

The impact of the COVID-19 pandemic on routine maternal vaccination acceptance; A mini review

Ioannis Pichlinski¹, Maria Lagadinou², Markos Marangos², Gabriel Dimitriou¹, Despoina Gkentzi¹

Abstract

In this mini review we aimed to identify how the COVID-19 pandemic affected pregnant women's acceptance of routine maternal vaccines and discuss further about the factors influencing decision making. The literature was reviewed from January 2020 to October 2023 in PubMed and Google Scholar, searching for relevant articles. The systematic review conformed to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines. The inclusion criteria were fulfilled by 12 studies conducted in several countries. Overall, a positive impact of the pandemic was suggested in seven articles, while four articles showed no alterations in pregnant women's opinions and attitudes towards routine maternal vaccines. Based on the results of this review, there is evidence that the COVID-19 pandemic may have had a positive impact on maternal vaccination acceptance. In order to effectively overcome the obstacle of vaccine hesitancy in the pregnant population, reliable professional information should be communicated targeting safety, effectiveness and availability of routine maternal vaccines.

Key words: COVID-19; impact; routine maternal vaccination; acceptance

INTRODUCTION

Routine maternal vaccination

The World Health Organization (WHO) as well as the Advisory Committee on Immunization Practices (ACIP) suggest that both the inactivated influenza vaccine and the Tdap (Tetanus, diphtheria and acellular pertussis) vaccine should be given as part of routine as antenatal care [1,2]. Additionally, the American College of Obstetricians and Gynecologists (ACOG) strongly recommends

COVID-19 vaccination during pregnancy [3]. All vaccines are effective and safe in protecting pregnant women, fetuses and infants up to six months of age from communicable and vaccine-preventable diseases (VPDs) [1,2,3]. Since fetuses and neonates have immature and relatively ineffective immune system, they receive passive immunity to potential pathogens by transplacental IgG transfer from the mother, which begins at about the 17th week of gestation, continues until birth and is followed by postnatal breast milk-derived antibody transfer. Consequently, there is a strong dependence of fetuses and newborn infants on maternal immunity which highlights the pivotal role of immunization of pregnant women [7,8].

During pregnancy, the human body faces several biological changes including alterations in metabolism, ventilation and tidal volume, blood pressure and vessel

¹Department of Pediatrics, Medical School of University of Patras, Rio, Greece

²Department of Internal Medicine, Medical School of University of Patras, Rio, Greece Sciences, University of Patras, Patras, Greece

Received: 19 Jan 2024; Accepted: 10 Apr 2024

permeability, along with immunological regulations [5]. The latter are crucial for the selective suppression of Th1 cell-mediated immunity and up regulation of regulatory T-cells activity [11], which is a protective mechanism against recognition of antigens of the fetus and consequent miscarriage. However, this compromise of maternal immune response leads pregnant women to be more vulnerable to infectious diseases and to have greater chances of experiencing severe infection-related complications, compared to non-pregnant women [9,12]. One of the major epidemiological burdens is caused by influenza virus, which puts pregnant population at increased risk for severe disease and hospitalization, while complications in pregnancy, such as preterm delivery and small for gestational age infants, are more likely to happen [10,13,14].

Bordetella pertussis is the second pathogen against which there is a strong recommendation for routine maternal vaccination, affecting mostly neonates and young children, causing life-threatening clinical manifestations and raising mortality in infants up to 2 months of age [15,16]. Unless Tdap vaccine is administered during pregnancy especially in the third trimester, infants remain vulnerable to pertussis until their primary vaccination series. Thus, infants under six months of age are considered to be a high-risk population for severe pertussis infection [15,16,17]. Taking into consideration that young infants are also not included in influenza vaccination recommendations before that specific age, the imperative need for routine maternal vaccination to protect the youngest and most vulnerable infants from these preventable infectious diseases, is emphasized [18].

COVID-19, obstetric care and maternal vaccination

The COVID-19 pandemic, caused by the Severe Acute Respiratory Syndrome-Coronavirus 2, (SARS-CoV2) outbreak in December 2019 in Wuhan, China, had a massive impact on healthcare services globally. In particular, obstetric care, which usually includes routine visits for the best prenatal and postnatal outcome, faced significant challenges including remote counseling, monitoring and guidance of pregnant women, besides access to vaccination [19,20,21]. Apparently, healthcare practitioners had to lead the campaign of communicating the undoubted benefits of immunization against COVID-19 not only for the mothers but also for their babies [2,4]. Thus, the experience of the pandemic demonstrated that

obstetricians' and midwives' recommendation for vaccination remained the most influencing factor to increase vaccine acceptance and outweigh hesitancy [22,23]. It is of note that the internet and social media were also significant sources of information about medical subjects, such as complications of COVID-19 during pregnancy and COVID-19 vaccine's safety and efficacy [24,25]. This review takes a comprehensive approach to clarify the impacts of COVID-19 pandemic on willingness and acceptance of routine maternal vaccination from pregnant women.

