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ORIGINAL RESEARCH

Access to COVID-19 vaccines in Indonesia: A scoping review applying the Levesque framework

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ABSTRACT

Introduction: Access to vaccines has been the most effective means of reducing COVID-19-related severity and mortality. This scoping review explored factors related to the accessibility of COVID-19 vaccines among the Indonesian population using Levesque's framework of access to healthcare.

Methods: A systematic search was conducted across five databases using PRISMA guidelines for publications from 1 January 2019 until May 5, 2023. This yielded 89 studies that met the inclusion criteria and were analysed using NVivo-14.

Results: More than half of the studies were published in 2022 (n=58), with most studies using data collected in 2021 (n=55); this body of literature therefore reflects the early days of the pandemic and COVID-19 vaccine availability. The majority of identified studies employed a quantitative approach (n=74) and utilised online survey methods (n=50). A focus on user factors predominated over those focused-on health system issues. Personal factors, particularly trust, beliefs, and perceptions, were found to significantly influence vaccine acceptance. The halal status of vaccines and information from social media were crucial in shaping perceptions. Age, gender, education level, marital status, and occupation influenced access, along with COVID-19 factors such as comorbidity and prior infection. Finance-related issues, such as direct, indirect, and opportunity costs, were less studied.

Conclusion: Addressing user perceptions, leveraging social media, ensuring equitable access, and providing clear communication about vaccine halal status were crucial for improving COVID-19 vaccine access in Indonesia. Future research focusing on health system factors will provide a more comprehensive understanding of vaccine accessibility.

Keywords: Access, COVID-19, vaccines, Levesque, acceptability, Indonesia.

Abstract in Español at the end of the article

INTRODUCTION

COVID-19 vaccines have played a crucial role in the control of the pandemic. Despite initial hesitancy in their development and trials, it was estimated that 14.4 million lives were saved through availability of vaccines from December 2020 - December 2021 [1]. Significant efforts were made to overcome inequalities in access to the COVID-19 vaccines including the establishment of the COVAX Facility which aimed to pool funds and procure vaccines for the majority world. COVAX procured nearly 2 billion doses of vaccines on behalf of 146 countries and helped avert an estimated 2.7 million deaths [2]. Through the COVAX facility, Indonesia secured nearly 430 million doses of vaccines by early October 2021 and by December 2023, had administered almost 450 million doses. COVAX ended on 31 December 2023 [3].

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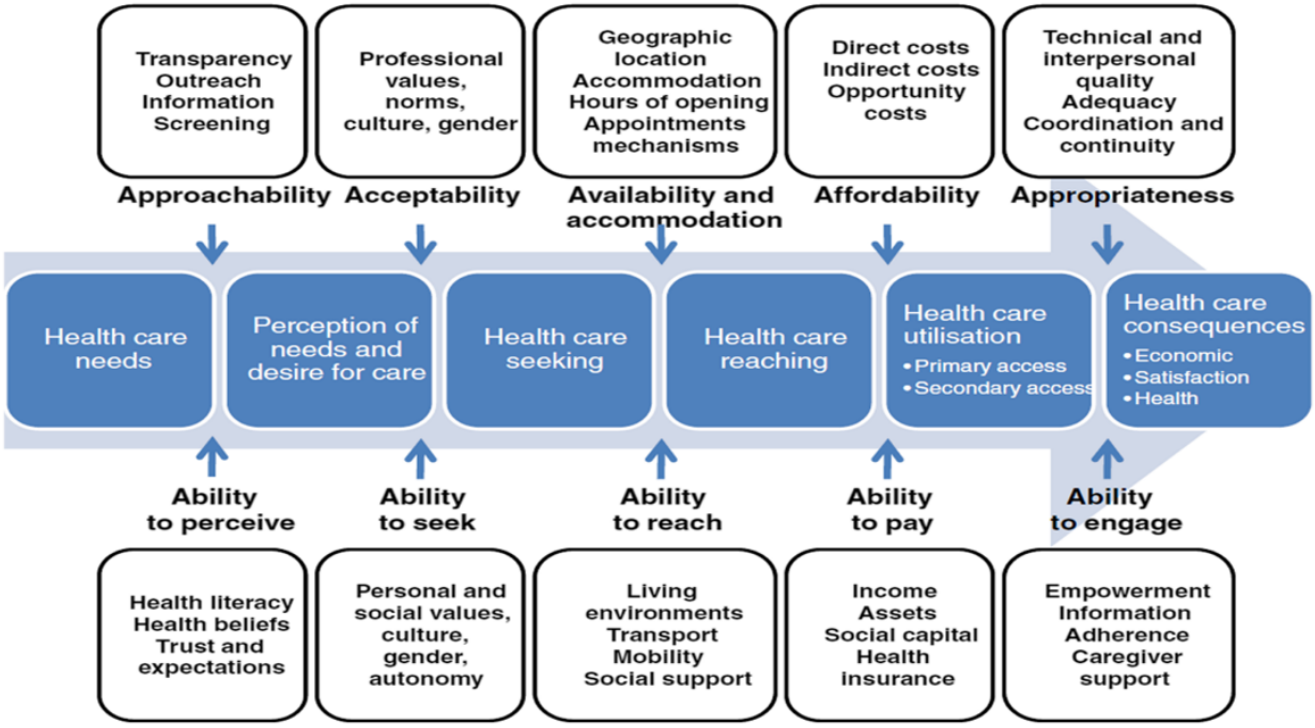

Figure 1. Levesque framework of access to healthcare [4].

Access is an important concept in health care and has been the subject of much theoretical and empirical work. Levesque's Framework of Access to Healthcare - developed through a review of prior models - provides additional nuance by considering the factors operating at individual and/or population levels, and those operating at system levels. The framework consolidates five users' abilities', and five service-side factors into pairs that are conceptualised as interacting to influence access at different points in the care continuum (Figure 1) [4]. While the service-side dimensions (represented at the top of the figure) primarily emphasise the factors controlled by policy makers, planners and providers in the health system, the user abilities (represented at the bottom of the figure) are associated with the community or users' capabilities, experiences and perspectives [4].

