

## Review Article

# Perspectives of Mothers and Providers regarding Virtual Care Approaches during Pregnancy in High and Low-Income Countries: A Meta-Synthesis on Qualitative Studies

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Received 27 February 2023; Revised 17 November 2023; Accepted 11 December 2023; Published 21 December 2023

Academic Editor: Helen Skouteris

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**Background.** Various conflicting views have been presented between beneficiaries from different countries regarding the usage of virtual prenatal care. This review aimed to explain the perspectives of mothers and providers in high- and low-income countries regarding virtual approaches during pregnancy. **Methods.** This synthesis was conducted with an aggregative technique (which adopts a pragmatist epistemological framework) by searching the Web of Science, PubMed, Scopus, ProQuest, SID, Irandoc, Magiran databases, and Google Scholar search engine from January 2005 to February 2021 and completed until December 2022. Qualitative and mixed-method studies in English were included in this review. Extracted codes were set in three areas: participants, type of views (+ or –), and countries' income levels. We used the JBI checklist for critical appraisal of the included studies. **Results.** Altogether, 1201 studies were retrieved, and finally, 16 articles were included in this review. We focused on the similarities of the extracted codes based on the stakeholders' perspectives. These codes were organized into seven categories: positive or negative belief/sense, socio-cultural issues, economic save or cost, communication and information, technical issues, access and utilization, and management issues. At both income levels countries, the availability of services, lack of trust in virtual methods, cost of services or smartphones, and challenging interactions were shared codes between mothers. Also, raising engagements and extending workloads were shared items between providers. Overall, language barriers, saving time, and Internet disconnection or poor connectivity were three shared codes between the beneficiaries at two levels of countries regarding virtual care during pregnancy. **Conclusion.** Paying attention to virtual methods in maternal care is inevitable. Evidence illustrated that mothers and healthcare providers had different positive or negative views on this issue. The stakeholders' perspectives should be considered in policies related to removing barriers and strengthening the benefits of virtual care during pregnancy.

## 1. Background

Based on the World Health Organization (WHO) recommendations in 2016, a routine prenatal care program and person-centered care have led to positive outcomes for

mothers and their children [1]. The number of mothers' visits with providers is adjusted according to the client's needs, pregnancy risk [2, 3], and countries' income levels [1]. On the other hand, some recent studies suggested integrating various virtual approaches in maternal care

programs, because they led to the same satisfaction and improved the inequality of access to health services, especially in remote and rural areas [2].

After the COVID-19 pandemic in the world, all countries' health sectors attempted to redesign their care services, including prenatal care, around essential services [2]. Worldwide, health centers rapidly reduced in-person visits and replaced some scheduled client care with virtual visits to protect sensitive groups such as mothers and healthcare providers from unnecessary contact [1, 4]. Although diverse virtual approaches have reduced in-person visits and maximized social distancing during the pandemic, using virtual practices has raised concerns about access to virtual care among clients, especially in low-income resource areas [5].

Kim and Kwon mentioned that the lack of information technologies, including suitable broadband, yielded a "digital divide" in low-income resource areas seeking affordable services [6]. Farrell et al. also clarified some mothers may have had restricted access to virtual technology and types of equipment; such problems have often been among mothers with low socioeconomic status [7]. In a mixed-method study from 71 countries with different socioeconomic conditions, Galle et al. indicated that providers in low-income countries have more severe barriers to implementing telemedicine for maternal care than their colleagues in middle- or high-income countries [8]. Until now, several studies have been conducted on applying types of digital health in maternal care. Digital health, as an umbrella term, encompasses many technologies in health care, including telehealth, telemedicine, mobile health (mHealth), eHealth, and artificial intelligence [9, 10]. Using alternative approaches instead of traditional prenatal care was accelerated in maternal services during the COVID-19 pandemic [2, 11]; therefore, some studies examined the opinions about the benefits and barriers of using these methods [12]. In this regard, there were some studies with different methodologies such as reviews and mixed methods [8, 13–19].

Although virtual methods in maternal care have multifaceted benefits [20], mothers or providers from different countries are concerned about their barriers [5], the same issue we are dealing within our study. As a part of doctoral work, our research team was eager to examine qualitative studies on the benefits and barriers of virtual pregnancy care in countries with different income levels to propose an effective intervention in this field at the national level by obtaining existing commonalities. In present synthesis, we sought answers to the following questions:

RQ1: What are the mothers' perspectives regarding virtual care approaches during pregnancy in countries with different income levels?

RQ2: What are the healthcare providers' perspectives regarding virtual care approaches during pregnancy in countries with different income levels?

## 2. Methods

We followed PRISMA 2020 guidelines for the accompanying explanation and elaboration of the present synthesis [21]. It is noted that this review's protocol has not been registered.

### 2.1. Definitions

*2.1.1. Virtual Care Approaches.* Virtual care approaches are a series of care services carried out remotely using modern technologies to facilitate care services and increase their quality and effectiveness. Therefore, patients can easily connect with the health service provider team members and receive the necessary care. These approaches pursue different goals, such as education, counseling, monitoring, evaluation, or intervention. The present synthesis includes all virtual care approaches, including mHealth, virtual visits, telehealth, eHealth, and remote care, for providing virtual care during pregnancy [22].

*2.1.2. Categorized Countries Based on Their Income.* According to the World Economic Situation and Prospects 2022 report, the World Bank has been classified countries by their level of development by per capita gross national income (GNI). Accordingly, all countries have been grouped as high-income, upper-middle-income, lower-middle-income, and low-income [23]. In this study, we have considered countries into two general groups: low- and lower-middle-income countries or high- and upper-middle-income countries. Therefore, based on the location of the included studies, we examined the relevant results in the above two groups (Our criterion for categorizing the included studies was the country of study although the participants might be selected from rural or suburban areas or poorer regions of a high-income country.)

*2.1.3. Meta-Synthesis and Meta-Aggregation.* Meta-synthesis or systematic review of qualitative research is one of the methodologies that provide evidence-based information in healthcare [24]. In the synthesis of qualitative studies, mainly two interpretative and aggregative approaches are used [25]. Meta-aggregation, in contrast to interpretation, focuses on gathering, integrating, and summarizing qualitative data instead of reinterpreting primary research. Therefore, meta-aggregation will lead to an increase in data sources for practical use in evidence-based medicine [26]. According to our objectives, the present study synthesis is reported based on meta-aggregation.

*(1) Eligibility Criteria.* Inclusion and exclusion criteria of the present synthesis were set based on the PICO (population, phenomena of interest, and context) framework [27]. The populations were patients (mainly pregnant mothers) and healthcare providers (in the field of mothers' care in different categories). The phenomena of interest were perspectives of the target population about applying virtual care approaches during pregnancy. The context also included two categories of countries based on their income level (low- and high-income countries).

We included all the qualitative studies (with different approaches) and the qualitative part of the mixed-method studies regarding the perspectives, opinions, and experiences of mothers, healthcare providers, or both about applying virtual care during pregnancy. We divided the studies

based on implementation location into two categories of low- and high-income countries relying on the latest World Bank report on the income status of the countries. All quantitative studies were excluded from the study. We also used the reference section to find relevant articles and improve the richness of our evidence. We excluded a few studies due to not separately reporting the providers' opinions in high- and low-income countries. The inclusion and exclusion criteria for this study are provided in Table 1.