METHODS

Review methods and eligibility criteria

This systematic review was organized and conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines [26]. We reviewed all the existing literature from January 2020 to October 2023, focusing on articles relative to the impact that the COVID-19 pandemic had on the acceptance of routine vaccination from pregnant individuals. All of them were written in the English language, while articles in other languages were excluded. Only full-text accessible articles were eligible for review, with particular interest in observational studies (Figure 1).

Information sources

PubMed and Google Scholar databases were thoroughly searched to select potential articles. The keywords and combinations of words used to select the relevant articles are the following: *COVID-19, pandemic, pre-pandemic, post-pandemic, impact, influence, affected, vaccines, vaccination, immunization/immunization, pregnancy, routine maternal, antenatal, pregnant, Tdap, pertussis, influenza, acceptance, accepted, willingness*. By screening the references of included articles using 'the snowball method', additional articles were retrieved. Duplicate publications were identified and excluded. Overall, we identified 274 potentially relevant studies (Figure 1) and screened all of them by title and abstract. Of these, we removed 61 duplicates, 196 studies that did not clearly relate the COVID-19 pandemic with routine maternal vaccination, one study published in Spanish and three studies that we did not have full access to the content but were excluded from the abstract. As the grey literature and national reports were not eligible for inclusion, another study, published by the Canadian Government, was excluded. We, therefore, included 12 articles.

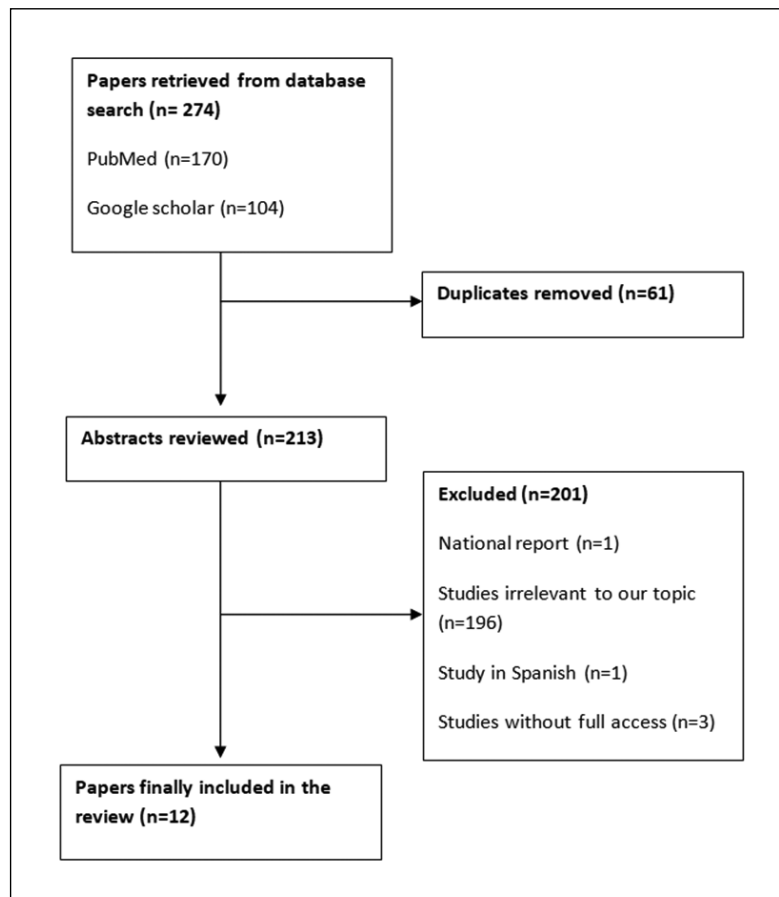


Figure 1. Study flowchart to identify and select eligible studies in the systematic review.

RESULTS

In total, the authors included 12 articles that specifically analyze, describe or refer to any potential impact that the COVID-19 pandemic may have had on routine maternal vaccination acceptance. In contrast to the limited number of articles, we tried to include studies conducted in a variety of countries, aiming to achieve a global approach (Table 1). Our main goal was to identify the effects of the pandemic on the perceptions of pregnant women for routine maternal vaccination. The majority of the reviewed articles were questionnaire-based.

