in the seven articles reviewed ranged from 4 to 88 %. The various factors that induce VH in adolescents are nearly identical to those observed in adults or the elderly. There is currently no standardized test for detecting VH in adolescents. Since adolescent is a unique, specific characteristic developmental phase, further research is needed to find the factors that may induce VH in the adolescent demographic, particularly those that affect decision making, such as religious, belief, or cultural aspects.

## CRedit authorship contribution statement

**Meita Dhamayanti:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Rita Andriyani:** Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing – original draft. **Shycha Moenardi:** Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Visualization, Writing – original draft. **Permata Putri Karina:** Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data will be made available on request.

## Acknowledgments

The authors thank to Anindita Noviandhari MD for manuscript revision and language editing. This review was supported by the Grant of Universitas Padjadjaran, Indonesia.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jvacx.2024.100477>.

## References

- [1] deSouza TH, Nadal JA, Nogueira RJN, Pereira RM, Brandão MB. Clinical manifestations of children with COVID-19: a systematic review. *Pediatr Pulmonol* 2020;1–8.
- [2] Satuan Tugas Penanggulangan COVID-19. Peta Sebaran COVID-19. Jakarta. 2022 [Available from: <https://covid19.go.id/peta-sebaran>].
- [3] Afifi TO, Salmon S, Taillieu T, Stewart-Tufescu A, Fortier J, Driedger SM. Older adolescents and young adults' willingness to receive the COVID-19 vaccine: implications for informing public health strategies. *Vaccine* 2021;39:3473–9.
- [4] MacDonald NE. The SAGE working group on vaccine hesitancy. vaccine hesitancy: definition, literature and determinants. *Vaccine* 2015;33:4161–4.
- [5] Opel DJ, Mangione-Smith R, Taylora JA, Korfiatis C, Wieseb C, Catzb S, et al. Development of a survey to identify vaccine-hesitant parents. *Hum Vaccin Immunother* 2015;7(4):419–25.
- [6] Cadeddu C, Castagna C, Sapienza M, Lanza TE, Messina R, Chiavarini M, et al. Understanding the determinants of vaccine hesitancy and vaccine confidence among adolescents: a systematic review. *Hum Vaccin Immunother* 2021;17(11):4470–86.
- [7] Editorial. Vaccine hesitancy: generation at risk. *Lancet Child Adolesc. Health*. 2019;3:281.