Rationale and objectives

Early willingness to accept COVID-19 vaccine varied across provinces in Indonesia, ranging from 74% in Papua Province to only 46% in Aceh Province [5]. One study conducted in March and April 2020 recorded a high rate of willingness to accept the vaccine among Indonesians (93.3%). However, in September 2020, a study conducted by the Ministry of Health (MoH) Indonesia found lower rates of acceptance (65%), along with considerable levels of hesitancy (27%) and 8% refusal [5, 6]. The national COVID-19 vaccination in Indonesia also demonstrated variation from the national coverage for the first dose which reached 86.88%, with DKI Jakarta achieving 134.21% of the target, while Papua province recorded the lowest coverage at 30.13% [7]. Indonesia has also faced significant challenges related to vaccine hesitancy, as reflected in the declining coverage of the national childhood immunisation program following the COVID-19 pandemic. This decline has contributed to several outbreaks of vaccine-preventable diseases: polio in Aceh Province in November 2022, diphtheria in West Java between 2023 and 2024, and most recently, measles in Sumenep, East Java in 2025, a region known for its strong Islamic traditions, resulting in the deaths of 20 children (https://kemkes.go.id/id/kematian-20-anak-jadi-ancaman-serius-pemerintah-dorong-imunisasi-massal-campak).

The acceptance of the COVID-19 vaccine has been analysed and documented in numerous studies on a global scale [8-11]. These responses were influenced by many factors, including sociodemographic aspects, personal and social values, perceptions of the safety and efficacy of vaccines, religious beliefs—especially concerning halal-haram status—as well as misinformation and conspiracy theories, leading to lower ability to seek for vaccine [10, 12-17]. Low education, perception of risk, distrust of government, concerns regarding potential side effects, belief in conspiracies, and misinformation were all associated with hesitancy [9, 11]. While there were some publications that shed light on vaccine acceptance issues in Indonesia, a more comprehensive focus on vaccine access issues including availability and affordability, has been rare. Therefore, a scoping review was conducted.

According to Moher (2015), a scoping review is a "species" that belongs to the "Family" of systematic reviews [18]. This scoping review formed one part of YY's PhD research which explores access to COVID-19 vac-

cines in Aceh, the only province in Indonesia that implements Islamic law. Like most scoping reviews, it sought to examine the breadth of existing literature to identify knowledge gaps and suggest directions for future research [19]. The review aimed to explore factors influencing vaccine access in Indonesia and applied the Levesque Framework to organise findings, focusing on both user-related and health system-related dimensions. The findings provided valuable insights that informed data structuring and analysis in the subsequent stages of the research.

To our knowledge the Levesque framework has not been applied to COVID-19 vaccination research; the framework most used in this context has been the WHO's Behavioral and Social Drivers (BeSD) guideline [20]. However, the Levesque Framework was selected over other available frameworks as it is recognised as providing a valuable framework for assessing the issue of "access" to health care services and technologies [4] due to its comprehensive approach, which considers both demand-side and supply-side dimensions. This dual perspective ensures attention to both users or communities as well as the health system factors likely to impact vaccinations. An analysis of Levesque's framework, performed by Cu et al in 2021, involving a review of 31 studies across a range of healthcare and treatment issues found that the framework was comprehensive, considering perspectives from both users and the providers and health system [21].

METHODS

A review protocol was developed and is reported here according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [22, 23]. Since the findings of the review were intended for structuring primary data collection for a vaccination study in Aceh Province, a broad understanding of access comprising both client and health system factors was required. This nuanced understanding was more appropriately built through a scoping review than other types of reviews. The results of the scoping review served as a foundation in developing research instruments for a mixed-methods study.

Table 1. Searching terms.

No	Groups	Keywords
1	Setting	Indonesia* OR Aceh OR Sumatera OR Sumatra OR Riau OR Jambi OR Bengkulu OR Lampung OR Bangka OR Belitung OR Jakarta OR Jawa OR Java OR Yogyakarta OR DIY OR Banten OR Bali OR Nusa Tenggara OR Kalimantan OR Borneo OR Sulawesi OR Gorontalo OR Maluku OR Papua
2	Vaccine	Vaccin* OR immune* OR vaksin* OR imun*
3	COVID-19	Covid* OR Coronavirus OR Cov OR Sars OR ncov
4	Final search terms	1 AND 2 AND 3

Five databases (Web of Science, Medline, Pubmed, Scopus and OVID) were searched for studies using three groups of keywords that were refined and tested before being finalised. To minimise the risk of missing relevant studies, terms specifically related to "access" were excluded, allowing for a broader initial search strategy. The final search terms are listed in Table 1.

The final search strategy was executed across five databases; references were exported to EndNote 21 and duplicates were removed. The final sample of papers (N=2577) were imported into Covidence for screening and review. Study inclusion and exclusion criteria are shown in Table 2.

Table 2. Inclusion and exclusion criteria for published studies to be included in the scoping review.

Inclusion Criteria	Exclusion Criteria
• Utilizing empirical data (either primary or secondary) gathered from the Indonesian population or data samples within Indonesia • Publication date: 1 January 2019 to 5 May 2023 • Containing data (qualitative or quantitative) on one or more factors related to access following Levesque's framework	• Non-empirical contributions • Conference abstracts and proceedings, editorial, commentary, systematic review, letters, books • Not mentioning Indonesian context • Not COVID-19 vaccine-related • No data on accessibility factors

The PRISMA-ScR diagram summarises the database search and selection approach (Figure 2).

During the initial title and abstract screening, AY and YY independently screened 50 references and discussed the results. Inclusion and exclusion criteria were then conveyed to and further discussed with ST and AZ, and all subsequent title and abstracts screened. Of all the studies at the title/abstract screening stage, 20% (N=2565, n=513) were screened by at least two authors (AY, YY, ST, AZ) and conflicts resolved. All studies included for full-text review (n=227) were screened by at least two authors (AY, YY, ST, AZ, MD), and conflicts resolved by consensus. YY reviewed all references at all stages, while the remaining authors (AY, ST, AZ, MD) were assigned different sequential sets of references. Any conflicts were resolved by a third author who had not previously reviewed the reference in question (AY, ST, or AZ).

A total of 89 studies matched the selection criteria and were extracted from Covidence and then exported to NVivo-14 for analysis. The use of NVivo-14 for analysis was considered appropriate, as the analytical approach in this scoping review was qualitative, combining inductive and deductive coding based on the Levesque domains. NVivo-14 enabled the flexible organisation of parent and child nodes into themes. The coding process was iterative and evolved throughout the analysis.

The studies were analysed in NVivo-14 by setting up deductive and inductive coding. Deductive coding was structured based on Levesque's framework of five types of abilities and five dimensions of access. Exploration of one or more framework factors was required for inclusion. All included studies were analysed in full, with a focus on the results section to identify factors in any domain. The findings of each study were categorised according to the codebook developed and presented in Table 3. Definitions of each domain were derived from publications utilising Levesque's framework and further developed based on the authors' interpretation and consensus. All other findings that did not align with the framework were grouped under inductive coding categories based on emerging themes. The process of categorisation involved multiple iterations to achieve the most appropriate coding classification.