Impact of the COVID-19 pandemic on the acceptance of routine maternal vaccination

During the pandemic pregnant women faced several unprecedented difficulties and changes in their standard prenatal care [18]. However, our review showed that their perceptions about routine maternal vaccination remained unchanged, as reported in four articles [31,33,37,38], or may have been positively affected by

the pandemic, which is an interesting finding of seven articles [28,29,30,32,34,35,36]. In addition, a common conclusion of these articles was the fact that the COVID-19 pandemic raised awareness about the benefits of maternal vaccines and in general positively changed pregnant women's attitudes towards vaccination. One study in Turkey also highlighted a 28,9% decrease in maternal vaccine hesitancy during the COVID-19 outbreak [33]. On the other hand, a study from Pakistan showed a 28,8% decrease in Tetanus Toxoid maternal vaccination during the pandemic [27].

As far as immunization against influenza is concerned, the higher acceptance rate during the COVID-19 pandemic [30,32,34,36] and the observed positive link between COVID-19 and influenza vaccine uptake [32], may indicate that pregnant women's opinions regarding influenza viral infection and their willingness to receive the vaccine has been positively influenced by the pandemic.

Of note, two articles found that the maternal atti-

Table 1. *Studies referring any impact of the Covid-19 pandemic on routine maternal vaccination acceptance.*

Reference	Country /year of publication	Study Type	Number of participants (if any)	Main findings
Chandir et al	Pakistan (2020)	Retrospective data-analysis study	-	A 28,8 % decrease in maternal Tdap vaccine was observed due to missing follow-up appointments during the spread of Sars-Cov-2.
Anderson et al	UK (2021)	Qualitative interview study	n=31	The pandemic had elevated the importance of routine maternal vaccines.
Cavaliere et al	Italy (2021)	Cross-sectional study	n=195	The COVID-19 pandemic raised awareness and had a positive impact on attitudes towards immunization during pregnancy.
Wang et al	China (2021)	Multicentre cross sectional study	n=2568	The higher acceptance rate of influenza vaccine during the Covid-19 pandemic may indicate raised awareness of pregnant women towards protection through vaccination.
Saleh and Halperin	Israel (2022)	Online questionnaire-based study	n=410	The pregnant women participating in this survey did not change their approach towards influenza vaccination despite the 2 nd and 3 rd wave of COVID-19.
Pisula et al	Poland (2022)	Cross-sectional study	n=515	The increase in vaccination acceptance might be influenced by the pandemic; positive link between COVID-19 and influenza vaccine uptake.
Gencer et al	Turkey (2022)	Cross-sectional study	n=152	The COVID-19 pandemic caused a decrease in vaccine hesitancy in 28,9% of the participants; no effect to 50,6 % and positive effect to 44,1% for future vaccinations.
Lumbreras Areta et al	Switzerland (2022)	Multicentre-prospective survey-based study	n=951	Comparing the findings of this survey during the pandemic (2021) with the maternal vaccination rates in 2019, those of influenza were significantly higher indicating increased vaccine awareness during the pandemic. Tdap rates were similar during both seasons.
Bruno et al	Italy (2022)	Repeated cross-sectional study	n=104/n=241	The pandemic may have positively affected pregnant women's opinions about vaccination.
Shamoun et al	USA (2022)	Retrospective descriptive cross-sectional study	n=293/n=185	The pandemic had a positive impact on influenza vaccination rates in the pregnant population. No difference in Tdap vaccination rates.
Kim and Kim	Korea (2023)	Cross-Sectional study	n=351	The Covid-19 pandemic did not affect or increased the uptake of influenza vaccine in pregnant women.
Zimmerman et al	USA (2023)	Qualitative study	n=42	The COVID-19 pandemic had not affected the perceptions towards vaccination in pregnancy (67%)- 19% positive impact.

tudes towards Tdap remained unchanged and similar to pre-pandemic years [34,36]. One article reported negative impact [27], in contrast with the conclusion

of a study from the USA that showed greater acceptance of maternal tetanus vaccine, compared with other vaccines [38].