**2.2. Information Sources.** In this synthesis, we conducted an advanced comprehensive search with related keywords in electronic databases: the Web of Science, Scopus, PubMed, and ProQuest, as well as the Google Scholar search engine and the Iranian databases SID, Irandoc, and Magiran (only English articles) from January 2005 to February 2021. Due to the dependence of our topic on modern technology, no valuable studies were found in our pilot search before 2005, so we set the lower limit of our search to 2005. In the following, all the new related articles from June 2021 to December 2022 were sent to the first author via e-mail alert and added to our library. In this way, the studies for this synthesis were included from January 2005 to December 2022 .

**2.3. Search Strategy.** Initially, a pilot search was performed with some search terms such as "Prenatal care" and "Telemedicine" to identify possible problems and prevent them in the final stage. We received guidance from an expert in methodology in generating a search strategy process and conducting a pilot search. After specifying the databases and related keywords table, an advanced comprehensive search was performed in the mentioned databases based on the title and abstract, and relevant studies in English were retrieved. The set of keywords used in the study is [Women\*/Prenatal care [Mesh] OR Antenatal care OR Obstetric care OR Maternal care] AND [Telemedicine [Mesh] OR Telemedicine OR Mobile Health OR mHealth OR m-Health OR Telehealth OR Tele-health OR eHealth OR e-Health OR Remote Consultation [Mesh] OR Teleconsultation OR Teleconsultation OR Telecare OR Tele-care OR Remote Care OR Tele monitoring OR Tele-monitoring OR Digital Health OR Virtual Approach OR App OR Digital app OR Mobile app OR Virtual Care OR Virtual Approach]. The study search strategy is listed in Supplementary 1.

**2.4. Selection Process.** All studies obtained in the searching phase were entered into the EndNote (EndNote-X9) library, and the duplication was removed automatically. To ensure the removal of all replication records, the first author (HS) checked out the library again manually. Two reviewers (AK and AS) independently screened the titles and abstracts of the studies. Then, full-text articles were evaluated for eligibility. The reviewers' opinions were compared with the first author (HS), and disagreements were resolved. Two other reviewers (JK and SG) reviewed the eligibility process and presented their views. Finally, all authors reached a consensus.

**2.5. Data Collection Process.** Two data extraction tables were designed based on low- and high-income countries. The included studies' characteristics were tabulated by HS. Three reviewers (AK, AS, and SG) independently reviewed the data extraction table and provided their comments. In the end, the differences of opinion were discussed and resolved.

**2.6. Data Items.** We extracted the following data items based on the first author, year of publication, setting (context), the phenomenon of interest, the virtual care type used, qualitative study approach/method of data gathering, characteristics of beneficiaries, and comments on participation (benefits and obstacles). Extracted data for high- and low-income countries are shown in Supplementary 2.

**2.7. Study Risk of Bias Assessment.** Since the quality of the meta-synthesis study depends on the methodological quality of the included studies, they need to be evaluated by an appropriate tool. The research team used the Joanna Briggs Institute's Qualitative Assessment and Review Tool (JBI-QARI), a validated and sensitive tool available to assess the validity of qualitative studies [25, 28]. Therefore, it was used as the principal tool to evaluate the methodological quality of our studies. JBI-QARI contains ten questions; the answers to these questions can be yes (Y), no (N), or unclear (UN). Also, "P" is used where the question is answered in a relative manner. The scores 1 and 0.5 are given for each "Y" and "P," respectively. In this way, the sum of the scores (maximum 10) is considered as the study quality. In addition, two cut-off points have been determined for this score as follows: studies above seven (7) and below five (5) are considered high and low quality, respectively [29, 30].

All included studies ( $N=16$ ) had higher than seven (7) scores, so we did not exclude any of these studies from the synthesis process, based on the quality.

In this approach, two other points are considered in the quality evaluation. The first issue is the richness of the study reports, which are divided into two categories based on the definition: "thick" and "thin" (mentioned in Supplement 3). "Thick" articles present a theory or provide deep explanations that can be transferred to other contexts, while "thin" articles provide superficial or limited explanations that are not transferable. Based on our recent source documents [30], attention to the study richness approach was proposed and operationalized by three previous studies [31–33]. The second issue is the relevance degree of the studies to the topic under discussion, which can be high, medium, or low [30]. The first author (HS) determined the richness and relevance criteria of the study and then reviewed and modified by other research team members.

In terms of readiness area, we had three "thin" studies and thirteen "thick" ones. In terms of relevancy area, it also consisted of three and thirteen medium and high studies, respectively. Our critical appraisal and quality assessments of the included studies with further details are available in Supplementary 3.

TABLE 1: The eligibility criteria of the present synthesis.

Attribute	Inclusion criteria	Exclusion criteria
Population/problem	Pregnant mothers and healthcare providers	Other participants
Phenomena of interest	Perspectives regarding applying virtual care approaches during pregnancy	—
Context	Categories of countries based on their income (low- and high-income)	—
Type of studies	All of the qualitative studies	Other type of studies
Time period	January 2005 to December 2022	Before 2005
Language	English language	Other languages

2.8. *Assessment of Confidence in the Qualitative Synthesized Findings (ConQual)*. Confirming confidence in meta-aggregation synthesis is particularly important because synthesis findings are often considered for use in healthcare decisions. The two main elements play an important role in increased confidence: dependability and credibility, as initially defined by Guba and Lincoln. The confidence rating tool for qualitative composite findings (similar to the GRADE in quantitative studies) has been introduced under the term ConQual. This tool shows how many results of individual studies are downgraded based on their dependability and credibility.

Five questions on the JBI checklist (Q2, Q3, Q4, Q6, and Q7) measure the dependability of studies based on the ConQual rating system. When the five mentioned criteria for dependability are not fulfilled in the included studies, it may be downgraded. With four to five positive answers to these questions, the individual findings remain at the same level. Two to three positive responses also decrease one level (from high to moderate), and zero to one positive response decreases two levels (from high to low or moderate to very low). Accordingly, the synthesis findings may be reduced based on the aggregate level of the included findings' dependability. In another element, when not all findings in a composite finding are considered "unequivocal," a downgrading of credibility may happen. Similarly, two downgrades in credibility may occur for "equivocal" findings, and four downgrades may occur for "unsupported" findings. Of course, the mixed states with one or three downgrades are also conceivable [24, 29].

In this synthesis, the dependability rating for all of our studies was high. In addition, we have two composite findings with one downgrade for credibility. Tables with explanations are given in Supplementary 3.