RESULTS

General characteristics of included studies

Among 89 studies included, more than half (n=58) were published in 2022 and the majority used data collected in 2021 (n=55). Online surveys were the main data collection method, followed by offline surveys (n=50 and 21 studies respectively). The majority of studies (n=74) used a quantitative approach, while nine were qualitative, and five used mixed methods. In relation to the population group focus, more than half the studies (n=49) focused on the general adult population, followed by healthcare workers (n=9), and studies conducted among a specific patient group (n=4). Social media analysis was conducted in six studies.

Among the 89 studies there were eight multi-country studies that included Indonesia. The other 81 studies were focused on Indonesia and were conducted at national level (n=42) or at one or more sub-national levels. Twenty studies were conducted in the Java islands including Central Java Province, while the remainder were spread across other provinces in Sumatera and other islands including Bali, Sulawesi, Borneo and Papua. Some studies incorporated psychological theory such as the Health Belief Model or the Integrated Behavioural Model [24, 27-30].

Supplement 1 presents a summary of all demand- and supply-side domains based on the Levesque Framework. The domain "ability to perceive" was the most frequently explored in the reviewed literature, followed by acceptability, with 72 and 69 references respectively. In contrast, the least explored of Levesque's domains were all from the supply side—affordability (5 references), appropriateness (10), and approachability (11). The study by Duong [31] covered all ten domains while several other studies addressed only one or a few factors.

Table 3. Codebook: Operational definition for analysing factors of access to COVID-19 vaccination in Indonesia using Levesque framework.

Name	Description
A1. Ability to perceive	Identifies/Recognises the necessity of seeking health services and relates to individuals' health literacy, knowledge and beliefs with respect to health and sickness [4].
Health belief	Individual's perceived threat of sickness or disease (perceived susceptibility), belief of consequence (perceived severity), potential positive benefits of action (perceived benefits), perceived barriers to action, exposure to factors that prompt action (cues to action), and confidence in ability to succeed (self-efficacy). This includes anxiety or worry as the barrier (afraid of syringe, side effects, safety) [24].
Health literacy	Relates to knowledge of health information, including knowledge about vaccination program, conspiracy theory, halal-haram concept in vaccine context. It does not include educational level. Key words: Know and/or do not know.

Trust and expectation	Trust or distrust of government, healthcare provider and/or the vaccine itself (safety, efficacy, effectiveness). The expectation of what government or health providers do and the benefit of vaccine. This also includes trust and preference for natural immunity and expectation of time needed to get vaccination.
A2. Ability to seek	The ability to seek for vaccination which is influenced by: personal and social values, culture, gender, autonomy. to seek health services, such as autonomy and knowledge about health care.
Autonomy	The power or choice to decide whether or not to be vaccinated; includes the ability to measure personal health, personal confidence, and willingness to get vaccinated.
Culture	Cultural factors related to ability to seek, including faith/religion, politics and ethnicity and includes taboos or prohibitions that hinder an individual/community to seek vaccination.
Gender	Gendered influences on the ability to seek (and demand) vaccination.
Personal and social values	Positive side: principles to prioritise personal and family health, responsibility to protect others, the role in the community. The responsibility as a family member (having dependents) and includes eagerness to meet and gather with family.
A3. Ability to reach	Individual's ability to move and mobilise resources to enable someone to physically reach the vaccination services.
Living environment	The living location such as provinces or situation where the environment affects someone's ability to reach vaccination.
Mobility	How to reach the vaccination site, including difficulty such as physical impedance/disabilities.
Social support	Support from family, friends, colleagues, religious figures and community to help reach the vaccination site or to raise the willingness to get vaccinated. It includes occupational flexibility.
Transport	The transportation modes including the barrier in transportation or distance.
A4. Ability to pay	The personal capacity to cover the service costs or to generate economic resources without burden/catastrophic expenditure.
Assets	The financial or material resources owned by an individual that can potentially be used to pay for health services related cost, such as property, vehicles, savings, and investments.
Health insurance	National Insurance (BPJS Kesehatan) or private insurance.
Income	A gain or recurrent benefit usually measured in monetary terms that derives from capital or labour [25].
Social capital	Community's ability to mobilise resources and collaborate, community initiative to conduct vaccination. This includes government, NGOs or other institutions such as Faith Based Organisations (FBOs).
A5. Ability to engage	Personal communication and the individual ability to participate and share in informed decision-making.
Adherence	Willingness to follow the program as stated by the government, the vaccination schedule, and to follow health measures before and after vaccination.
Caregiver support	The availability of encouragement from family members, friends or health providers including having relationship with the medical sector/affiliation but not occupation.
Empowerment	Act to enhance someone or community power and control on their lives including by engaging with them, sharing knowledge and experiences.
Information	Information from media and people which included positive/promoting vaccination and negative ones such as hoaxes or antivax issues.
D1. Approachability	Health services discoverability: existence of vaccination services is apparent – relates to information, outreach activities and transparency.
Information	Information regarding available COVID-19 vaccine news, promotion and services from the government or health providers that influence its discoverability.
Outreach	Extending services or assistance beyond current or usual limits [26] or proactive effort to reach the community such as extension of public health centre, home visit or phone call reminder.
Screening	Checking some relevant conditions before continuing with the vaccination.
Transparency	The provision of clear information from both positive and negative aspects of vaccination such as safety, efficacy, side effects, and criteria.
D2. Acceptability	Acceptability of services: it relates to the adaptability of the services to an individual's culture and social determinants ensuring appropriate and equitable service provision.

