
**“KNOWLEDGE ATTITUDE AND PRACTICE
OF COVID-19 VACCINATION IN
PREGNANCY AT KAHER’S DR.
PRABHAKAR KORE HOSPITAL AND
MEDICAL RESEARCH CENTRE”**

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LIST OF ABBREVIATIONS USED

Cov19	Covid 19
ICU	Intensive Care Unit
NICU	Neonatal intensive care unit
KAP	Knowledge Attitude and Practice
NTAGI	National Technical Advisory Group of Immunisation
MV	Mechanical Ventilation
OICU	Obstetric Intensive Care unit
ARDS	Acute Respiratory distress Syndrome
VLP	Virus like particle
MERS	Middle East Respiratory Syndrome
WHO	World Health Organisation
IEC	Information Education and Communication
MNHR	Maternal Neonatal Health Registry
BMI	Body Mass Index

ABSTRACT

AIM

Pregnant women were susceptible to corona virus infection because of the physiological changes attained due to the pregnancy in cardio-respiratory system and immune system. Fetus in the uterus may be exposed to the infection when mother is infected with the disease. Corona virus may be associated with adverse pregnancy outcomes like preeclampsia, pre-term birth, gestational diabetes, c-section, NICU admission of the newborn, stillbirth, maternal deaths, deaths of infected newborns. Hence, present study was conducted to understand the factors like knowledge, attitude and behavior toward the corona virus vaccination among pregnant women. This reduces the burden of complications during pregnancy and reduces the complications of newborn.

METHODOLOGY

In an Antenatal clinic of KAHER's Dr Prabhakar Kore's charitable Hospital, Belagavi, Karnataka state. The study design was cross-sectional prospective study. The study duration was one year. All pregnant women attending the outpatient or inpatient department of the clinic were eligible. Those eligible patients who gave informed consent in written format were included in the study. Pregnant women with history of anaphylaxis reaction to influenza or dengue vaccines were excluded from the study.

RESULTS

Awareness about corona virus infection was present in majority of the study participants (n=196, 81%). Awareness of availability of Corona virus vaccine were in

56.2% of the study participants (n=136, 56.2%). Awareness of availability of vaccine were: Covaxin vaccine (n=112, 46.3%), followed by Covishield (n=101, 41.7%) and other vaccines like Sputnik (n=29, 12%). Among study participants, only 55.8% of the study participants were aware of single dose of vaccine (n=135, 55.8%). Majority of them reported that corona virus vaccine is unsafe during pregnancy (n=144, 59.5%). Among the study participants, 68.9% (n=168) recorded corona virus vaccine is unsafe on lactating women. Among the study participants, 67.4% (n=163) mentioned they are aware of adverse effects of taking corona virus vaccination. Majority of study participant's source of information regarding corona virus were through television (TV) or social media accounting to 28.9% (n=70). Among the study participants, prevalence of vaccinated individuals was 14% (n=34). Among the study participants, 82.4% (n=28) reported they had side effects after taking corona virus vaccination.

INTERPRETATION

Low acceptance of corona virus vaccine among study participants during pregnancy was reported. Even though the knowledge on corona virus and the vaccination availability is high, the vaccine hesitancy is higher. Recommendations from the healthcare workers on knowledge on safety of vaccines among the pregnant and lactating women and its importance should be provided as counselling. Providing knowledge on the side effects, safety, and complications in pregnancy should be counselled by healthcare workers or general physician to increase the vaccine acceptancy among the study participants.

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INTRODUCTION

The World Health Organization (WHO) announced corona virus as a global outbreak in March 2020. Severe mortality and morbidity were observed in the pandemic ⁽¹⁾. The corona virus caused by SARS-CoV-2 which erupted in Wuhan, China. Globally, 772 million corona virus cases were confirmed and 7 million deaths were reported as of December 2023 report from the World Health Organization ⁽²⁾. In India, 45 million corona virus cases were confirmed and over half a million were died due to the infection ⁽³⁾. Lockdown of the country was announced at various phases to reduce the decrease the spread of the corona virus infection in India. Lockdown was announced on 25th of March 2020 ⁽⁴⁾.

Pregnant women were susceptible to corona virus infection because of the physiological changes attained due to the pregnancy in cardio-respiratory system and immune system. Fetus in the uterus may be exposed to the infection when mother is infected with the disease. Corona virus can lead to unfavorable complications like preeclampsia, pre-term birth, gestational diabetes, c-section, NICU admission of the newborn, stillbirth, maternal deaths, deaths of infected newborns ^(5, 6, 7, 8, 9).

Most of expecting women with the corona virus infection doesn't show any symptoms. However, expecting women with corona virus infection can have symptoms from mild to severe and even critical disease. This might lead to ARDS (acute respiratory distress syndrome), pulmonary embolism, and acute coronary syndrome. Among the target group, number of days in the hospital were reported to be significantly increased ⁽¹⁰⁾. When compared to expecting and non-expecting women, almost one by third of expecting women had to be hospitalized whereas only 5.8% of non-expecting women had to be institutionalized according to a study

conducted in 2020 ⁽¹¹⁾. Another study from 2021 reported pregnant women with corona virus had severe corona virus US infection when compared to non-pregnant women with corona virus ⁽¹²⁾.

Corona virus pandemic considered as a threat to multiple dimensions of life including lifestyle, current health systems, economy. Because it causes mortality among individuals who are vulnerable. One among the vulnerable population is pregnant women. The risk of developing severe corona virus infection is higher among pregnant women. The infection is rare to transfer from mother to fetus ⁽⁶⁾. Corona virus can be passed from mother to fetus intrauterine, intrapartum, during delivery or during contact between the mother and the baby in postpartum ⁽⁷⁾. Corona virus also increases the risk of development of chronic anxiety among the pregnant women. It can also increase the risk of development of adverse outcomes during pregnancy like increased cesarean section during delivery, still birth, maternal mortality. Corona virus outbreak leads to reduced or disrupted required maternal child health services ⁽⁶⁾.

To combat the disease, which was also continuously mutating, development of vaccine became the priority. Various countries tried to develop vaccines for corona virus which included inactivated, live attenuated, viral vector, protein subunit, RNA, DNA, and virus like particle (VLP) vaccines. One essential way of stopping the corona virus infection from spreading and eventually containing epidemic is vaccination ⁽¹³⁾. However, a higher rate of virus RNA-dependent RNA polymerase (RdRp) and the presence of a highly changeable receptor-binding motif in the spike (S) protein, vaccine effectiveness is impacted by the ongoing acquisition of viral mutations ^(14, 15). Initially when the corona virus vaccines were released, pregnant women and elderly were not administered. Even after the vaccine availability for

pregnant women, majority of them were hesitant at the beginning^(16, 17). Many studies reported no significant pregnancy outcome due to vaccination^(18, 19).

Several myths and misconceptions regarding corona virus vaccines were increased. Physicians should respond to these myths and misconceptions and provide clear information to the patients. Spreading of facts should be done via social media or any other platform whenever possible. Pregnant women should be assured there are no adverse effects to the mother and child when the vaccine is taken during pregnancy.