2.9. *Synthesis Methods*. We selected the meta-synthesis method to achieve the research goals because the synthesis of qualitative research provides evidence for health care and decision-making to inform developments in policy and practice. By deducing the perspectives of the beneficiaries at different levels, it is possible to propose suitable interventions in each group and each level for planning and implementation. We needed the same codes for comparison and classification to synthesize the data. Then, the research team meeting was held, and we decided to use a shared vocabulary for the concepts, provided that the meaning should not be changed. Changes were made by the first author (HS) and checked and corrected twice

by two reviewers (AK and AS). These findings were divided into two groups of benefits and barriers based on their positive or negative load. The process of extracting findings, categorizing, and defining shared codes was carried out manually. Two reviewers (AK and AS) monitored each step, and the process continued after applying the corrections. Next, we used meta-aggregation for synthesizing the data based on the Joanna Briggs Institute approach for qualitative systematic review [24]. Although meta-aggregation (developed in early 2000) is conducted on a systematic review process, it is sensitive to the nature and tradition of qualitative research. Regarding this approach, Lockwood and Mann stated: "The reviewer avoids reinterpretation of included studies, but instead accurately and reliably presents the findings of the included studies as intended by the original authors."

### 3. Results

3.1. *Selection of Sources of Evidence*. First, we examined 1201 studies. Following the exclusion of 387 duplicated studies, the research team reviewed the titles and abstracts of 814 studies. All quantitative articles with different methodologies, such as cross-sectional, case-control, cohort, and commentaries, were excluded from the synthesis. After applying the exclusion criteria at this stage, 113 studies were in terms of eligibility. We also checked the references of several reviews and syntheses to ensure we did not miss any relevant studies. However, fortunately, the desired studies were already available in our library. With the exclusion of 94 studies in the second stage, we included 16 qualitative articles with different approaches in the present synthesis. Two reviewers (AK and AS) rechecked this process. The PRISMA flow diagram illustrates the studies' selection of our synthesis as shown in Figure 1.

3.2. *Characteristics of Sources of Evidence*. All included studies were in English and were published from 2015 to 2022, including 2022 ( $n = 2$ ), 2021 ( $n = 1$ ), 2020 ( $n = 3$ ), 2019 ( $n = 2$ ), 2018 ( $n = 2$ ), 2017 ( $n = 4$ ), 2016, and 2015, one article each. Among the 16 included articles, ten (62.5%) were related to high-income countries [2, 7, 11, 34–40] and six (37.5%) to low-income countries [20, 41–45]. From high-income countries, three articles were implemented in the USA [2, 7, 11], followed by one in the UK [35], China [39], South Africa [36], Guatemala [37], Germany [34], the Netherlands [38], and Australia [40]. Also, in low-income countries, one study was conducted in each country,

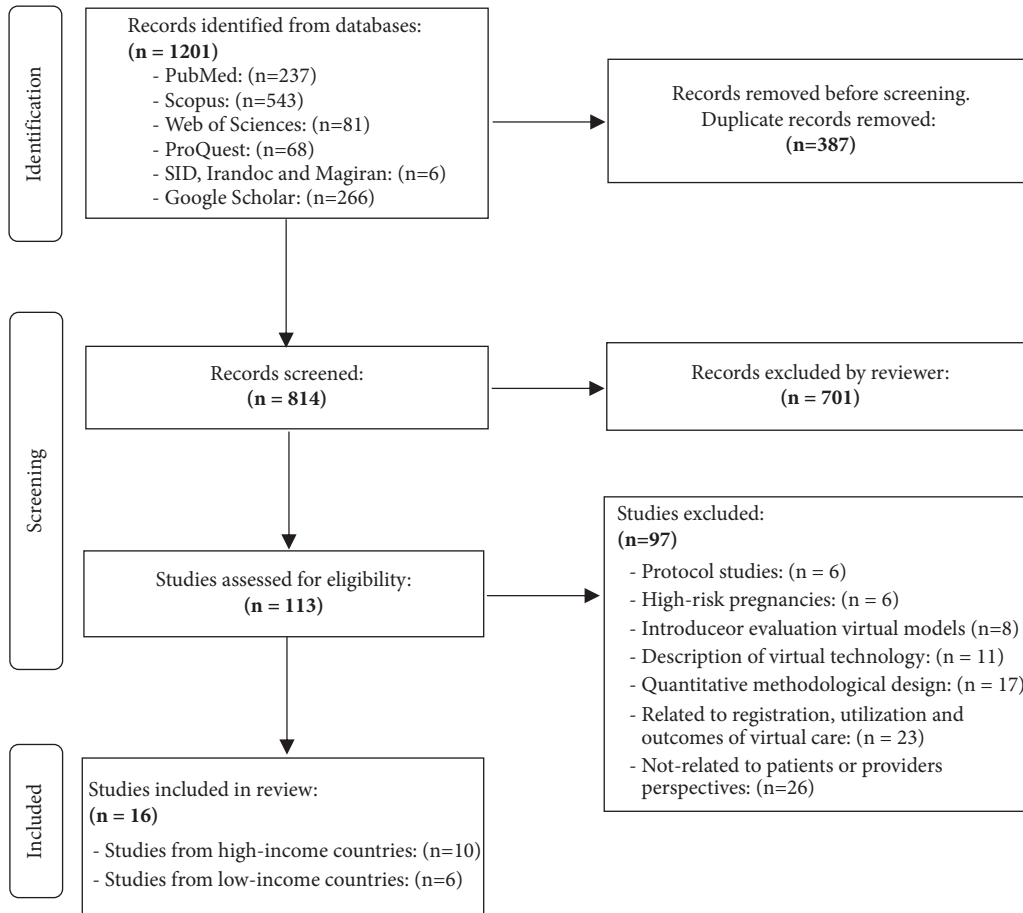


FIGURE 1: The PRISMA flow diagram for studies' selection.

including Uganda, Madagascar, Bangladesh, India, Pakistan, and Ghana.

The included studies in terms of the type of virtual approach contained mHealth ( $n = 7$ ) [20, 36, 37, 40–43], mHealth or eHealth App ( $n = 4$ ) [34, 38, 39, 45], Telehealth ( $n = 2$ ) [7, 11], eHealth [44], remote care [35], and virtual visit [2] having one each case (Figure 2). Regarding the type of participant, in six studies (37.5%) [7, 34, 36, 37, 39, 44], mothers were the only participants in three (18.75%) [11, 43, 45], providers presented only, and in seven (43.75%) [2, 20, 35, 38, 40–42], both were involved.

In six studies (37.5%) with the participation of mothers, the age range was mentioned. The mothers' age in four studies [7, 20, 34, 39] was over 18 years, in one [37] was over 16 years, and in another [44] was between 18 and 49 years. The smallest reported participants in the studies were two mothers [38] and eight providers [43]. In our included studies, the highest number of participants was 115 mothers [44] and 34 providers [35]. However, in a study with a retrospective evaluation method [2], the opinions of 150 mothers and 53 providers were also reported.

In terms of compliance with ethics in the included studies, all studies had approval from a reputable scientific institution, among which 11 studies (68.75%) had also mentioned the code of ethics. Regarding obtaining consent to participate in the studies, 13 studies specifically obtained

informed consent from the participants, and two studies [11, 20] received verbal consent. In one study [2], informed consent was not reported due to the methodology of retrospective evaluation and reporting of participants' opinions.