Culture	Culture related to willingness or acceptance to COVID-19 vaccines. It includes religion, the taboos, prohibitions or local habits that lead to acceptance or hesitancy. In a culture prohibiting physical contact among genders will make the service less acceptable if the provider is from different gender.
Gender	Sex and gender differences of the community/patients/providers related to acceptance or hesitancy.
Norms	The norms related to standard regulation or attitude including conflict of interest and halal-haram status of vaccine.
Professional values	The conduct, aims, or qualities that characterise a professional. Professionals refer to healthcare providers, government and other related institutions. The ethical principles guide healthcare professionals' conduct, decision-making, and provision of care.
D3. Availability and Accommodation	The physical and timely reachability of the services and service providers, as well as the capacity to provide the services.
Accommodation	Including the physical facilities and non-tangible process to support vaccination.
Appointment mechanism	The modes/procedures of vaccination services: online booking or direct registration, only the mode.
Geographic location	Especially rural and urban criteria, east and western part of Indonesia and other relevant geographical situation that influences the provision of service.
Hours of opening	Adjusted to when and for how long the services are provided, how many days in a week, how many hours in a day.
D4. Affordability	The economic capacity for people to spend resources and time to use appropriate services. The direct and indirect costs of getting the services including the payment methods and resources.
Direct cost	The cost to pay vaccine if it is not free and to procure vaccine including buying, distribution, storage, and administration.
Indirect cost	The cost of treatment for side effects and other costs that are not directly related to the vaccination process (transportation, meals, childcare). This also includes intangible costs such as social and mental health effects.
Opportunity cost	Loss of income due to vaccination, including when become sick and cannot go to work after vaccination.
D5. Appropriateness	The fitting of the service to patient needs includes adequacy, quality and effectiveness of the services.
Adequacy	Relates to the appropriateness of services provided and the quality or way it is provided, including the appropriate schedule for vaccination. It also included the number of vaccines related to sufficiency.
Coordination and continuity	Coordination between providers including: the registration system, bureaucracy.
Technical and interpersonal quality	Technical quality: the proficiency of intervention such as the reliable guidelines and the accuracy in administering vaccine. Interpersonal quality: health providers' skill and ability in providing high quality of vaccination such as the communication process and empathy.

Supply and demand side of the Levesque framework domains

Approachability and ability to perceive

Approachability, defined in Table 3 as the 'discoverability' of vaccine and vaccine services by those in need, was examined in eight studies, focusing on information (n=5), transparency (n=3), screening (n=2), and outreach (n=1). Information on COVID-19 vaccine updates, promotion, and services from governmental entities or healthcare providers [32-34] and its transparency [35-37] were addressed in several studies and related to community perceptions. One study described how the vulnerable populations including the elderly and individuals with disabilities, derived benefit from a home-based outreach vaccination program known as the 'Picking Up the Ball' system [34]. No study specifically explored the relationship between disability status and approachability.

A majority of studies (n=72) explored the demand side factors associated with individual ability to perceive the necessity for vaccination including trust and expectations (n=50), health beliefs (n=49), and health literacy (n=36).

Thirty-one studies explored trust and expectations in relation to acceptance. The main trust-related issues were concerns about vaccine safety and efficacy which influenced acceptance to COVID-19 vaccination [38-46]. The level of community trust toward the government in handling COVID-19 and the influence of trust on willingness to be vaccinated were explored in several studies [40, 43, 45, 47]. Individuals' expectation or trust in natural immunity was also linked to reluctance to be vaccinated in several studies [38, 48-50]. Certain vaccine brands and country of origin influenced perceptions, with some

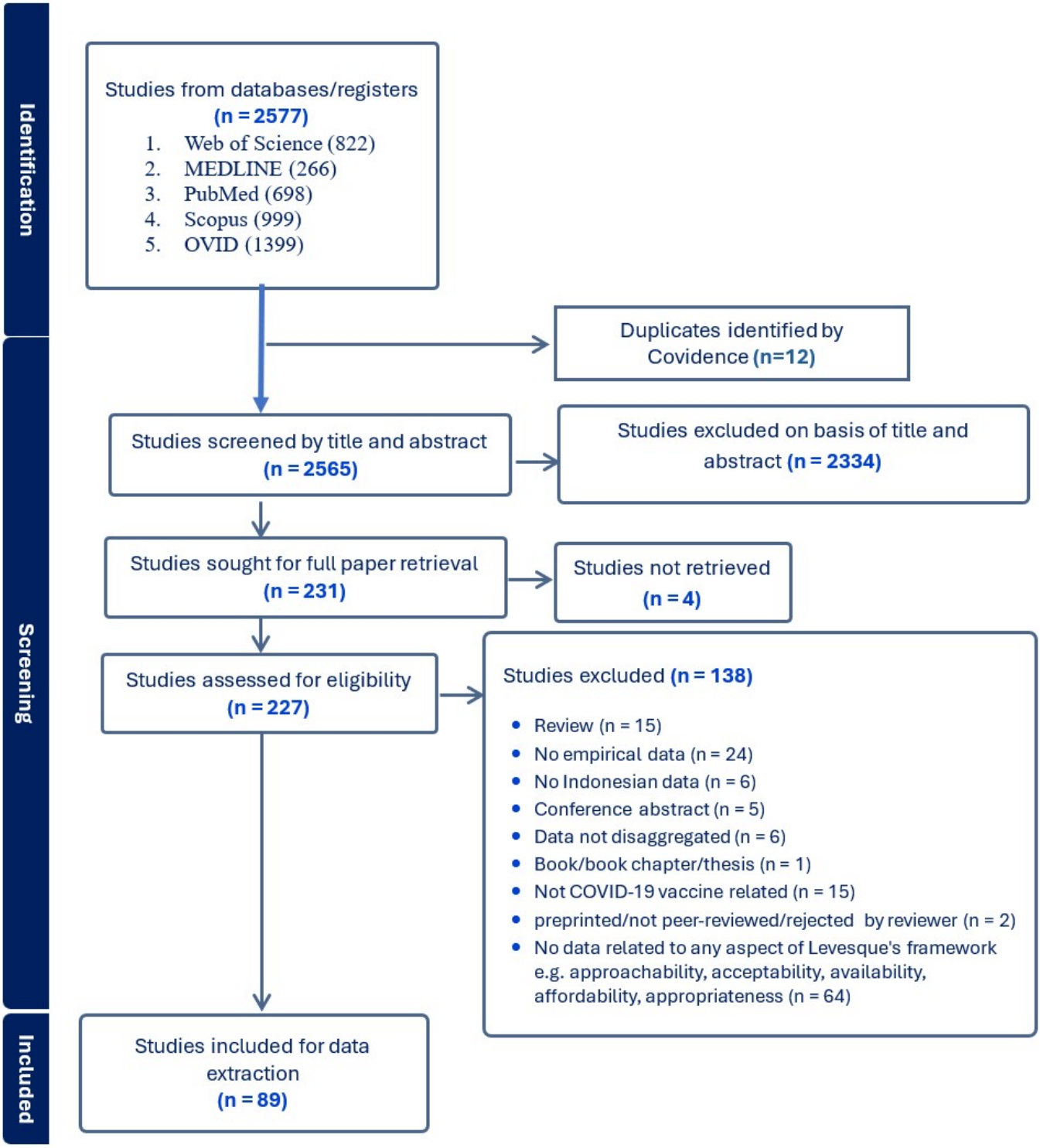

Figure 2. PRISMA-ScR diagram.

community groups expressing distrust toward vaccines from China due animosity, consumer boycotts, and conspiracy theories suggesting the virus was intentionally transmitted to gain economic benefit from vaccines sales [51, 52].