Hence, present study was conducted to understand the factors like KAP toward the corona virus vaccination among pregnant women. This reduces the burden of complications during pregnancy and reduces the complications of newborn.

AIMS AND OBJECTIVES

To assess the level of knowledge, attitude and behavior towards corona virus vaccination in pregnant women.

REVIEW OF LITERATURE

Corona Virus Disease

A zoonotic virus corona virus caused by 2019-nCoV or SARS-CoV-2 which belongs to Coronaviridae family caused a major outbreak in China ⁽²⁰⁾. corona virus disease may exhibit symptoms or may be asymptomatic among the infected individuals. Those who have symptoms, it can be mild to severe illness. The corona virus can cause fever, chills, cough, shortness of breath, fatigue, muscle/ body ache, headache, loss of smell and/ or taste, sore throat, congestion, nausea, vomiting and diarrhoea.

Structure of corona virus

Because of the spikes on its outer surface that resembles a crown, the virus is known as corona virus. Corona virus nucleic material is composed of single-stranded RNA which is minuscule with dimensions of 65 to 125 nm in diameter and 26 to 32 kb in length (Figure 1). There are four subgroups within corona virus family. It includes alpha, beta, gamma and delta corona virus. SARS corona virus, H5N1 influenza A, H1N1 2009 and MERS corona virus are the viruses that cause acute lung injury and acute respiratory distress syndrome (ARDS) which lead to pulmonary failure and eventually death ⁽²¹⁾. It was previously believed that these viruses exclusively affected animals before the China pandemic in 2002 ⁽²²⁾. Ten years later, the Middle East respiratory syndrome coronavirus (MERS-CoV), another deadly coronavirus, produced an endemic in the Middle Eastern countries ⁽²³⁾.

A new coronavirus outbreak that killed over eighteen hundred people and infected over seventy thousand over the first fifty days of the pandemic occurred recently at the end of 2019 in Wuhan, an emerging commercial hub in China. It has

been revealed that this virus belongs to the coronavirus beta group. The researchers from China have identified the new virus as 2019 novel coronavirus, or 2019-nCov. corona virus is the disease and SARS-CoV-2 is the virus, according to the International Committee on Taxonomy of Viruses (ICTV)⁽²⁴⁾.

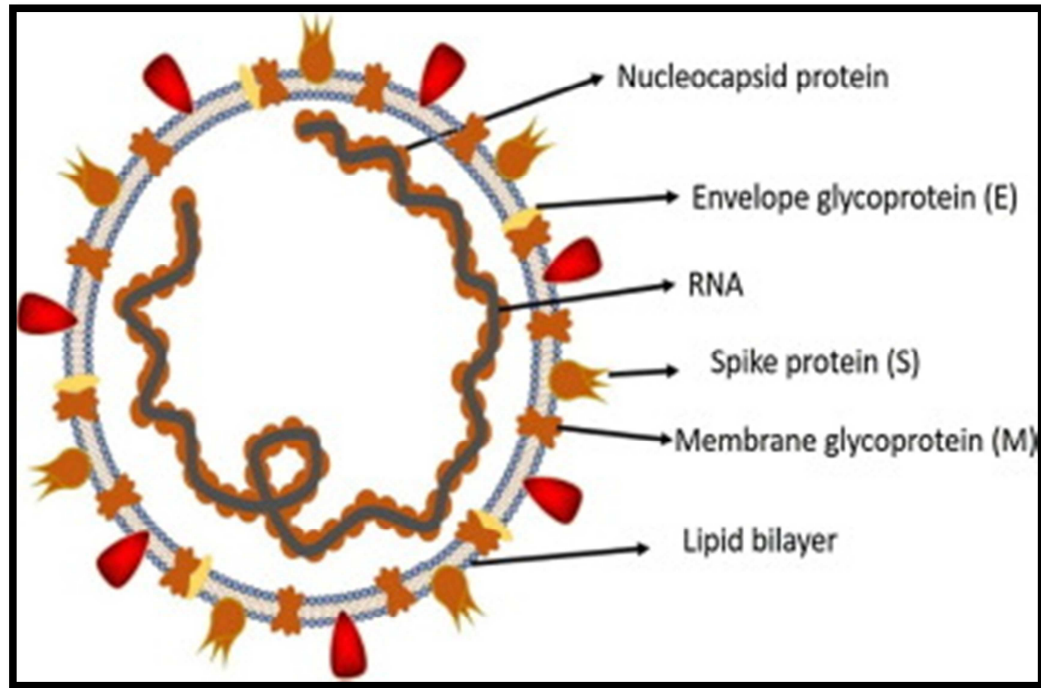


Figure 1: Structure of Corona Virus

Historically, the new corona virus in 2019 had spread more than one lakh people with mortality rate of almost 3% over 109 nations. In contrast, the SARS-CoV (2003) infected 8098 people with a 9% mortality rate across 26 countries. It indicates that SARS-CoV-2 is spreading more quickly than SARS-CoV, and this could be due to a genetic recombination event that occurred at the S protein in the RBD region of SARS-CoV-2, which may have improved the virus's ability to spread. We briefly address the propagation of human coronaviruses in this review article. We go on to talk about the biological characteristics and contagiousness of SARS and MERS, with an emphasis on corona virus⁽²¹⁾.

Disease outbreak - 2019

At the end of 2019, the Chinese government informed the WHO about several pneumonia cases of unknown origin. Although scientific evidence suggested Hunan seafood market in Wuhan might have played a role in spreading the virus, the outbreak did not originate there. On January 12, 2020, China’s national health commission provided information, indicating a viral pneumonia outbreak. Sequence-based analysis of patient samples identified the virus as a novel corona virus, and its genetic sequence was released to aid in diagnosing viral infections. Initially, it was thought that the Chinese patients who contracted pneumonia caused by Wuhan corona virus might have visited seafood market where live animals were sold or consumed contaminated animals or birds. However, further research revealed that some individuals were infected without any history of visiting the market. These findings suggested person-to-person transmission, and the virus has since been reported in almost all the continents and countries. The virus spreads through close contact with an infected individual, respiratory droplets, aerosols, coughing, and sneezing. These aerosols, can either enter the body through the mouth or nose and reach the lungs (Figure 2).