Data collection in seven studies (43.75%) [7, 11, 20, 34, 35, 43, 44] was carried out by interviews (semistructured, interviews by phone or face to face), in three studies (18.75%) [37–39] by FGD, and in five studies (31.25%) [36, 40–42, 45] by using both methods. A retrospective study's report (6.25%) [2] was also collected through free-text response. Among the included studies of stakeholders' perspectives about virtual interventions during pregnancy, the contribution of studies before the COVID-19 pandemic was ten (62.5%) [20, 34, 36–42, 45] studies (six [34, 36–40] from high-income countries and four [20, 41, 42, 45] from low-income countries). Also, six (37.5%) [2, 7, 11, 35, 43, 44] studies were related to the pandemic (four [2, 7, 11, 35] from high-income countries and two [43, 44] from low-income countries).

The included studies applied different approaches, which are as follows: grounded theory (1) [7], integrating thematic analysis (1) [35], qualitative part of a mixed-method study (3) [11, 34, 39], qualitative part of a retrospective evaluation study (1) [2], contextualized interpretative (1) [36], qualitative part of a pilot impact evaluation and follow-up (1)

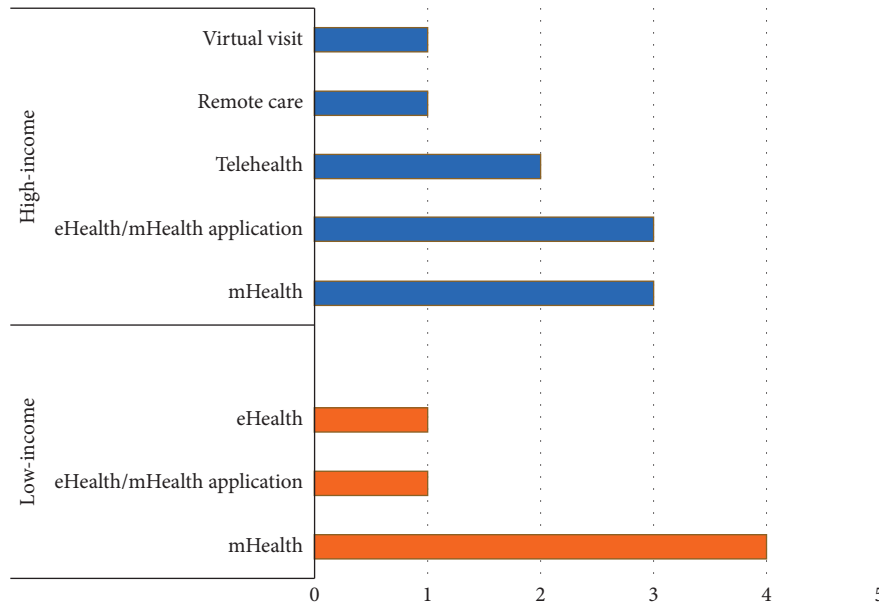


FIGURE 2: The number of included studies distributed based on virtual care approaches.

[37], thematic analysis (1) [38], qualitative descriptive (1) [40] in high-income countries and, thematic analysis (2) [44, 45], exploratory qualitative (2) [20, 41], inductive coding (1) [43], and content analysis (1) [42] in low-income countries.

The above details are provided in the characteristic of the included studies (Table S2) as shown in Supplementary 2.

**3.3. Critical Appraisal within Sources of Evidence.** Based on JBI-QARI, all included studies ( $n = 16$ ) had a high-quality score (more than seven), so we did not exclude any studies from this synthesis. Meanwhile, all 16 included studies scored “high” for ConQual-dependability. In our included studies, two subcategories had an “equivocal finding” that lowered their scores from high to moderate. The total scores of all others were “high” for ConQual-credibility.

**3.4. Results of Individual Sources of Evidence.** In the present synthesis, out of 16 studies, 10 (62.5%) [2, 7, 11, 34–40] were related to high-income countries. Among these, two studies [7, 11] were on the use of telehealth during the pandemic period. The main goal of telehealth (by phone or video) was to reduce the risk of exposure of pregnant mothers to COVID-19. Therefore, it developed rapidly during the pandemic. Of the two studies [7, 11], one [11] expresses experiences of providers with applying telehealth compared to in-person visits. Also, in one of the studies [7], recommendations have been delivered for providing resources and managing telehealth implementation. Four studies [34, 36, 38, 39] have proposed to receive information and reduce problems related to pregnancy by pregnancy apps [34, 38, 39] or text-based information service [36]. In three studies [34, 36, 39], the attitudes, perceptions, and experiences of mothers, and in another study [38], the facilitators and barriers of apps were expressed from the point of view of

mothers and providers. These apps helped them to facilitate their communication and to personalize the services. The views of health workers and mothers in two studies [37, 40] with the mHealth approach showed that this approach is an accessible source of information on various pregnancy issues. In particular, mHealth interventions were suitable strategies for rural areas and marginalized regions. The study [35] related to remote care did not define it. However, it considered remote consultations by phone or video and asked about the views and experiences of mothers and providers. In this study [35], the quality of remote care was mentioned in terms of efficiency and timeliness, effectiveness, safety, accessibility, justice, and continuity. Another piece of evidence [2] was a retrospective evaluation of access, quality and health, and satisfaction of mothers and providers from virtual visits. This approach was presented as a prenatal care model previously developed by the University of Michigan. This model [2] includes reduced in-person visits and replaces with virtual visits through video conferences. It also included improving mothers’ self-care knowledge and delivering self-care tools to volunteers among low-risk pregnancies.

In our synthesis, six studies (37.5%) [20, 41–45] were related to low-income countries. A study [44] has investigated mothers’ perspectives on e-health adoption in antenatal care, and the barriers to e-health technology acceptance are pointed out. This study [44] has categorized and discussed the challenges based on the unified theory of acceptance and technology model into five subconstructs: performance expectancy, effort expectancy, social influence, facilitating conditions, and behavioral intention. Three studies [41–43] have addressed the mHealth approach. One [41] has investigated the feasibility of mHealth interventions in improving prenatal and postnatal care services. Based on the exploratory method of this study, mothers and providers have reported that mHealth is generally a feasible, culturally acceptable, and appropriate strategy for

local communities to telecommunicate with health workers and provide mother and infant services. Another mHealth study [43] was the perception of different categories of providers towards the implementation of a dedicated mobile wallet for pregnancy-related health care—the Mobile Health Wallet (MHW). The participants' perceptions were categorized as facilitators and barriers of mHealth with a coordinated social-ecological model and relevant codes. The third study [42] also presented the perceptions and experiences of community health workers and mothers in the field of mHealth technology and the background factors that affect maternal health behavior in the form of content analysis. In one of the studies [45], health workers were asked about the feasibility, applicability, and accessibility of the application “MOTTECH.” This program was designed for low-skilled health providers in rural and under-resourced areas. It was efficiently integrated into care and facilitated the follow-up of maternal and newborn services, although its challenges should also be considered. The final study [20] also raised the perception of patients and doctors regarding mobile phone-based counseling services. The “Aponjon” services include a messaging service with interactive voice responses (IVR) and text messages. Although these consultations provided practical medical advice and support to subscribers, the service lacked policies supporting poor households.