Several studies discussed key constructs in health beliefs and utilised health beliefs or integrative behaviour as a model to help understand COVID-19 vaccine acceptance [24, 27-30]. Other studies identified barriers to vaccination including concern about vaccine safety and side effects, fear of syringes or needles, and a perception of low infection risk due to the belief that COVID-19 is not dangerous [24, 40].

Health literacy or one's knowledge about vaccine information such as its safety was associated with acceptance [50]. Knowledge or awareness of the concept of permissibility regarding vaccine use in Islamic law, the belief that vaccines are halal and pure, and the understanding that in emergency situations, even vaccines considered haram are permissible, were also found to contribute to increased confidence in vaccination [53]. Health literacy influenced engagement with vaccination services, as explored in nine studies, particularly in how users received and interpreted information and how literacy affected adherence to the program [54, 55].

Acceptability and ability to seek

The acceptability of vaccines was examined in 69 studies, and identified professional values (n=17), norms (n=16), gender (n=15), and culture (n=11) as important, while the majority of studies (n=56) explained acceptance as a result from other factors. Healthcare workers, as professionals, had initial access to vaccination due to being prioritised [27, 33, 56]. Community trust in health providers was associated with adherence to professional recommendations or suggestions to follow the health protocol and to be vaccinated [37, 47, 48, 56-61].

Norms that influenced vaccine acceptability included alignment with standard regulations or attitudes, religious reasons [40, 60, 62], the halal-haram status of the vaccine [24], and perceived conflicts of interest such as pressure from influential persons to prioritise vaccination of their own families [34].

As Indonesia has the largest Muslim population in the world, the halal-haram consideration is important. On one hand, halal is defined as the permissibility to eat, drink, or act based on Islamic law and principles. On the other hand, haram refers to substances which are forbidden for Muslims to consume. In relation to vaccine manufacturing, haram status may result from substances of animal origin, including swine or derivatives, dead animals, or blood [63].

Among the 16 references discussing norms, 11 specifically mentioned concerns about the halal status of the vaccine [17, 24, 34, 40, 44, 46, 48, 53, 55, 64, 65], and four addressed religious beliefs or reasons more broadly [42, 58, 62, 66]. Limited access to information regarding the vaccine's halal or haram status during the initial vaccination period generated uncertainty among the community, leading to hesitancy or refusal to be vaccinated [24, 46, 48, 49, 64]. Awareness of Islamic regulation stating that in emergency conditions the use of non-halal vaccines is allowed, were found to be a supporting factor for acceptance in several studies [53, 55]. Boekoesoe mentioned that offering souvenirs such as "sembako" (the nine necessities for daily living) enhanced willingness to go for vaccination [67].

Indonesia officially recognises six religions: Islam, Catholicism, Christianity /Protestantism, Hinduism, Buddhism, and Confucianism. Multiple studies identified lower rates of vaccine refusal from non-Muslim groups, in line with another study which found higher acceptance among Buddhists compared to Muslims or Christians [17, 29, 48, 58, 66, 68]. On Belitung Island, Sumatra, Islamic religious leaders collaborated with healthcare providers to promote vaccination initiatives in mosques [34].

Sex and gender differences were studied in relation to acceptance or hesitancy in several studies [40, 41, 47, 58, 68-71]. The results appear equivocal. Some studies suggested that gender does not significantly influence acceptance [17, 48, 54, 68]. However, three studies found that women have statistically higher levels of acceptance [41, 47, 70], and at least two studies found higher acceptance in men [40, 58].

Individuals' ability to seek vaccination was identified in 38 studies, encompassing research that explored personal and social values such as familial roles and responsibilities (n=21), cultural issues (n=10), gender (n=10), and the autonomy or power to make decisions (n=5). Personal and social values including those that prioritised personal and family health, the responsibility to protect others, particularly family members, and eagerness to meet and gather with family emerged as motivating factors for individuals' willingness to seek COVID-19 vaccination [27, 37, 40, 48, 52, 61, 71-75]. Autonomy related to the personal confidence and a "can do" attitude influenced the decision whether or not to seek vaccination [37, 71].

Gender was examined as a factor related to knowledge of vaccination [50]. Females were found to have greater knowledge of the vaccine [50, 76] although this was not always found to make a difference in their ability to seek vaccination [49, 77]. Gender in most studies was used to describe sex – usually binary in terms of male/female and no studies were found that examined other gender or sexual identities and their access to or attitudes towards COVID-19 vaccination.

Availability and accommodation, and ability to reach

Availability of vaccine and accommodation facilities were discussed in 16 studies, including accommodation issues (n=9), geographic location (n=8), appointment mechanisms (n=2), and opening hours (n=1). The health centre (*Puskesmas*) became the most preferred site followed by hospitals, private doctors and midwives' practices facilities, workplaces, and schools or universities [78]. The two largest faith-based organisations (FBOs) in

Indonesia, Nahdatul Ulama and Muhammadiyah dedicated hospitals for vaccination sites and health workers to be involved as vaccinators [65]. The unavailability of vaccine made some people go back and forth which eventually made them reluctant to come again [34].

Geographic location was also found to be influential – with notable differences found between urban and rural areas, and in relation to eastern and western Indonesia. People living in Java (western) region reported receiving an earlier first dose of vaccination but a later second dose compared with those outside Java [79]. Those in urban areas had higher access and acceptance to vaccination compared with rural areas [17, 54, 80]. Easy appointment mechanisms and the availability of health providers, including a shorter waiting time positively influenced willingness to be vaccinated [31, 60]. Limited vaccination opening hours to a certain time frame created barriers for those in employment and could not leave their work [60].

Ability to reach focuses on user-related factors in accessing vaccination, while approachability refers to the system or service-related factors that influence access. There were 26 studies that identified factors influencing individuals' ability to reach vaccination sites including social support (n=17), living environment (n=9), mobility issues (n=6) and transportation (n=4). Social support including spouses, family and friends was reported to assist in reaching vaccination sites and support willingness to get vaccinated [34, 37, 40, 45, 61, 64, 72, 75, 81]. Family consent for vaccination was a supportive factor [24]. For workers or students, mandatory vaccination, encouragement from their institutions, and work flexibility such as time off to take up vaccines that were not workplace-based were important considerations [29, 48, 60, 61, 82]. Difficulty in accessing vaccination sites including due to distance reduced individuals' willingness to get vaccinated [46, 54, 64, 83].