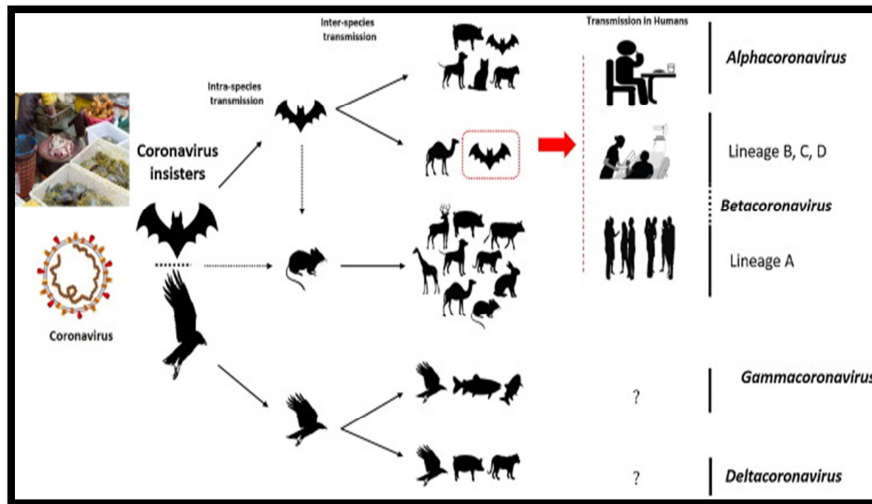


Figure 2: Mode of transmission of Corona virus (Red encircled-suspected reservoir)

Reservoirs and host of virus

To create preventative measures to keep the infection under control, it is critical to identify the origin and the route of transmission. Researchers identified racoon dogs and palm civets as significant reservoirs of infection in corona virus.

However, only samples from civets at the food market tested positive for viral RNA, suggesting that civets may act as secondary hosts ⁽²⁷⁾. In 2001, molecular analysis of samples from Hong Kong's healthy population revealed a 2.5% prevalence rate of anti-SARS corona virus antibodies. These findings imply that the SARS corona virus may have circulated among humans before 2003 outbreak ⁽²⁸⁾. Further examination of homologous recombination indicated that the receptor-binding spike glycoprotein of the novel coronavirus originates from an unidentified beta-CoV and SARS corona virus. Nevertheless, additional research is needed to pinpoint the intermediate zoonotic source responsible for the virus's transmission to humans to fully eradicate the infection ⁽²¹⁾.

A number of different combinations were also tested against SARS-CoV-2-induced illness in humans and mice, including mixing the antiviral or antibiotics with traditional Chinese treatments ⁽²⁹⁾. Recently, physicians in Shanghai extracted blood plasma from corona virus patients who had recovered clinically and injected it into infected patients who had recovered quickly and exhibited positive outcomes ⁽³⁰⁾. Recent research demonstrated that the monoclonal antibody CR3022 can bind to the spike RBD of SARS corona virus. This binding is likely due to the fact that the divergent ACE2 receptor-binding motif does not overlap with the antibody's epitope. Consequently, CR3022 holds potential as a therapeutic candidate for preventing and treating corona virus infections either alone or in combination with other neutralizing antibodies ⁽³¹⁾.

Development of corona virus vaccines

The corona virus vaccines licenced for clinical trials are divided in to several categories by WHO, including vector, live attenuated, inactivated, RNA, DNA, protein subunit, and virus-like particle (VLP) vaccines. Animal trials are a crucial component of the vaccine development process, as they help assess the safety and protective effectiveness of vaccines, as well as determine the correct dosage and injection schedule. Rodents, in particular, are small animals that form the foundation for biological and immunological research in vaccine development. Animal models such as rats, mice, guinea pigs, rabbits, and other creatures can generally be utilised to assess the safety, immunogenicity, and tolerance of potential vaccinations. Nevertheless, the species distinctions between these animals and humans might prevent the immunisation from having the same biological effects. Research on non-human primates (NHPs) is valuable for understanding human immune responses due to their similar innate and adaptive immune system. Many reagents used to identify human immune molecules behave similarly in NHPs. Alongside preclinical trials involving animals, clinical trials are essential for vaccine development. Phase I trials assess the safety, dosage, and tolerability of vaccines, while phase II and III focus on evaluating their efficacy and side effects (Figure 3).

One essential strategy way the reduce the infection spread and eventually containing epidemic is vaccination. However, because of the high mistake rate of the virus's RNA-dependent RNA polymerase (RdRp) and the presence of a highly changeable receptor-binding motif in the spike (S) protein, vaccination efficacy is constantly impacted by the acquisition of viral mutations ⁽¹⁴⁾. As we have previously reported, recipients of mRNA and inactivated vaccines had considerably lower neutralising geometric mean antibody titers in response to the B.1.351 (Beta) strain,

which may also lead to breakthrough infections ⁽³²⁾. The effectiveness of the vaccine has come under scrutiny because to the decline in neutralisation activity. Therefore, timely vaccination updates and virus sequence surveillance—such as the discovery of E484 mutations in novel SARS-CoV-2 variants¹⁶—are essential ⁽³³⁾. The milestones in the development of corona virus vaccines represented as Figure 4.

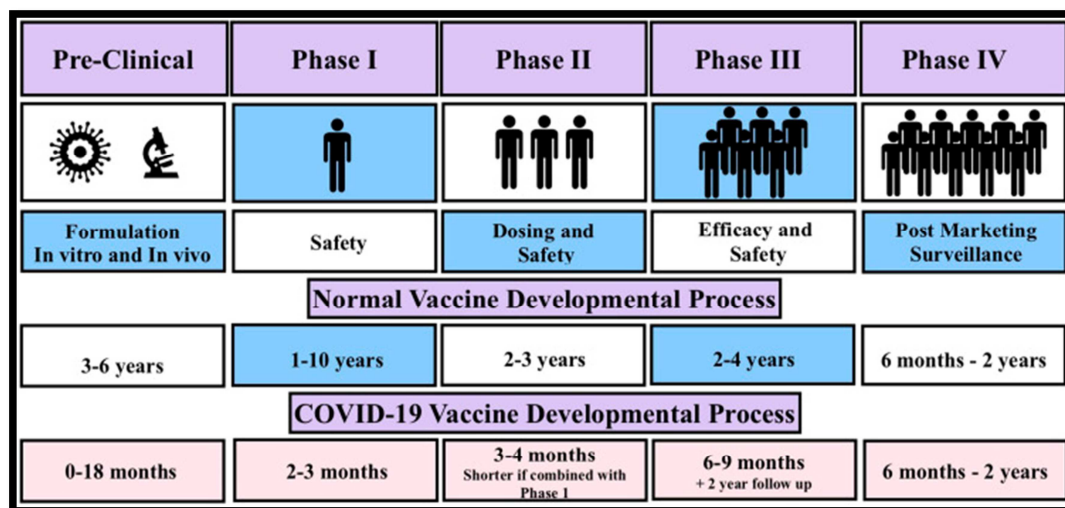


Figure 3: Development process of vaccine

Types of vaccines

Peptide vaccines, often referred as protein subunit (PS) vaccines, comprise the majority of vaccines. Additionally, inactivated virus known as IV, non-replicating virus known as VVnr, DNA and RNA vaccines are commonly used. During clinical development, there are also single vaccinations employing a viral vector capable of replicating such as virus-like particles known as VLP, live attenuated vaccine virus known as VVnr with APC, bacterial antigen-spore expression vectors and replicating viral vectors known as VVr (Figure 5) (Table 1).