**3.5. Synthesis of Results.** According to the extraction of mothers' and providers' views on virtual care approaches during pregnancy from the included studies and inspired by the thematic classification, we showed our findings (170 codes; 77 benefits, 93 barriers) in seven categories as follows: 1: positive or negative belief/sense, 2: sociocultural issues, 3: economic save or cost, 4: communication and information, 5: technical issues, 6: access and utilization, and 7: management issues. Each class contains related codes. These codes were separated according to participants (mothers/providers), countries' income level (high/low), and their conceptual burden (benefits/barriers). In this way, shared codes between mothers and providers were determined between two income country levels. In addition, we did not use a software program for the coding process.

The classification of codes was based on conceptual load depending on how they were reported in the included studies, while some propositions themselves indicated benefits or barriers (challenges). The seven categories and the definition of related codes are presented in Table 2. To review the results of all the classified codes by three levels of participants, type of views (+ or -), and countries' income levels, refer to Table S4 in Supplementary 4. The seven categories with shared codes between mothers and providers in countries with two income levels are also shown in Figure 3. To avoid clutter in some parts of the text and Figure 3, signs (+) and (–) have been used to indicate benefits and barriers, respectively.

**3.5.1. Positive or Negative Belief/Sense.** This category had two shared codes (two barriers) between mentioned participants from different income levels.

(1) *Lack of Trust in Virtual Methods (Mothers).* The messages and calls through mobile were not reliable for mothers unless some reputable health organizations sent them. Most preferred to visit the doctor in-person for the first time and then follow-up virtually [41, 44].

“I could not trust any message or call sent to me by any organization.” Mother (–) in a low-income country [41].

On the other hand, some participants were concerned about whether or not remote care can improve pregnancy outcomes as much as in-person care [35].

(2) *Low Willingness to Engagement (Providers).* It was expressed that even though the mobile phone (as a remote technology) was considered one of the appropriate ways to communicate with mothers, some healthcare providers were less engaged in it due to the lack of interest or unfamiliarity with the capabilities of these new technologies [40].

“A lot of my cohorts [providers] wouldn't be as engaged with all of that (digital health).” Provider (–) in a high-income country [40].

Also, changes due to the use of technology in the current reward systems of health workers may raise objections and concerns for them [43]. In the mentioned study, providers in a low-income country noted that the implementation of a new mobile payment system in the field of pregnancy-related health care replaced the former payment and reward system and finally changed their official or unofficial benefits. This issue led to an unwillingness to use and even an adversarial attitude towards the program [43].

**3.5.2. Sociocultural Issues.** This category had two shared codes (two barriers) between mentioned participants from different income levels.

(1) *Not Aware of some Related Terminology (Mothers).* There were some short terms in mobile phone text-based information services such as “high-high,” referring to high blood pressure, which was not familiar to all mothers [36]. On the other hand, most of the respondents (pregnant and postnatal period women, even lady health workers) in FGDs from low-income countries [41] declared that they were not aware of the “mHealth”-related terminologies; nonetheless, the majority of participants knew that mobile phones could provide the antenatal care services. In this regard, a study in a low-income country [44] stated: One respondent described eHealth technologies “as platforms for people in urban areas” while another mother, “thought that they are for the rich and educated class of people.” This study pointed to a strong relationship between digital literacy and the use of technology. It emphasized that for the proper use of digital technologies, the individuals (including mothers) must have reached a certain level of education and ICT skills [44].

“I am not technically proficient in software and hardware usage, it becomes hard to use sophisticated technology.” Mother (–) in a low-income country [44].

TABLE 2: Presenting the seven categories and defining the relevant codes.

		Both high- and low-income countries
Benefits	Mothers and providers	<i>Positive belief/sense</i> Positive belief and feelings codes, such as feeling safe, supporting, empowering, participating, having flexibility, and having fun
		<i>Sociocultural issues</i> Codes with the concept of reducing harm and risk. (In low-income countries, no code was reported.)
		<i>Economic save</i> Codes with the concept of saving time, travel, and child care
		<i>Communication and information</i> Codes with the concept of providing health education classes and counseling, information evidence, and improving knowledge and experiences
		<i>Technical issues</i> Codes with the concept of different technological learning, valued resources, and easy use. (In this section, for mothers from low-income countries, no code was reported.)
		<i>Access and utilization</i> Codes with the concept of the availability of health services or care
		<i>Managerial issues</i> Codes with the concept of transparency in activities and having guidelines. (Codes in this section were limited to providers from low-income countries. For other groups in this section, no code was reported.)
		<i>Negative belief/sense</i> Negative belief and feelings codes, including a lack of trust in methods or persons and concern about safety or missing health care
		<i>Sociocultural issues</i> Codes with the concept of poverty, illiteracy, lack of family or spouse support, barriers in language, or using personal mobile phones
		<i>Economic cost</i> Codes with the concept of the cost of technology or services
Barriers	Mothers and providers	<i>Communication and information</i> Codes with the concept of worrying about too much or unreliable information and the challenges in the interaction between mother and provider. (For providers from low-income countries in this section, no code was reported.)
		<i>Technical issues</i> Codes with the concept of Internet disconnection or poor connectivity and difficulties with using apps
		<i>Access and utilization</i> Codes with the concept of the probably missed usual care, difficulty in diagnosis symptoms, or lack of databases. (In this section, for mothers from low-income countries, no code was reported.)
		<i>Managerial issues</i> Codes with the concept of medicolegal risks and excessive work

(2) *Language Barriers (Mothers and Providers)*. Mothers from South Africa who responded to the “MomConnect” program [36] reported that not all languages were available for each region, so they chose English.

“Xhosa has deep words that are difficult to understand. . . about English at least you can even look in your dictionary.” Mother (–) in a high-income country [36].

A small group of them tried to change the language of the messages, but they did not succeed because they selected the desired language during registration. One of the mothers who renewed the registration with a new language received

two group messages in two languages [36]. The Dutch participants, both mothers, and providers, in the Use of a Medical Mobile App study [38], stated that it is essential to provide the program in several languages (Dutch, English, Spanish and Polish, and even Moroccan and Turkish if needed) and it improves the access of all users to the program. Also, in a study [41] on mHealth interventions, most Pakistani pregnant women wanted SMS and voice messages to be sent to them in Urdu, while a limited number requested to be sent in Sindhi.