Affordability and ability to pay

Of the 10 studies exploring affordability, all identified direct costs, two identified opportunity costs, and none mentioned indirect costs. Financial concerns related to the cost of vaccines were raised in two multi-country studies where the majority of respondents wanted vaccine for free so it could reduce users' out of pocket payment [31, 72]. However, none of the studies explored how competing household needs or expenses influence vaccine affordability. Meanwhile, the availability of free of charge COVID-19 vaccines in Indonesia elaborated in seven studies was a key factor supporting acceptance [31, 36, 44, 45, 48, 60, 75]. Another multi-country study carried out prior to vaccine production found that cost of vaccine was an important consideration for those deciding whether or not to get the vaccine [57, 84].

The decision to receive a vaccine was also found to be influenced by considerations of opportunity costs, particularly regarding the time required for travel and waiting at vaccination sites [31]. Although statistically insignificant, the availability of paid leave was documented as playing a role in vaccine uptake in one study [60].

The ability to pay for vaccination was the least frequently discussed demand-side dimension (n=24). Among studies that examined this dimension, income (n=21), insurance (n=4), social capital (n=2), and assets (n=1) were identified as relevant factors. Income could be regarded as a sociodemographic factor and was significantly correlated to acceptance [24, 27-31, 40, 54, 58, 62, 68, 85]. However, a small number of studies suggested that income was not a significant factor in acceptance [17, 48, 66]. The reduction in income resulting from the COVID-19 pandemic also influenced acceptance rates [60]. The possession of either national health insurance or private insurance was associated with a higher willingness to accept vaccination [29, 40]. Social capital including collaboration between government entities and non-governmental organisations (NGOs) or other institutions such as Faith Based Organisations (FBOs) reduced personal cost to get the vaccine [65].

Although not explicitly covered in the framework, patient willingness to pay was also explored at some level in nine studies [40, 42, 44, 49, 50, 66, 77, 78, 86]. Based on several studies, willingness to pay a proportion of vaccine costs among general adult population in Indonesia ranged from 20.1% to 78.3% [44, 50, 66, 77, 78].

Appropriateness and ability to engage

Among the 10 studies on appropriateness that explained the fitting of the service to patient needs, the majority focused on technical and interpersonal quality (n=8) and the rest explored adequacy (n=5) and coordination and continuity (n=2). Unclear procedures, administration and bureaucracy caused barriers to access for vaccination [37, 61]. There were technical issues such as individuals' unfamiliarity with online registration that caused crowds at the vaccination location [65] and limited vaccine availability causing some people to register in more than two vaccination sites impacting accuracy of vaccine dose calculation [34]. Interpersonal quality barriers reported by pharmacists included lack of training and skills in vaccination, low confidence to vaccinate, lack of collaboration with other health professionals and the unavailability of regulation for pharmacists to provide vaccination [83].

Cross-sectoral coordination and continuity were found to positively impact appropriateness of vaccines in one study targeting vaccinators in Belitung Island, where health providers, police, religious leaders, traditional leaders or *pemangku adat*, villages heads, and NGOs collaborated. The police prioritised driving license applicants who had been vaccinated to get more prompt service. Those who showed vaccination cards could get a coupon for a lower down-payment when buying a motorcycle from the vehicle dealer [34].

The ability to engage defined as the individual's ability to participate in the vaccination process was examined in 38 studies. Engagement was associated with

factors related to information (n=30), adherence (n=16), caregiver support (n=4), and empowerment (n=1). Information on COVID-19 vaccine was mainly shared through social media such as WhatsApp, Facebook, Instagram, and Twitter [36, 62, 78, 87, 88]. Many studies indicated that hoaxes regarding the COVID-19 vaccine contributed to vaccine hesitancy; these included claims of microchip implantation, seizure induction in children, autoimmune disease causation, stroke, and death [44, 46, 75]. Multiple studies measured adherence, or the willingness to comply with the government-mandated vaccination program and schedule, and pre- and post-vaccination health protocols [27, 33, 36, 37, 52, 54, 61, 89, 90]. Several studies mentioned support from healthcare providers, such as encouragement and medical advice for vaccination or treatment of potential side effects [37, 75, 76].

Additional inductive factors

Several studies highlighted important issues that did not fit neatly within the Levesque framework, notably a range of demographic factors including education (n=29), age (n=25), occupation (n=20), and marital status (n=13), as well as other issues including prior history of infection (n=14) and medical considerations (n=24).

The influence of education level was unclear given that higher education was associated in some studies with higher levels of refusal and hesitancy [17, 69, 85] while in others, higher levels of education was associated with greater levels of acceptance to COVID-19 vaccination [29, 54, 91]. Hesitancy was also more prevalent in younger age groups [85, 92], although some studies found the opposite [17, 46, 66, 68].

Occupation influenced acceptance, with students and employed individuals showing higher rates of vaccine acceptance [17, 29, 58], particularly those in health-related fields [92]. Single or widowed individuals were more willing to be vaccinated than married persons [17, 27, 48, 68] although another study reported different findings [69].

Medical conditions also impacted decisions, with individuals having comorbidities or chronic illnesses showing lower willingness [46, 54, 80, 93]. Prior infection was associated with lower adherence [54], although a contrasting finding emerged elsewhere [48].

DISCUSSION

We conducted a scoping review to explore and synthesise published literature regarding what factors affect access to COVID-19 vaccines in Indonesia. We applied the Levesque framework as it offered a comprehensive approach to assessing both the user and health service factors that affect access to a given health care technology or service – in this case, vaccination for COVID-19. We identified 89 studies that fulfilled our inclusion criteria (present empirical data on some aspect of vaccine access from Indonesia, published between 2019 and May 2023). These studies were subsequently examined to identify and categorise insights regarding "access." As none of the reviewed studies explicitly applied the Levesque Framework, all findings were carefully read and manually coded into the framework, although some findings were not relevant to any of its domains. Acceptability emerged as a domain that could not be fully explained by the existing sub-domains including culture, gender, norms, and professional values suggesting the need for more nuanced categorisation within this domain.