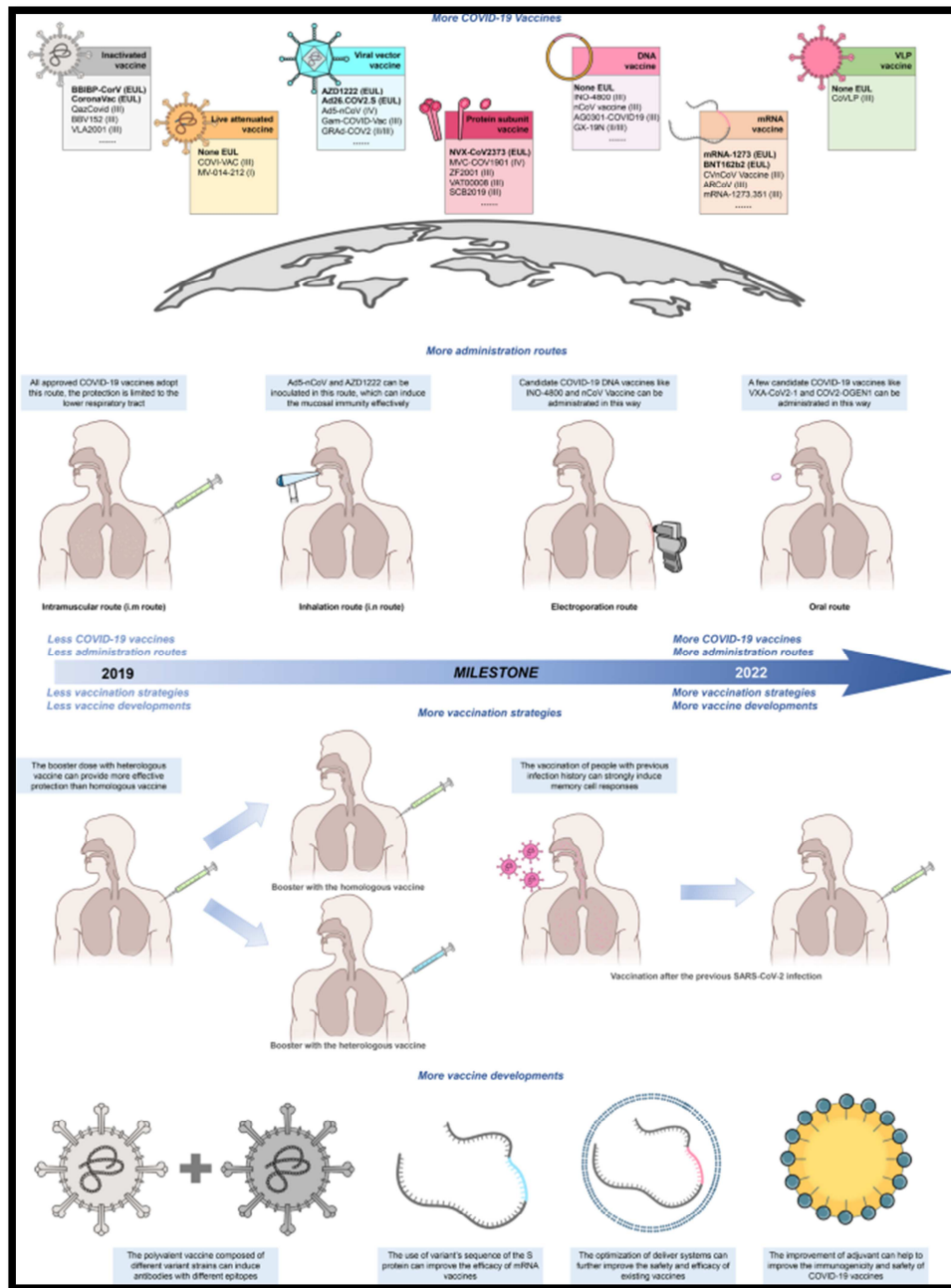


Figure 4: Milestones of corona virus vaccine development

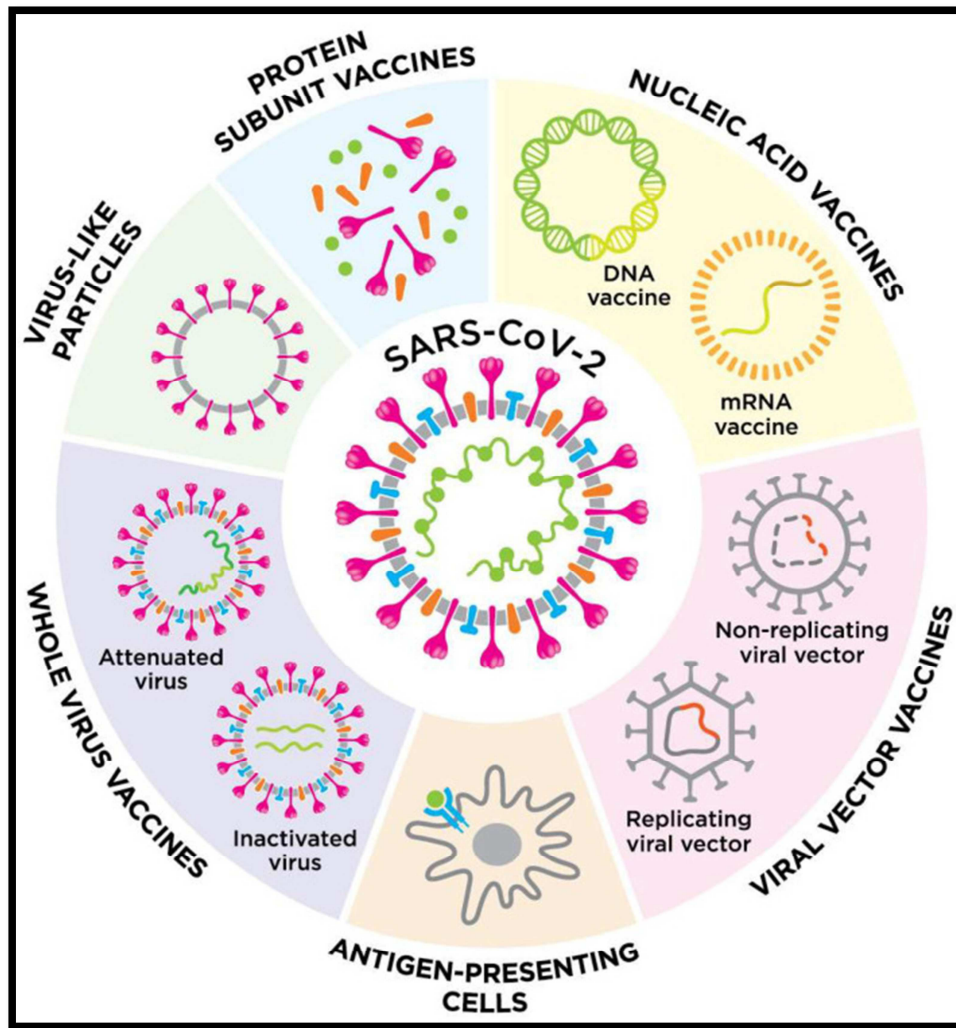


Figure 5: Various vaccine platforms for corona virus

Non-replicating viral vector vaccines

The genetic material of SARS-CoV-2 is contained in a viral (vector) envelope in VVnr vaccines; it can't divide even if it enters the human cell. For a very long time, medical professionals have created and employed viral vectors. Although vectors were first more widely utilised in gene therapy, they have now been used for the development of vaccines for more than 25 years⁽³⁵⁾. Adenoviruses, herpes viruses, alphaviruses, variola, vesicular stomatitis, and measles viruses are among the most frequently occurring vectors. Although there are some clear benefits to using

traditional vectors (the variola and measles viruses), such as lifetime immunity, their use is currently restricted due to the challenges associated with managing their production ⁽³⁶⁾.