It is expressed that healthcare providers with older age and more education had a greater understanding of the concepts of their native language in mHealth messages than



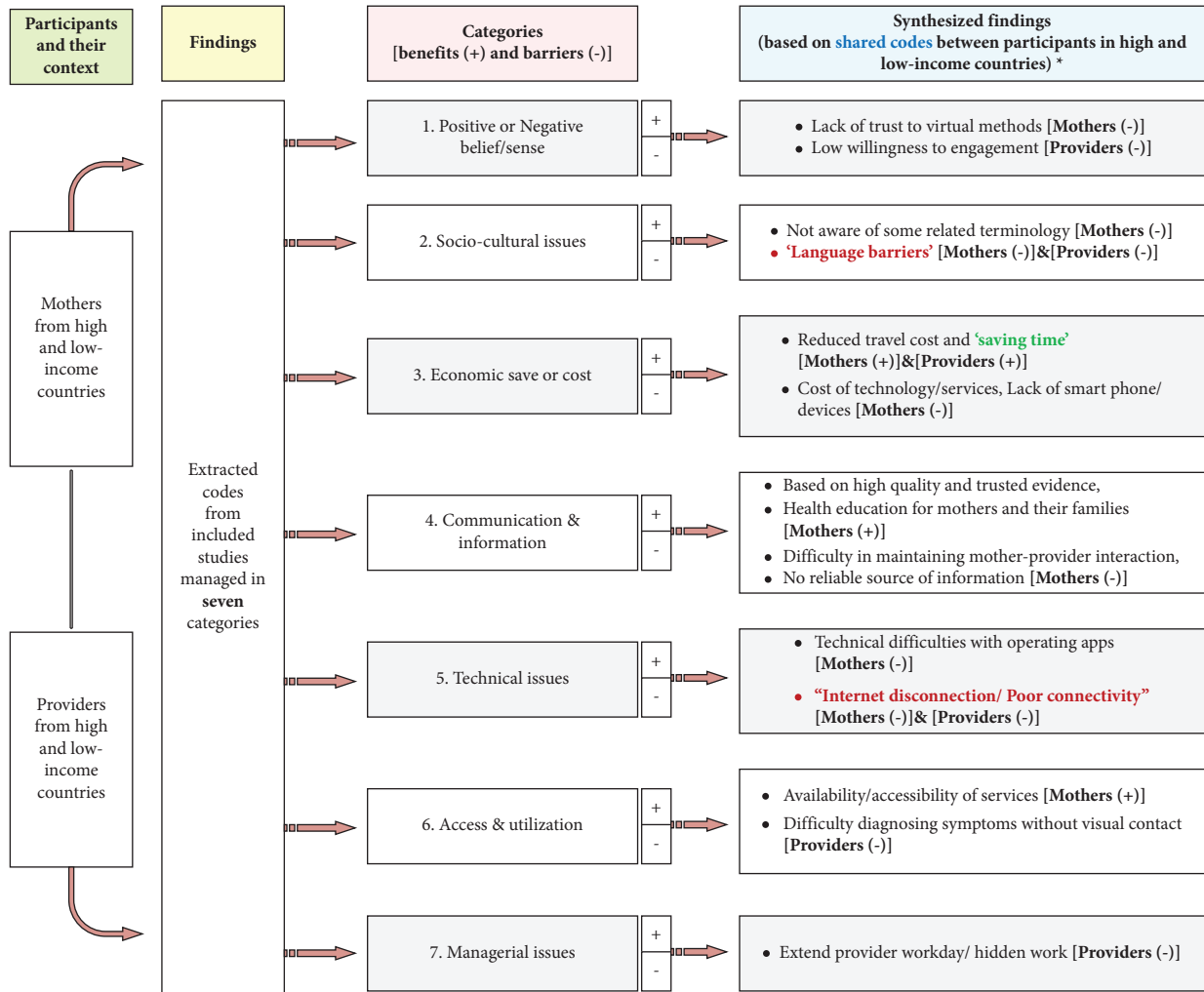


FIGURE 3: Demonstration of seven categories and summary of synthesis findings based on shared codes. \*The (+) sign indicates the benefits, and (-) the barriers. Three shared codes between participants in high- and low-income countries are highlighted.

younger and less educated ones [42]. Moreover, providers had more difficulties during telehealth visits or remote care because they were afraid of losing translations in fast talking [11, 35].

“I felt like it was really. . .she was talking really fast, and maybe I could have said, like, for. . .ask for her to slow down a little bit. I think that the main barrier was actually getting a bit lost in translation.” Provider (-) in a high-income country [35].

“Language barriers” is a shared barrier between mothers and providers from high- and low-income countries.

3.5.3. *Economic Save or Cost.* This category had two shared codes (one benefit and one barrier) between mentioned participants from different income levels.

(1) *Reduced Travel Cost and Saving Time (Mothers and Providers).* Mothers participating in the “remote care” study [35] reported potential efficiency benefits, including savings in time, travel costs, and the need to take time off work or arrange childcare. In this regard, healthcare professionals suggested teleconsultation because it was more time efficient and flexible in optimal conditions [35]. In the qualitative part of the “new prenatal care model” study [2], mothers and providers from high-income countries had a unanimous positive view in eliminating traditional barriers such as travel time and child care using the introduced model [2].

“I like the time saving it (virtual visit) brings previously, I would need to block 1-2 hours for a 10–15 min in-person visit.” Mother (-) in a high-income country [2].

Several respondents in their interviews about the “mHealth” intervention [41] expressed that this method

took less time and was easier than conventional methods of consulting a doctor, especially when the mothers' symptoms during pregnancy were not normal [41].

"Video visits are so much more convenient than in-person. I realize now that there is so much wasted time." Provider (–) in a high-income country [2].

"Saving time" is a shared code between mothers and providers from high- and low-income countries.

(2) *Cost of Technology/Services and Lack of Smartphone/Devices (Mothers)*. In a low-income country, mothers needed an Internet package to use eHealth, but it was too expensive for them. Evidence also confirms that many mothers had no or little income [44]. Hence, the continuous mHealth programs have faced barriers such as technology costs and lack of funding, and poor mothers were worried they needed smartphones to benefit from mHealth services [41]. Even for most mothers in some high-income countries, the virtual visit or telehealth model, which required a self-care device, was expensive and difficult [2, 11].

"Many people may not be able to afford a monitoring device to have at home." Mother (–) in a high-income country [2].

3.5.4. *Communication and Information*. This category had four shared codes (two benefits and two barriers) between mentioned participants from different income levels.

(1) *Based on High Quality and Trusted Evidence (Mothers)*. The care based on quality evidence is described as effective care. There were different views that remote care [35] is as effective as in-person care in achieving prenatal care outcomes. According to some mothers' ideas, remote care could improve the effectiveness of some types of care, including empowering mothers to participate in self-care [35]. The participating mothers in the mobile phone-based counseling MCH services (Aponjon) [20] explained that they considered Aponjon to be a reliable source of medical information and clinical recommendations. Their husbands also expressed their desire to use the counseling services offered by this method. While Aponjon's services have been reliable for callers, it has caused significant changes in their healthcare-seeking behavior [20].

(2) *Health Education for Mothers and Their Families (Mothers)*. The pregnancy apps played a noteworthy role in health education, especially for women with low education levels or no medical background [34].

"...Many pregnant women, especially the less educated, only know too little about their pregnancies. ...Maybe via answering the questions, women might experience a kind of wow-effect." Mother (+) in a high-income country [34].

MHealth is also used for patient education. Providers have shared their information with pregnant mothers through mobile phones and have used website links, photos, text, and videos for health education [41]. In a mHealth lifestyle intervention in high-income countries [40], mothers expressed a desire to use several technological elements in interventions to benefit from different learning styles based on their needs. In another mHealth intervention in low-income countries [41], mothers noted that reminders and voice messages of health education (including maternal nutrition and danger signs in pregnancy) helped them improve their positive behaviors.