- [8] Larson HJ, Jarrett C, Schulz WS, Chaudhuri M, Zhou Y, Dube E, et al. Measuring vaccine hesitancy: the development of a survey tool. *Vaccine* 2015;33(34):4165–75.
- [9] Friedrich M. WHO'S top health threats for 2019. *JAMA* 2019;321(11):1041. <https://doi.org/10.1001/jama.2019.1041>.
- [10] Goldman RD, Yan TD, Seiler M, Cotanda CP, Brown JC, Klein EJ, et al. Caregiver willingness to vaccinate their children against COVID-19: cross-sectional survey. *Vaccine* 2020;38(48):7668–73.
- [11] Arede M, Bravo-Araya M, Bouchard É, Gill GS, Plajer V, Shehraj A, et al. Combating vaccine hesitancy: teaching the next generation to navigate through the post truth era. *Front Public Health* 2019;6(381):1–6.
- [12] WHO SAGE roadmap for prioritizing uses of COVID-19 vaccines in the context of limited supply. Geneva: World Health Organization; 2020 [updated 16 JUL 2021]. Available from: <https://www.who.int/publications/i/item/who-sage-roadmap-for-prioritizing-uses-of-covid-19-vaccines-in-the-context-of-limited-supply> 16 JUL 2021.
- [13] Stefanizzi P, Bianchi FP, Martinelli A, Di Lorenzo A, De Petro P, Graziano G, et al. Safety profile of MenB-FHBp vaccine among adolescents: data from surveillance of Adverse Events Following Immunization in Puglia (Italy), 2018–2020. *Hum Vaccin Immunother* 2020;18:1, DOI: 10.1080/21645515.2022.2041359.
- [14] Hanson KE, Marin M, Daley MF, Groom HC, Jackson LA, Sy LS, et al. Safety of measles, mumps, and rubella vaccine in adolescents and adults in the vaccine safety datalink. *Vaccine: X* 2023;13(100268). <https://doi.org/10.1016/j.jvacx.2023.100268>.
- [15] Stefanizzi P, De Nitto, Patano SF, Bianchi FP, Ferorelli D, Stella P, et al. Post-marketing surveillance of adverse events following measles, mumps, rubella and varicella (MMRV) vaccine: retrospective study in apulia region (ITALY), 2009-2017. *Hum Vaccin Immunother*, 2020; 16(8):875–1883.
- [16] Yuxuan Du, Chen L, Shi Y. Safety, immunogenicity, and efficacy of COVID-19 vaccines in adolescents, children, and infants: a systematic review and meta-analysis. *Front Public Health* 2022;10:829176.
- [17] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *J Clin Epidemiol* 2021 Jun;134:178–89. <https://doi.org/10.1016/j.jclinepi.2021.03.001>.
- [18] Lee H, Choe YJ, Kim S, Cho H-K, Choi EH, Lee J, et al. Attitude and acceptance of COVID-19 vaccine in parents and adolescents: a Nationwide survey. *J Adolesc Health* 2022;71:164–71.
- [19] Rehati P, Amaerjiang N, Yang L, Xiao H, Li M, Zunong J, et al. COVID-19 vaccine hesitancy among adolescents: cross-sectional school survey in four Chinese cities prior to vaccine availability. *Vaccines* 2022;10(452):1–13.
- [20] Wong WHS, Leung D, Chua GT, Duque JSR, Peare S, So HK, et al. Adolescents' attitudes to the COVID-19 vaccination. *Vaccine* 2022;40:967–9.
- [21] Gewirtz-Meydan A, Mitchell K, Shlomo Y, Heller O, Grinstein-Weiss M. COVID-19 among youth in Israel: correlates of decisions to vaccinate and reasons for refusal. *J Adolesc Health* 2022;70:396–402.
- [22] Fazel M, Puntis S, White SR, Townsend A, Mansfield KL, Viner R, et al. Willingness of children and adolescents to have a COVID-19 vaccination: results of a large whole schools survey in England. *EclinicalMedicine* 2021;40(101144).
- [23] Nilsson S, Mattson J, Berghammer M, Brorsson AL, Forsner M, Nollbris MJ, et al. To be or not to be vaccinated against COVID-19 – the adolescents' perspective – a mixed-methods study in Sweden. *Vaccine* 2021;9(100117).
- [24] Wang D, Chukwu A, Mwanyika-Sando M, Abubakari SW, Assefa N, Madzorera I, et al. COVID-19 vaccine hesitancy and its determinants among sub-Saharan African adolescents. *PLOS Glob Public Health* 2022;2(10):e0000611.
- [25] Oduwole EO, Pienaar ED, Mahomed H, Wiysonge CS. Current tools available for investigating vaccine hesitancy: a literature review protocol. *BMJ Open* 2019;9:e033245.
- [26] Tu P, Kotarba M, Bier B, Clark R, Lin C. Internal and external motivations and risk perception toward COVID-19 vaccination in adolescents in the U.S. *Vaccine* 2022;10(697).
- [27] Wang B, Giles L, Afzali HHA, Clarke M, Ratcliffe J, Chen G, et al. Adolescent confidence in immunisation: assessing and comparing attitudes of adolescents and adults. *Vaccine* 2016;1–9.
- [28] Olusanya OA, Bednarczyk RA, Davis RL, Shaban-Nejad A. Addressing parental vaccine hesitancy and other barriers to childhood/adolescent vaccination uptake during the coronavirus (COVID-19) pandemic. *Front Immunol* 2021;12(663074).
- [29] Puri N, Coomes EA, Haghbayan H, Gunaratn K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. *Hum Vaccin Immunother* 2020;16(11):2568–93.
- [30] Tomietto M, Simonetti V, Comparcini D, Stefanizzi P, Cicolini G. A large cross-sectional survey of COVID-19 vaccination willingness amongst healthcare students and professionals: Reveals generational patterns. *J Adv Nurs*. 2022 Sep;78(9):2894-2903. doi: 10.1111/jan.15222. Epub 2022 Mar 17. PMID: 35301774; PMCID: PMC9111790.
- [31] Elliott TR, Perrin PB, Powers MB, Jacobi KS, Warren AM. Predictors of vaccine hesitancy among health care workers during the COVID-19 pandemic. *Int J Environ Res Public Health* 2022;19:7123. <https://doi.org/10.3390/ijerph19127123>.
- [32] Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes toward a potential SARS CoV-2 vaccine: a survey of U.S. Adults *Ann Intern Med* 2020;173:964–73.
- [33] Stefanizzi P, Provenzano S, Santangelo OE, Dallagiaco G, Gianfredi V. Past and future influenza vaccine uptake motivation: a cross-sectional analysis among Italian health sciences students. *Vaccines* 2023;11:717. <https://doi.org/10.3390/vaccines11040717>.
- [34] Zhang D, Zhou W, Poon P-K-M, Kwok KO, Chui T-W-S, Hung PHY, et al. Vaccine resistance and hesitancy among older adults who live alone or only with an older partner in Community in the Early Stage of the fifth wave of COVID-19 in Hong Kong. *Vaccines* 2022;10:1118. <https://doi.org/10.3390/vaccines10071118>.
- [35] Bulusu A, Segarra C, Khayat L. Analysis of COVID-19 vaccine uptake among people with underlying chronic conditions in 2022: a cross-sectional study. *SSM Popul Health* 2023;22:101422. <https://doi.org/10.1016/j.ssmph.2023.101422>.