Clinically, vector vaccinations have several benefits. Vaccines against VNr induce a strong and comparatively long-lasting immune response, which offers long-term defence against serious illness and infection ⁽³⁶⁾. It is possible to attain protective antibody titers with just one injection of the VVnr vaccine, provided that immunogenicity is high enough. This makes it possible to create and approve the single-phase vaccines Ad26.COVS.2 and Sputnik Light ⁽³⁷⁾. The research has not supported a theory that a decrease in immune response occurs when a person has innate immunity to the vector or viruses that resemble them ⁽³⁸⁾. Meanwhile, the issue of maintaining VVnr immunogenicity after vaccinations are given again is still pertinent. The Sputnik V vaccination is one example of how to employ a variety of vectors to tackle the issue in the first place ⁽³⁹⁾. Using well-known technologies, such as dosage forms with microspheres or pegylated forms—which are mostly employed in gene therapy and are now in preclinical development—is the second method to prevent vector neutralisation ⁽⁴⁰⁾. The challenge of increasing vector vaccine production due to the unique characteristics of vector manufacture, which necessitate duplication inside cell, is another major setback encountered by numerous companies. Furthermore, the scalability of production is limited by direct procedure in constructing vector with genetic material from SARS corona virus ⁽⁴¹⁾.

RNA vaccines

The corona virus pandemic has accelerated the advancement of novel RNA vaccine technology. Nucleic acid-based vaccines operates by delivering immunogenic viral fragments into human cells via genetic materials. Once this genetic material

(RNA or DNA) is introduced, it prompts the production of viral proteins, which in turn initiates an immune response and leads to generation of antibodies against the virus. The creation of nucleic acid vaccines can be facilitated by three primary technologies:

- DNA vaccines are vaccinations that contain DNA. After DNA enters cell of the host, it is translated to mRNA and then proteins are synthesised ⁽⁴²⁾.
- Immunisations containing messenger RNA (mRNA). Bypassing transcription and streamlining the antigen production, mRNA is used ⁽⁴²⁾.
- mRNA-based vaccines that can self-amplify by amplifying coding region of the antigen mRNA through added insertion of alphavirus protein's nsP1-4 sequence into the original RNA; an alternative is the use of trans-amplifying mRNA, in which the nsP1-4 mRNA is distinct fragment ⁽⁴³⁾

Because RNA vaccines may omit extra steps in the establishment of the immune response, DNA vaccines are thought to be a less promising platform. Nevertheless, India has authorised ZyCoV-D, the first DNA vaccine against corona virus ⁽⁴⁴⁾. Even though self-amplifying RNA generates a more robust immune response and requires fewer doses, simpler vaccination strategies were preferred due to urgency of developing corona virus vaccines quickly. The Pfizer and Moderna vaccines contain an mRNA fragment that encodes the entire S protein, which possesses the highest number of immunogenic epitopes in the virus ⁽⁴⁵⁾.

Two significant technological challenges are associated with the development and production of mRNA vaccines. Firstly, delivery mechanisms must protect the genetic material from degradation within the host organism until it reaches the target cell. Lipid nanoparticles used in the delivery of RNA have addressed this issue in the two approved RNA vaccines BNT162b2 and mRNA-1273 ⁽⁴⁵⁾. Secondly, the easy

degradation of RNA in the external environment poses another challenge⁽⁴²⁾. The current vaccinations contain modified nucleosides to stabilise mRNA and stop its breakdown. The issue of mRNA instability and quick breakdown is not entirely resolved by the introduction of modified nucleosides, though⁽⁴⁵⁾. As a result, supply chains for mRNA vaccines must adhere to stringent guidelines for extremely low storage and transportation temperatures⁽⁴⁶⁾. All things considered, mRNA is a technical platform that is both practical and promising. However, the primary obstacle for mRNA vaccines continues to be maintaining mRNA stability throughout the manufacturing, shipping, and patient administration processes. This issue needs to be resolved in order to expand the availability of mRNA vaccines⁽²¹⁾.

Vaccines with viral proteins

As an integral component of vaccines, viral proteins with immunogenic properties serve as an advanced technological platform on which numerous vaccines against infectious diseases like hepatitis B and C, influenza, pertussis, HPV been built⁽⁴⁷⁾. The main component utilized in the development of coronavirus vaccines includes the entire S protein such as Nuvaxovid (NVX-CoV2373 and MCV-CoV1901) or its receptor-binding domain which facilitates the virus's binding to the angiotensin-converting enzyme-2 (ACE2) receptor⁽⁴⁸⁾.

Protein vaccines offer advantages such as simpler manufacturing processes and greater stability in external environment⁽⁴⁷⁾. Nevertheless, adjuvants are often necessary in combination with protein vaccines to boost the immune response⁽⁴⁹⁾. Specifically, the S protein elicits a well-balanced immune response involving CD4+ and CD8+, T-lymphocytes, leading to sustained antibody production including neutralizing antibodies against viruses. Some scientists also speculate that subunit vaccinations may polarise the Th-1/Th-2 response. The process of creating protein

vaccines involves a protracted hunt for a target that is sufficiently immunogenic to be included in a vaccine ⁽⁵⁰⁾.

Inactivated virus vaccines

Vaccines that have been inactivated and live attenuated have the longest histories. This technology is still in widespread use today because of how easy it is to produce inactivated vaccines, how quickly mass production can be deployed, and how easily the technological process can be adjusted to account for changes in the viral strain, for example ⁽⁵¹⁾. In addition, since a breakdown in inactivation can result in a widespread infection pandemic, strict batch control is necessary throughout the manufacture of inactivated vaccines ⁽⁵¹⁾. The comparatively low immunogenicity of inactivated vaccines in comparison to mRNA or vector vaccines could be another important drawback. According to one study, patients who received the Pfizer vaccine had far greater neutralising antibody titers than those who received the CoronaVac vaccine following vaccination ^(52, 53).

Although a decline in immunogenicity may result in a reduction in clinical efficacy, these vaccinations are more suitable for patients with compromised health because the possibility of an adverse reaction is a more important consideration when selecting a vaccine for these patients than it is for the general public. Although inactivated vaccines are a well-established platform, their production involves strict control over the inactivation of the virus, and additional development or approval of vaccines may be necessary to enhance their immunogenicity and effectiveness ⁽²¹⁾.