Domination of user perspective in shaping access to COVID-19

The studies in this scoping review predominantly focused on individual user perspectives and experiences, providing some important understandings in relation to the different barriers and facilitators of access to COVID-19 vaccination. The findings revealed that acceptance issues stemmed significantly from user factors, including trust in the government, beliefs about the existence of COVID-19, and the safety of the vaccine itself. The review also demonstrated the importance of users' perceptions of vulnerability to, and severity of, COVID-19 and the perceived benefit of vaccination for vaccine acceptance. These were shaped by knowledge or information, cultural issues, and religious norms.

These findings resonate with other studies using the WHO tools of behavioural and social drivers (BeSD) of COVID-19 vaccination in Vietnam, India, and the US, indicating that trust in healthcare systems, prevailing social norms, and risk perception were prevalent factors [115-118]. Those factors belonged to the 'thinking and feeling', and 'social processes' of the BeSD framework [20]. However, several determinants additional to those in the current review have been identified in studies from other settings. Government communication strategies and socioeconomic variables played a significant role in India [117]. Vietnam's vaccination rates were notably influenced by prosocial attitudes and timing of vaccine deployment [118]. The United States highlighted institutional mandates and political ideological factors as key drivers of vaccine acceptance [115, 116].

Our analysis also indicated that age, occupation, and marital status were associated with acceptance or willingness to receive the vaccine [101]. A global meta-analysis on vaccine hesitancy reported an overall hesitancy rate of 25%, with significant associations observed for sociodemographic factors, particularly among females, individuals aged 50 years or younger, those who were single, unemployed, or had education levels below an undergraduate degree [16]. Another study highlighted greater acceptance among males, married, individuals, those with higher education, healthcare workers and older age groups [14]. Although not always framed as such, these demographic features likely play a role in users' ability to perceive.

Specific conditions related to COVID-19 that affected individuals' sense of vulnerability, such as medical considerations (comorbidity and potential side effects) and the history of previous infection of an individual or in their immediate environment, appeared to influence vac-

cine access [24, 27, 28, 37, 46, 48, 54, 66, 75, 80, 82, 93]

The majority of reviewed studies focused on users, resulting in less research on certain structural aspects of vaccine access within the health system, such as maintaining vaccine availability and service coverage. Given Indonesia's geographic characteristics, an archipelago comprising thousands of inhabited islands, the logistic challenges to vaccine distribution were always likely to be significant [12]; however, limited research on COVID-19 vaccine access focused on this issue. Several health system-oriented studies reviewed the regulations for the procurement and administration of COVID-19 vaccine but were excluded from our scoping review since they did not provide empirical data [119, 120]. In Vietnam, however, the BeSD review indicated that practical issues within the health system, such as location and site access, lack of registration system flexibility in the early stage, and limited availability of vaccines and storage equipment, were minor concerns compared to the perception and social norm drivers [118].

Studies in other countries have documented efforts to facilitate access and improve uptake. Two studies in Italy developed vaccination models for socially vulnerable groups (homeless, undocumented migrants, informal settlement) and the "vaccine islands" mass-immunisation model for the general population [121, 122]. Israel's success in COVID-19 vaccination for various target groups was partially attributed to experience in emergency response and logistical capabilities, including actions to track vaccination uptake, tailoring outreach through mobile vaccination units, and appointing coordinators for childcare during vaccination [123]. Adoption of Internet of Things (IoT) and harnessing excess power from cellular phone towers in India were proposed as solutions in the vaccine distribution process [124, 125]. In the US reaching certain communities were conducted through utilisation of worship places and partnering with faith-based organisations (FBO) [126, 127].

Particular aspects of access to COVID-19 vaccine

The halal-haram status of vaccines was a significant consideration in Indonesia, a country with the world's largest Muslim population. Consequently, Indonesia declared the halal status of the Sinovac vaccine, which was utilised as the primary option in the initial vaccination phase [12]. Muslims generally prefer halal vaccines, and the ambiguous information regarding the halal or haram status of many vaccines contributed to hesitancy and influenced acceptance [24, 46, 48, 49, 64]. This has been documented elsewhere, with a study in Malaysia demonstrating a high proportion of individuals (78.5%) were unwilling to receive the vaccine unless it was certified halal; although, 91.8% agreed that they would accept the vaccine in an emergency where no alternative medicine was available [128].

The COVID-19 pandemic also highlighted the influence of social media in disseminating both positive and negative information [129]. The infodemic—an overabundance of information, including false or misleading information in digital and physical environments during a disease outbreak (https://www.who.int/health-topics/infodemic#tab=tab_1) must be considered to reach a high level of vaccination coverage. Recognising the significance of social media during the COVID-19 pandemic, Indonesia leveraged this opportunity by engaging Raffi Ahmad, a well-known influencer with over 50 million Instagram followers, to promote vaccination [12].

This scoping review found that financial factors related to COVID-19 vaccine access were the least researched in the Indonesian context. A potential explanation for this was the perception of low or no cost associated with vaccine due to the absence of out-of-pocket charges for individuals receiving vaccinations in Indonesia and elsewhere [130]. However, costs related to accessing COVID-19 vaccines strained healthcare budgets at local, national, or regional levels [130]. In many articles reviewed, cost was primarily framed as the only cost of the vaccine itself, with no other access-related costs considered, including indirect costs (e.g., travel cost), opportunity costs (e.g., potential income loss), and willingness to pay. The cost per dose in Bangladesh was reported as having no direct cost for the vaccine, with $1.63 for indirect costs, comprising 46% for transportation and the remainder for registration at internet cafes, printing vaccine certificates, managing side effects, and food and beverages. The opportunity cost averaged 2 hours and 20 minutes, equivalent to $3.14 (1% of beneficiaries' monthly income) [131]. A national-level study in Kenya demonstrated that the total cost of procurement and delivery incurred by the government, based on various coverage level, ranged from $7.34 to $16.47 per person vaccinated with two doses [132].

Using the Levesque framework: The devil is in the details

The Levesque framework has proven useful for assessing access to COVID-19 vaccines and may be applicable also to other vaccination research. However, the post-hoc application of the framework in this review went beyond simply mapping findings to predefined domains. Categorising findings into dimensions and abilities presented challenges as the relationships between factors were not always one-to-one or direct. For instance, difficulties arose when assigning evidence to overlapping sub-domains—such as distinguishing between cultural and gender-related influences within the "ability to seek" and "acceptability" domains. To address these challenges in any future application of the framework to similar research, we note the importance of defining the domains in relation to the specific service or intervention early in the analysis, distinguishing between supply-side factors (e.g., vaccination services) and demand-side factors (e.g., community or user aspects). Categorisation should begin with the framework's ten core domains, followed by their sub-domains. This process should occur in parallel with the development of descriptive definitions, which can later form the basis

of a codebook. In the context of qualitative research, it is also important to allow for inductive placeholder codes—emerging themes that initially not fit within the framework but could later be integrated or retained as separate groups. Findings categorisations should be reviewed to develop consensus among researchers. We are aware that other researchers may encounter similar issues; therefore, we offer our operational definitions in Table 3 for consideration. However, researchers intending to apply this codebook in different settings or for other health issues should refine it to ensure its relevance to their specific objectives.