The pivotal role of healthcare practitioners

Among the reviewed articles mentioned above, one study from the USA showed that 79%-81% of the participants were more inclined to receive influenza and Tdap vaccines if their doctor recommended them to do so [38], while two more studies stated that a medical recommendation would make mothers more positive to receive the vaccines [29,36]. In addition, a Polish study reported that the majority of its participants would prefer to receive better and more detailed information about maternal influenza vaccination from their healthcare practitioners, even though they were not offered the vaccine during their pregnancies [32]. Moreover, an Italian survey, comparing beliefs of pregnant women before and after the pandemic, found that in both periods the most trusted source of information about vaccines were institutional sources and healthcare providers [35]. With regards to influenza, a Korean survey found that trust in healthcare professionals was significantly higher in pregnant women vaccinated against influenza [37], whereas a study from Israel highlighted that although pregnant women's trust in healthcare practitioners is a fundamental factor for vaccine compliance, their recommendations for flu vaccine were ignored during the pandemic [31].

Factors that influence maternal vaccination uptake

Except from the recommendation from a healthcare practitioner, other factors determining the decision for vaccination in pregnancy, as highlighted during the pandemic, include mother's level of education with women with higher academic degrees being more inclined to get vaccinated [31,34,55], ethnicity [57], younger maternal age [55,57] and working status [56] along with average income per family member [32]. Additionally, what the COVID-19 pandemic definitely clarified was the power of influence of the internet and social media on public opinion about medical issues, such as vaccine confidence [24]. In particular, one article in this review mentioned that non-institutional websites with COVID-19 related content received significant attention during the pandemic [35]. Also a study from Turkey related vaccine hesitancy with fear derived from negative news from social media [33], while another study characterized the Internet as the main source of information about the pandemic [32].

DISCUSSION

In the era of COVID-19, vaccination in general and particularly during pregnancy was a widely discussed

topic. The fact that pregnant women were excluded from clinical trials of COVID-19 vaccines and the consequent lack of evidence about safety and efficacy regarding this population, led them to question the need of vaccination [24,32,42,46,47,48,59]. As far as general population is concerned, the pandemic had also indirect effects on routine immunization programs by disrupting health-care services, causing a worth-mentioning decline in childhood vaccination [49,50,51]. However, the experience of the pandemic resulted in raised awareness about routinely used vaccines and motivated people to search for more information about immunization [52].

Inevitably though, vaccine hesitancy remained one of the most critical obstacles to overcome, in order to minimize the mortality and the morbidity caused by vaccine-preventable diseases [53]. While pertussis, influenza and SARS-Cov2 vaccination during pregnancy protects not only pregnant women but also their fetuses and infants, strategies to decrease maternal hesitancy are of paramount importance [54].

A relationship of trust between pregnant women and health-care practitioners, such as obstetricians-gynecologists, midwives or general practitioners plays a pivotal role in the decision for vaccination [58]. The COVID-19 pandemic emphasized the health-care practitioners' responsibility for raising awareness about the availability, the indications and the benefits of routine maternal vaccination, along with addressing every question and concern about safety is of great significance [29,36,38,59].

This review article tried to identify how pregnant women's perceptions about routine maternal vaccination were affected by the COVID-19 pandemic, during which the subject of immunization was put in the center of interest and this area is obviously still evolving yet more data is to come.

Conclusions and future perspectives

Although there is yet limited data in the field, there is evidence that the COVID-19 pandemic has not altered and may have had a positive impact on maternal vaccination acceptance. However, further research and actions are needed and global harmonized vaccination strategies for pregnant women should be implemented. The pandemic reminded the international medical community that the role of health care practitioners, especially obstetricians and midwives, for raising public awareness about the risk of infectious diseases during pregnancy and the necessity of vaccination, is of paramount impor-

tance. In order to effectively overcome the obstacle of vaccine hesitancy in the pregnant population, reliable professional information should be communicated targeting the efficacy, the safety and the availability of routine maternal vaccines. Interestingly, the number of the available maternal vaccines will increase in the future, while the new maternal Respiratory Syncytial Virus (RSV) vaccine is already licensed [60] and others are yet to come. The lesson learnt from the COVID-19 pandemic could contribute to raise vaccine acceptance for future vaccines in pregnancy.

Conflict of interest disclosure: None to declare.

Declaration of funding sources: None to declare.

Author Contributions: Ioannis Pichlinski performed the literature search under the supervision of Despoina Gkentzi and drafted the manuscript. Despoina Gkentzi, Maria Lagadinou, Markos Marangos and Gabriel Dimitriou contributed to the critical revision of the article for important intellectual content and final approval of the article.

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Corresponding author:

Despoina Gkentzi
Department of Paediatrics, Medical School of University of Patras, Rio, Greece
Tel.: +30 2610999543, +30 6972307569
E-mail: gkentzid@upatras.gr