Table 1: Types of vaccines, its mechanism, advantages and disadvantages

Type of vaccine	Mechanism	Advantage	Disadvantage
DNA Vaccine	Like viral infections, DNA vaccines can infiltrate cells and produce target antigens by utilising the host protein translation machinery. It has the ability to simultaneously elicit cellular and humoral immune responses.	Live viruses are not necessary for DNA vaccinations. Plasmid DNA may be made in a somewhat simple manner; the double-strand DNA molecules can be freeze-dried for long-term preservation and are more stable than virus molecules.	Limits application
mRNA vaccine	Enters the cytoplasm to achieve target antigen expression	Safer (Theoretically)	Unsatisfactory immune effect. Significantly higher side effects
Non-replicating viral vector vaccines	Encode the complete length of S-protein of SARS-CoV-2	Higher effectiveness (relatively)	Not effective for recessive infectious virus
Inactivated vaccines	Three basic inactivation techniques are used to produce inactivated vaccines, which retain their immunogenicity but lose their toxicity and infectivity.	Easy to prepare. Humoral immune response can be produced efficiently.	High viral concentrations are necessary for the manufacturing of vaccines, which presents a risk to biological safety. Generally speaking, inactivated vaccinations induce a poor T-cell immune response.
Live attenuated vaccines	decreases the pathogenicity of the virus by deleting or point-mutating important virus proteins, but leaves the virus's immunogenicity and replication capacity intact.	exceptional immunogenicity, with the ability to elicit both mucosal and systemic immunity, and long-lasting immunity.	Retrograde mutations might cause the body to regain its pathogenicity.
Subunit vaccines	Through genetic engineering, the pathogen's antigen protein is produced and purified in order to trigger an immune response.	Subunit vaccines are thought to be the safest type of vaccinations, consisting of pure recombinant proteins. It is immunogenicity and safety favourable.	Subunit vaccines are non-endogenous antigens that cannot be presented by MHC-I and do not efficiently generate sensitised cytotoxic T lymphocytes (CTL).
Trained immunity-based vaccines	Vaccines based on learned immunity have the ability to stimulate the immune system and offer protection against specific pathogens.	NA	The BCG vaccination will be produced according to different standards.

Strategies to combat the pandemic

Following the declaration of the virus as a global health emergency, numerous countries implemented stringent quarantine protocols, enforced social distancing measures in schools and workplaces, initiated community lockdowns, provided extensive public education on personal hygiene practices like frequent hand washing

and wearing face masks, called off large-scale events, and even banned flights to and from infected countries ⁽⁵⁴⁾. But in other nations, there has been much discussion about some of these measures—like forced mask wear in public areas, proactive school closures, and general lockdowns ^(55, 56) (Figure 6).



Figure 6: Strategies in prevention and control of corona virus in India

The main argument regarding SARS-CoV-2 transmission seems to be leaning towards airborne infection rather than surface transmission. This may emphasise how crucial it is to avoid crowded areas, social separation, and the proper usage of face masks. Emphasizing the significance of maintaining proper hand hygiene during an epidemic is crucial. Yet, it is essential to conduct information, education, and communication (IEC) campaigns to mitigate the excessive fear and anxiety surrounding coronavirus transmission associated with handling door knobs, elevator buttons, newspaper, vegetables, and food items. These actions are inexpensive, cause little inconvenience in day-to-day activities, and have a direct positive impact on the people who engage in these behaviours. To prevent and limit the spread of corona

virus at the community level, however, ensuring their ongoing acceptance would require continuous IEC efforts at all levels, along with shifts in attitudes at both individual and societal levels ⁽⁵⁶⁾.

The disease is spreads quickly across the nation, making it difficult to trace, diagnose, and confine sick persons. This is putting a great deal of strain on the public health system. These interventions were continued throughout the second phase of epidemic also. The main obstacles to this strategy's implementation are the prevalence of a high percentage of asymptomatic persons and its restricted application in community transmission scenarios. Locating these resources became increasingly challenging during the second wave, when community transmission appeared to have become wide-spread nationwide, given the laborious and costly nature of this endeavor. Government-imposed limitations, such as curfews on weekends and nights, bans on using public transit, market closures, total lockdowns, etc., should only be used as a last resort because they are ineffective and cause financial loss ⁽⁵⁶⁾.

Details of strategies implemented and its effectiveness were tabulated in Table 2a and 2b.

Table 2a: Strategies implemented to prevent corona virus to reduce the spread of corona virus infection

Strategy	Government resources required	Monitoring	Feasibility	Acceptance by public	Cost-effectiveness	Effectiveness
Social distancing & restrictions in gathering	Low	Difficult	Difficult	Low	Low	High
Vaccine	High	Easy	Easy	High	Low	High
Face mask	Low	Difficult	Easy	Moderate	Low	High
Closure of educational institutions	Low	Easy	Easy	High	Low	High
Travel restrictions/ border restrictions	High	Difficult	Difficult	Low	High	Moderate
Educating and communicating with public	High	Easy	Difficult	High	Low	moderate
Closure of non -essential business	Low	Easy	Easy	Low	High	moderate
Quarantine & isolation	High	Difficult	Difficult	Low	High	Moderate
Hand hygiene	Low	Difficult	Easy	Moderate	Low	Low
Environment cleaning, disinfection	High	Difficult	Difficult	High	Moderate	Low
Airport health check-ups	High	Easy	Easy	High	Low	Low
Night curfew	Low	Easy	Easy	Low	Low	Low
Complete lockdown (along with other restrictions)	High	Difficult	Difficult	Low	High	Low
Contact tracing & testing	High	Difficult	Difficult	Low	Low	Low

Table 2b: Strategies implemented to prevent corona virus to reduce the morality of corona virus cases

Strategy	Government resources required	Monitoring	Feasibility	Acceptance by public	Cost-effectiveness	Effectiveness
Hospital treatment of severe/ moderate cases	High	Easy	Easy	High	High	High
Vaccination	High	Easy	Easy	High	Low	High

Pregnancy and corona virus

Due to hormonally-induced immune changes, pregnant individuals are more susceptible to infectious infections and their severity varies from non-pregnant patients⁽⁵⁷⁾. High levels of oestradiol during pregnancy improve innate immunity in a number of ways, while placental progesterone reduces the mother's immunological responses^(57, 58). Due to the intricate interaction between sex hormones and the immune system, T-cell, natural killer cell, and perhaps B-cell activity diminishes as pregnancy progresses, increasing the severity of certain infections in the latter stages of pregnancy^(57, 59). Comparably, in the later stages of pregnancy, the prevalence of symptomatic and serious infections rises with corona virus⁽⁶⁰⁾. Diaphragmatic splinting and elevation by the gravid uterus cause a steady decline in functional residual capacity, end-expiratory volume, and residual volume⁽⁶¹⁾. As a result, lung function is compromised, and pulmonary secretions cannot be adequately cleared. In addition to these physiological and immunological changes, elevated oxygen consumption and edema of the pulmonary mucous membrane may influence the intensity and vulnerability of corona virus in pregnant women, worsening hypoxic compromise⁽⁶²⁾.