(3) *Difficulty in Maintaining Mother-Provider Interaction (Mothers)*. Mothers often noted a lack of effective communication with providers and a lack of confidence in the use of Web and mobile phone apps or remote care [34, 35]. According to the experience of some mothers, due to the short time of virtual conversation, the direct interaction time between the doctor and the patient was not enough. Furthermore, it was difficult for mothers to express concern about some of their symptoms or mental health issues in these virtual ways [34].

"I'll be honest, I don't think I have got a relationship with the midwives because there isn't that face-to-face interaction." Mother (–) in a high-income country [35].

Also, mothers in a low-income country who experienced eHealth mentioned that they were not connected to health providers directly [44].

(4) *No Reliable Source of Information (Mothers)*. Most pregnant women respondents in the pregnancy-related apps study criticized the lack of authentic scientific virtual resources [34]. The lack of Internet resources was mentioned, especially on issues like pregnancy complications, fetal growth, or nutrition [34, 39].

"...There is so much information out there, and when you get some sort of guideline, that's something different from reading magazines or other Web-based portals." Mother (–) in a high-income country [34].

Pregnant women in a low-income country with eHealth antenatal care practices [41] had stated that they did not respond to the information received through messages and calls unless the source sender was some well-known health organization. According to some mothers, text messages also were not a sufficient source of information [41].

3.5.5. *Technical Issues*. This category had two shared codes (two barriers) between mentioned participants from different income levels.

(1) *Internet Disconnection or Poor Connectivity (Mothers and Providers)*. Both groups of doctors and mothers mentioned challenges related to mobile phone-based consultation

services during network outages. In addition, it happened because the center's line was also busy, and mothers had to call many times [20].

“(The) Internet in this area is not good at all. I cannot sustain a WhatsApp call for even 3 minutes, calls keep dropping.” Mother (–) in a high-income country [44].

Sometimes, mothers had problems accessing the network during registration, which led to delays and increased waiting time for mothers to register their details [36].

“The network is not stable. The thing indicates it's connecting, for five minutes, it's still connecting. So you have to wait, waiting, waiting, ...” Provider (–) in a low-income country [45].

The limitations of the mobile phone network in rural areas created influential challenges for uploading the data needed by mothers. This issue also made providers face additional trouble because they had to look for suitable places where the connection to the network could be established better [45]. “Internet disconnection or Poor connectivity” is a shared code between mothers and providers from high- and low-income countries.

(2) *Technical Difficulties with Operating Apps (Mothers)*. The initial setup of the software was challenging for some mothers, so they were reluctant about telehealth services [11]. Sometimes, there were problems due to the lack of access to the network during the registration of mothers in the app, which led to an increase in the waiting time for mothers [36]. A few mothers had difficulty using smartphones and widely used applications such as WhatsApp [41]. On the other hand, some applications were difficult for mothers to use, especially for beginners. If there were nonvisual guides, their use would have become more complicated [44].

“How do you use something you do not know about?” asked one mother. “Some systems are very hard to navigate,” another mother emphasized. Mother (–) in a high-income country [44].

3.5.6. *Access and Utilization*. This category had two shared codes (one benefit and one barrier) between mentioned participants from different income levels.

(1) *Availability/Accessibility of Services (Mothers)*. The undergoing mothers in remote antenatal care cited increased access as one of the benefits of this method [35]. Various ways facilitate their access, including receiving psychological support for mothers in the perinatal period and consulting with a multidisciplinary specialist team. Up-to-date communication methods such as social media, pregnancy apps, and various digital resources also improve mothers' access to information, services, and support [35, 40].

“I believe that mobile phones would provide easy access to healthcare providers. I could resolve my queries over the phone without even waiting for a long time in the clinic.” Mother (+) in a low-income country [41].

By the way, mothers who experienced “Aponjon” services in a low-income country were satisfied with counseling services because they could access a specialist doctor at different times [20]. Anxious pregnant women, with quick access to these counseling services, were able to find the necessary information and reassurance about their situation [41, 43].

(2) *Difficulty Diagnosing Symptoms without Visual Contact (Providers)*. The participating doctors in a low-income country reported that one of their challenges in “Aponjon” consultation services was diagnosing symptoms without performing a visual examination [20]. Then, they had to ask for more explanations from the mother. At the same time, they could not rely on the explanations because a mild condition, in their opinion, could be a severe diagnosis [20].

“We look at the color of their skin, whether or not they look anemic, or depressed, we can't do that on the phone.” Provider (–) in a high-income country [35].

About remote care, providers in a high-income country were worried that touch, nonverbal signs, and symptoms of physical and mental illnesses in pregnant mothers would be ignored and missed [35].

3.5.7. *Managerial Issues*. This category had only one shared code (one barrier) between mentioned participants from different income levels.

(1) *Extend Provider Workday/Hidden Work (Providers)*. In using the mobile client data app [45], mothers have stated that “if employees had the opportunity to manage their data instead of multiple care tasks, the provision of virtual services to them had improved.” Some employees also suggested hiring a new cadre of training for data entry [45].

“I do have some problems with...recording the care given. There is no help. We need some nurses to help us.” Provider (–) in a low-income country [45].

In addition, remote care created hidden work and increased the workload. Collaborative spaces for teamwork, communication, and positive working relationships appear to have been required for remote care delivery [35].

## 4. Discussion

4.1. *Synthesis of Evidence*. This synthesis presented results in seven categories from mothers' and providers' perspectives on virtual care approaches during pregnancy, separated from high-income and low-income countries. In this study, we used the meta-aggregation method based on pragmatism.

Meta-aggregation is interested in how the findings are helpful and applicable. This method also seeks to activate generalizable statements to use them to provide advice and guidance to practitioners and policymakers [24, 25]. According to scientific innovations, the world emphasizes improving maternal health services using digital technologies [46]. This review presented studies from six virtual approaches of mHealth, eHealth, telehealth, remote care, virtual visits, and applications for prenatal care. Most of our studies showed the use of mHealth methods [20, 36, 37, 40–43]. Accordingly, a review from Morocco confirmed that this method is an attractive way to provide health interventions due to their capabilities, widespread acceptance by people, and easy portability [47]. Moreover, another review of mHealth intervention emphasized that mobile phones in low- or middle-income countries have been used to sensitize the target group and provide prenatal education as a participation tool. Also, mobile phone technologies have followed up mothers' care through interactive communication [19].

In the present synthesis, there was a conflicting view among the participants for using virtual practices. Some mothers and providers in both groups of countries had a pessimistic view of using virtual methods in prenatal care, while more identified risks and barriers to implementation [2, 35, 36, 41]. The participants were concerned about the continuity of prenatal care and the effectiveness of these methods [2, 35, 37, 44]. On the other hand, the reduction of in-person visit schedules and replacement virtual visits have been associated with positive views and experiences for some other patients and providers [2]. Even some mothers from low-income countries showed willingness to use mHealth in the future [41]. Confirming the issue, mothers and health-care providers who had benefited from telemedicine through video visits would like to continue virtual visits in the future [48]. In another study, mothers and providers were grateful for the virtual care provided because mothers could raise their problems with the providers through the phone or video and follow the health status themselves [13].