Although in this scoping review we categorised the topic of *halal-haram* vaccine status under the "norms" sub-domains, we acknowledge this is not a perfect fit. The *halal-haram* consideration is more closely tied to religious law or faith-based factors, which can differ significantly from broader social and cultural norms. Given its importance, we propose that religious or faith-related factors should be explicitly recognised as a distinct subdomain within the framework for future work examining access to healthcare, and particularly vaccines. Additionally, factors such as demographic characteristics, along with context-specific considerations like comorbidities and history of infection, should be incorporated into the framework to enhance its relevance and applicability. By expanding the framework to include these factors, we can better capture the complexity and diversity of factors that shape access to vaccines and healthcare in general.

Limitations

This review is limited by the timeframe of data collection (2019 to May 5, 2023), i.e., the first two years of vaccine availability (2021 and 2022) in response to the pandemic. Subsequent publications were excluded from the analysis. Nevertheless, we continue to identify relevant publications and highlight their relevance to our findings. One pertinent publication explores vaccine hesitancy and strategies to overcome it [133]. The primary findings indicate that low trust in vaccines, misleading information, cultural beliefs, and negative previous vaccine experiences were the main reasons for hesitancy. The recommendation was to collaborate with various stakeholders, including community and religious leaders and influencers, to raise awareness [133].

Most of the studies we reviewed had collected data in 2021, representing the pandemic situation at that stage. Since the review was conducted after lifting international emergency concerns and Indonesia's declaration of entering the endemic period, several aspects have changed, including vaccine availability, types of vaccines, prioritisation of groups, vaccination coverage, and policy guidelines. Despite study limitations and specificity to a particular time, this review provides an in-depth understanding of the literature in Indonesia on vaccine access and the factors to consider for evidence-informed policy drawing on appropriate evidence and knowledge [134].

Conclusion

This scoping review provided insights into factors affecting access to COVID-19 vaccines in Indonesia, highlighting the complex interplay of user and health system factors influencing vaccine acceptance and uptake. The findings emphasised users' perception in shaping vaccine access more than health system factors. Trust in government, religious beliefs, and perceptions of vaccine safety and efficacy emerged as key determinants of acceptance.

The halal status of vaccines was a significant consideration, reflecting the importance of religious factors in the Indonesian context. Social media emerged as a powerful tool in shaping vaccine perceptions. The review revealed sociodemographic disparities in vaccine access, and the influence of medical considerations and previous infection history specific to COVID-19.

While user factors were extensively studied, there was a notable gap in research on health system factors such as vaccine availability, distribution logistics, and operational challenges. The application of Levesque's framework provided a structured approach to analysing access factors, although some findings did not neatly fit within it, indicating the need for context-specific adaptations.

Improving access to COVID-19 vaccines in Indonesia requires addressing user perceptions, leveraging social media, ensuring equitable access, and considering religious and cultural factors. Policymakers should use these insights to develop targeted strategies enhancing vaccine acceptance and uptake, contributing to better pandemic management and public health outcomes. These findings were important for studies on access to vaccination using frameworks of access. The review highlighted the importance of integrating community and user perspectives with health system perspectives to improve access by promoting acceptance and reducing vaccine hesitancy, contributing to evidence-informed policy and pandemic preparedness.

DECLARATIONS

AI utilization

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author contributions

Conceptualisation (YY, AY, ST, AZ), data curation (YY, AY, ST, AZ), formal analysis (YY, AY, ST, AZ), methodology (YY, AY, ST, AZ), software (YY, AY), supervision (AZ, ST, AY), validation (YY, AY), visualization (YY), writing original draft (YY), review and editing (YY, AY, ST, AZ). All authors have read and approved the final manuscript.

Data availability

Available from the corresponding author upon request.

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ABSTRACT IN SPANISH

Acceso a las vacunas contra el COVID-19 en Indonesia: Una revisión de alcance basada en el marco de Levesque

Introducción: El acceso a las vacunas ha sido el medio más efectivo para reducir la gravedad y la mortalidad relacionadas con el COVID-19. Esta revisión de alcance exploró los factores relacionados con la accesibilidad de las vacunas contra el COVID-19 en la población indonesa utilizando el marco de acceso a la atención sanitaria de Levesque.
Métodos: Se realizó una búsqueda sistemática en cinco bases de datos siguiendo las directrices PRISMA para publicaciones del 1 de enero de 2019 al 5 de mayo de 2023. Se identificaron 89 estudios que cumplían los criterios de inclusión y se analizaron con NVivo-14.
Resultados: Más de la mitad de los estudios se publicaron en 2022 (n=58), y la mayoría utilizó datos recolectados en 2021 (n=55). Esta literatura refleja, por tanto, los primeros momentos de la pandemia y la disponibilidad inicial de las vacunas contra el COVID-19. La mayoría de los estudios emplearon un enfoque cuantitativo (n=74) y encuestas en línea (n=50). Predominaron los factores relacionados con los usuarios sobre los centrados en el sistema de salud. Los factores personales, en particular la confianza, las creencias y las percepciones, influyeron significativamente en la aceptación de las vacunas. El estatus "halal" de las vacunas y la información difundida en redes sociales fueron determinantes en la formación de percepciones. La edad, el género, el nivel educativo, el estado civil y la ocupación influyeron en el acceso, junto con factores relacionados con e COVID-19, como comorbilidades e infecciones previas. Los aspectos financieros, como costos directos, indirectos y de oportunidad, fueron menos estudiados.
Conclusión: Abordar las percepciones de los usuarios, aprovechar las redes sociales, garantizar un acceso equitativo y comunicar de manera clara el estatus "halal" de las vacunas fueron elementos clave para mejorar el acceso a la vacunación contra el COVID-19 en Indonesia. Las investigaciones futuras centradas en factores del sistema de salud ofrecerán una comprensión más completa de la accesibilidad a las vacunas.

Palabras clave: Acceso, COVID-19, vacunas, Levesque, aceptabilidad, Indonesia.

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