Due to concerns about the virus's potential effects on newborns, the best course of treatment for pregnant women with corona virus is still up for debate. Carefully monitored increases in a number of unfavourable maternal and newborn outcomes during the pandemic were reported in comparison to pre-pandemic levels in a worldwide systematic assessment. The pandemic's direct impacts on pregnancy as well as its consequences on the healthcare system led to these unfavourable outcomes. The results could be skewed because the initial data were not national representative samples, did not have suitable comparator groups, and could not be confounded factor

adjusted. According to reports, 3–20% of pregnant women are infected with SARS-CoV-2, and the illness can range widely in severity from asymptomatic to very severe (7, 63).

About 80% of corona virus infections while pregnant are asymptomatic or mild in nature, 15% are severe and need extra oxygen, and 5% are critical and need mechanical ventilation, according to the World Health Organisation ⁽⁶⁴⁾. Other research, however, indicates that just 20% ⁽⁶⁵⁾ or even 40–45% ⁽⁶⁶⁾ of the infected individuals may not show any symptoms. While the majority of pregnant women infected with SARS-CoV-2 have mild illness and recover, 1 in 11 have a severe or critical illness, 1 in 10 are hospitalised specifically because of a corona virus concern, 1 in 30 are admitted to the intensive care unit (ICU) for respiratory issues, 1 in 60 require mechanical ventilation, and 1 in 80 passes away. These findings suggest that pregnant women are more likely to be hospitalised than non-pregnant women of the same age ⁽⁶⁷⁾. According to reports, 18% of corona virus patients experience dyspnea ⁽⁶⁸⁾. It's important to distinguish between physiological dyspnea, which is typical throughout pregnancy and results from elevated oxygen needs in the mother due to a heightened metabolism, gestational anaemia, and foetal oxygen intake, and pathological dyspnea. Pregnant women have three times the risk of ICU admission, 2.9 times the risk of invasive ventilation need, and 1.7 times the risk of death compared to non-pregnant women ⁽¹¹⁾.

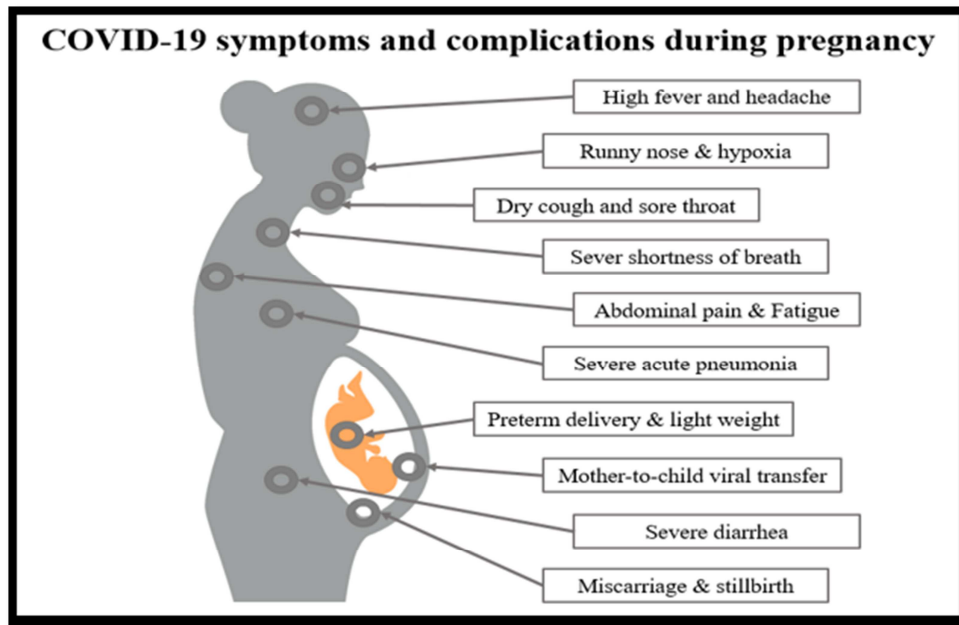


Figure 7: Complications in pregnancy due to CORONA VIRUS infection

Complications of corona virus during pregnancy

Multiple studies reported higher rates of preterm delivery when mother is infected with corona virus infection ^(69, 70, 71). Preterm labour and early rupture of the membranes are associated with an increased risk of fever, hypoxemia, and serious respiratory diseases. Preterm birth was the most frequent poor pregnancy outcome, with pneumonia affecting over 90% of hospitalised corona virus moms. Furthermore, the foetus could not tolerate infection-induced hypoxemia well, and it often triggered preterm labour following mid-pregnancy ⁽⁷²⁾.

Table 3: Adverse outcomes of corona virus on maternal and child health

Study	Study location	Sample size	Maternal effect	Foetal effect
Blitz et al (73)	USA	462	Preterm birth, Increased inflammatory markers, Tachycardia, Lymphopenia, & Hypoxia	Preterm babies & CORONA VIRUS positive baby
Yan et al (74)	China	116	Spontaneous preterm birth	Severe neonatal asphyxia, & Neonatal death
Sayed et al (75)	Bangladesh	68	Dyspnoea, Myalgia & Increased rate of abortion	Preterm babies, Neonatal pneumonia, Hyperbilirubinemia, & Foetal death
Elshafeey et al (76)	Global	385	Dependant on mechanical ventilation, Increased abortion, & Maternal mortality	Neonatal Death, Preterm birth, Intrauterine foetal distress, Corona virus positive babies
Savasi et al (77)	Italy	77	Increased pregestational BMI, Abnormal respiratory rates & Abnormal heart rates	Corona virus infection
Smith et al (78)	Global	92	Ventilation	Preterm birth, Neonatal ICU admission, Low birth weight, Foetal distress.
Capobianco et al (79)	China	13 research studies	ICU admission	Pneumonia, Infected infant pooled proportion, Respiratory distress syndrome
Zaigham & Andersson (80)	Global	108	Elevated CRP, ICU admission & Lymphocytopenia	Intrauterine death, & Intrauterine growth restriction
Diriba et al (81)	Global	879	Miscarriage, Preeclampsia	Foetal growth restriction, Preterm birth, Neonatal asphyxia, Perinatal death.
Gholami et al (6)	Iran	23,71,332	Preeclampsia, c-section, & gestational diabetes mellitus	Preterm birth, & Neonates' hospitalization in NICU
Wang et al (8)	Global	10 studies	Miscarriage, Elective termination of pregnancy, Maternal mortality, Intubation, & ICU admission	Preterm birth, & Corona virus positive
Cannarella et al (9)	Global	28 studies included	NA	Preterm delivery, & Foetal death
Wei et al (5)	Global	42 studies included	Stillbirth, Preeclampsia, c-section, gestational diabetes,	Preterm delivery, Low birth weight
Nayak et al (82)	India	141	c-section	Corona virus positive

Knowledge, attitude, practise and behaviour of pregnant women regarding corona virus vaccination.