One of the benefits of video visits in high-income countries related to sociocultural status has been reported to eliminate risks of exposure and avoidable harm for mothers and providers during the pandemic [7, 11, 35]. Evidence in this review showed that illiteracy and digital poverty affected technology adoption. Also, in low-income countries, the use of health technologies contributed to the workload at home and the lack of mothers' support from their spouses, family members, and community [41, 42, 44]. In this regard, language barriers are presented in both level-income countries because mothers prefer to use programs or messages set in their local language [1, 11, 35, 37, 42, 44]. There were other studies to agree affected the context and sociocultural status of maternal health by digital interventions [8, 15, 49–51].

Despite the benefits of virtual pregnancy care in saving time, travel cost and time, and child care [2, 35, 41, 45], which have been mentioned in other studies [52, 53], some mothers from countries of both income levels are involved with the lack of funds and the cost of technology to provide

smartphones or self-care devices; of course, these problems were deeper in low-income countries [2, 11, 20, 35, 40–44]. Other studies have also mentioned some challenges of equipping smartphones and home monitoring devices [1] or financial issues [8].

Some studies showed that new and evidence-based information on pregnancy-related topics was made available to mothers through different virtual modalities [20, 35, 37–39]. Other similar studies also confirm this issue [49, 54]. However, some mothers from countries with both income levels criticized the low quality of web-based information resources or mobile apps and sometimes did not consider the resources to be reliable [36, 39–41]. Moreover, another issue that bothered mothers was the provision of large amounts of information by various apps, which confused mothers and occupied a lot of smartphone memory [38]. Other studies have also pointed out participants' concerns about the reliability of information [1, 55, 56] or information fatigue [16].

Some providers used mHealth and mobile phone-based programs for counseling, data management, and patient education to help mothers with decision-making or follow-up on health issues. [2, 34, 36, 37]. In this issue, there was other evidence about using virtual technology, especially mHealth, to improve mothers' knowledge and practices related to pregnancy in low-income countries [57–60]. Nevertheless, some mothers complained of barriers such as lack of nonverbal feedback and difficulty maintaining continuous interaction between mother and provider [2, 7, 35, 44].

Our evidence indicated that in the technical sector, the most challenges related to mothers and providers in countries of both income levels were in the Internet and network connection domain [2, 20, 36, 42, 44]. About this issue, other studies confirm the unstable network connection or its coverage problems [1, 15, 49, 54, 55, 61]. Some participants declared that the Internet was cut off during the virtual visit or in the middle of the consultation, which led to mothers' stress regarding their health and the fetus [2, 20, 36, 44, 45]. Then, they are forced to use virtual services during nonpeak hours (midnight to early morning), especially with low Internet speeds [36, 44].

Most participants in high- and low-income countries acknowledged that virtual visits, mHealth, and other digital methods help to increase access to antenatal services [20, 35, 40–42]. It has been mentioned in numerous studies that these methods have eliminated traditional barriers to receiving care [16, 19, 53, 62]. At the same time, some providers and mothers from high-income countries (who had virtual contacts for mothers' care) were concerned about missing usual prenatal care, including BP and FHR, because it was difficult to diagnose the problem in mothers without visual contact [2, 20, 35]. Healthcare providers in a study of 71 countries with different income levels also reported that they could not perform physical examinations and monitor fetal heart rate and fundal height with telemedicine [8].

One of the challenges for providers in high- and low-income countries was that applying digital technologies such as remote care had led to an increased workload or their

invisible work [35, 44]. Some healthcare workers in a study from low-income countries stated they faced multiple caregiving responsibilities at work [44]. What added to the problem was the withdrawal of some trained personnel from the health services system [35]. The regional managers proposed to hire new staff for additional digital services or to instruct the existing cadre and strengthen their motivations [35, 44, 45].

**4.2. Limitations.** According to the research team's opinion, the strength of this synthesis was the investigation of views in three areas, including the participants, the type of views (+, -), and the income level of the countries, and then presenting in a comparable set. We have also had several limitations during this synthesis. One of our challenges in this synthesis was that the participants' sentences, despite the same concept, sometimes had different words, which probably made it difficult to combine the codes. Therefore, to solve this challenge, we had to search for the same concepts after extracting the raw statements of the participants from the entered studies, even though they were not expressed in similar words. After setting the table of desired terms, we used the consensus of the reviewers in a meeting to obtain single codes and finalize our table. The number of included studies was not equal between high- and low-income countries (ten versus six). Of course, this could be due to the tremendous development of digital technology in high-income countries. However, we were concerned about the lack of intended data from low-income countries. Fortunately, due to the reasonable validity of the included studies and the richness of the findings of the studies of low-income countries, the difference in codes between the two categories of countries was 16 codes. Some included studies did not mention a quote in desired topics or had different participants. Therefore, we could not find the appropriate quote for some shared codes. Although some of the recent studies did not have a full qualitative report with participants' quotes, at the same time, they contained valuable information due to the classification of extracted themes and codes by separating benefits and barriers. We know the number of participants is not as significant as the sample size in quantitative studies, but we were sensitive to it. Further, the findings showed that data saturation was also adjusted for this weakness. Finally, our inclusion criteria in the current synthesis were studies in English, so studies in other languages were not included.

## 5. Conclusions

This review synthesized perspectives of mothers and providers in high- and low-income countries regarding the virtual care approach during pregnancy. We focused on similarities between participants' views in the different income countries levels and organized all these similarities into seven categories. Positive or negative belief/sense, socio-cultural issues, economic save or cost, communication and information, technical issues, access and utilization, and management issues were our categories that each class

contains related codes. These codes were set in three areas: participants, type of views (+ or -), and countries' income levels for comparing them. Language barriers, saving time, and Internet disconnection or poor connectivity were three shared codes between the beneficiaries at two income countries levels regarding virtual care during pregnancy. Our review indicated overall shared views between participants with using virtual methods. However, to provide effective interventions based on virtual methods during pregnancy, there is a need for different types of studies on these methods in each particular region.

## Abbreviations

SID:	Scientific information database (a Persian database)
ConQual (the ConQual approach):	Confidence in qualitative synthesis findings.

## Data Availability

All data generated during this study are included in this published article (and its supplementary information files).

## Disclosure

This article is part of the first author's doctoral (Ph.D.) thesis. It is worth mentioning that it was registered with ID code (896) at Shahroud University of Medical Sciences.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

## Authors' Contributions

All authors contributed to this manuscript. H.S. as a first author (doctoral student) extracted the codes and prepared the manuscript draft. A.K. as the first supervisor and A.S. as the thesis advisor reviewed the manuscript, critically evaluated the studies, and reviewed the tabulation based on the extracted cases. J.K. and S.G. reviewed the search process, extracted data, and prepared figures as a second supervisor and statistics consultant, respectively.

## Supplementary Materials

Table S1: the search strategy in databases and search engines. Table S2: characteristics of included qualitative studies in high- and low-income countries. Table S3-1: the included qualitative studies' critical appraisal within sources of evidence using the JBI critical appraisal checklist. Table S3-2: the ConQual summary findings. Table S4: summarized codes from participants' perspectives. Completed table of PRISMA-ScR 2020 checklist for systematic reviews. (*Supplementary Materials*)

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