A prospective, observational, population-based study was conducted in seven low-income countries including Bangladesh, India, Pakistan, Guatemala, Democratic Republic of the Congo, Kenya and Zambia between February 2021 and November 2021. The study participants were enrolled in a face-to-face interview from an ongoing registry for pregnant women. The study aimed to determine the knowledge, attitude and practice of pregnant women during pregnancy regarding corona virus vaccination. Vaccine related survey was conducted among the eligible study participants. Eligible participants were the one's who are enrolled in global network's maternal and neonatal health registry (MNHR). The study questionnaire was designed to understand the participant's belief on vaccine effectiveness and safety, and their willingness to take the vaccine. If a participant was not willing to take the vaccine, the reason for same was asked and recorded. Additionally, vaccination status was recorded. A total of 13,105 pregnant women were included in the survey. In India, 12.9% of the study participants were vaccinated followed by 5.5% in Guatemala. Almost half of the study participants believed the vaccine is very or somewhat effective. More than half of the study participants (56.7%) were willing to take the vaccine on availability and 34.8% refused to take vaccine. The reasons recorded for refusal of corona virus vaccine were safety, fear of adverse effects, and lack of trust. Lower the educational status, lesser the willingness for vaccination. Hence, education directly impacts the willingness for vaccination. Family members and healthcare professionals were trusted as a source of information regarding corona virus vaccination⁽⁸³⁾.

A cross-sectional study conducted in Maharashtra, India during August 2021 and October 2021. The study was conducted among pregnant and lactating women who attended the outpatient department and Obstetrics and Gynaecology wards of a tertiary care centre, Smt. Kashibai Navale Medical college and general hospital in Pune. The data collection was done face-to-face. The study aimed to understand the knowledge, attitude and practice related to corona virus vaccination among pregnant and lactating women. Postpartum women of up to 6 weeks post-delivery were included in the study. All the patients who attend the outpatient department and Obstetrics and gynecology wards of the hospital were eligible to participate in the study. Patients who provided consent to the study were included in the study. Questionnaire with knowledge, attitude and practice related questions were administered and recorded. A total of 250 participants were included in the study. Among the study participants, 212 were pregnant women and 38 were lactating women. Mean age of the study participants was 25.54 years. Majority (89.92%) of the study participants were aware of the existence of corona virus vaccines. Over half of the study participants (58.7%) felt it would reduce the severity of corona virus. Among them, only 47.56% of the study participants believed the vaccine is effective for pregnant and lactating women. A small proportion (9.16%) of the study participants had taken vaccine. Reasons for refusal of vaccines were safety (17.5%), safety of fetus (48.1%), lack of awareness (58.5%), and lack of recommendation by the healthcare providers (63.5%). Only 67.8% of the study participants believed on the efficacy of the vaccine. This study showed a low acceptance of corona virus vaccines. Education and recommendation by the healthcare workers can increase the acceptance rate of vaccines ⁽⁸⁴⁾.

A cross-sectional study was conducted in Department of Obstetrics and Gynecology, Government medical college, Kozhikode, Kerala. This study was conducted from July 2021 to September 2021. This study aimed to assess the knowledge, attitude and practice regarding the health effects of corona virus pandemic and the preventative measure of corona virus including vaccination. All pregnant women who attended the inpatient and outpatient department of the hospital were eligible to participate in the study. Pregnant women with complications like eclampsia, heart diseases, intrauterine demise, corona virus infection, and lactating women were excluded from the study. The eligible pregnant women whoever provided written consent were included in the study. Details like age, BMI, educational status, occupational details, marital status, marital age, obstetric history & complications, and corona virus vaccination status were recorded. A total of 505 women were approached and everyone approached provided consent and participated in the study. Mean age of the study participants was 26.53 years and 99.6% of the study participants were literate. Preeclampsia, gestational diabetes, and anemia were reported by 7.5%, 17.6% and 7.7% of the population respectively. Among the study participants, 24.3% of them had taken the first dose and 10.9% had taken both the doses of corona virus vaccination. Previous history of corona virus was reported by 19.2% of the study participants. The mean knowledge, attitude and practice scores were 15.55, 7.09 and 4.04 respectively. About 57.6% of the study participants were aware that corona virus vaccination is safe for pregnant women and 74.9% of the study participants had a positive attitude towards vaccination ⁽⁸⁵⁾.

A cross-sectional study was conducted in Haryana, India in Department of Obstetrics and Gynecology of a periurban tertiary care teaching hospital in 2021. Pregnant women who attended the outpatient department were enrolled into the study

if they provided consent to participate. Sample size was 300 of which, 100 were pregnant women, 100 doctors and interns of the same hospital and 100 other healthcare workers (nurses, technicians, etc). A questionnaire was administered which contains questions related to knowledge, attitude and practise regarding corona virus pandemic and acceptance of the corona virus vaccine. Age, name, residence, education, and occupation were also collected. Mean score of knowledge and practice were 22.54 and 23.91 respectively. Majority (84%) of the study participants mentioned corona virus vaccine is safe during pregnancy. Among the study participants, 48% were vaccinated and 34% were vaccinated during pregnancy. Majority of the study participants who refused to take vaccine listed fear of side-effects as the reason (70%), followed by fear of going to hospital (29.3%) and refusal of family to vaccinate during pregnancy (0.7%)⁽⁸⁶⁾.

A systematic review was conducted to assess the knowledge, attitude acceptance of vaccine, and hesitancy among pregnant and postpartum mothers⁽⁸⁷⁾. In this review, hospital-based observational studies were included. The review followed PRISMA guidelines (preferred reporting items for systematic reviews and meta-analysis) 2020 as guidelines. Knowledge of corona virus vaccines ranged between 18.8%⁽⁸⁸⁾ and 88.2%⁽⁸⁹⁾. Positive attitude towards corona virus vaccine were reported in 5 studies^(88, 89, 90, 91, 92). Corona virus vaccine acceptance rates range from 16%⁽⁹³⁾ to 78.52%⁽⁹⁴⁾. Safety (including fear of infertility), and risk of death (of mother and baby) were the main reasons for refusal of vaccines.

A cross-sectional study was conducted to understand the knowledge and attitude of pregnant women on corona virus vaccines in Croatia. Among the 430 study participants included in the study, 16% were willing to take the vaccines. The main

reason for vaccine hesitancy was safety of the fetus and themselves (73% and 75% respectively) ⁽⁹³⁾.

A study from North India intended to assess the KAP and concerns of pregnant and lactating women in receiving corona virus vaccines. Among the study participants, 90% reported it was essential to take the vaccination against corona virus. Among the study participants, 72.2% of the participants who were pregnant knew they were eligible to take the corona virus vaccine. In this study also, the hesitancy of taking vaccine among pregnant women was due to concern on safety of the fetus ⁽⁹⁴⁾.

A cross-sectional study from Pakistan designed to evaluate the KAP among pregnant women during corona virus pandemic period. The study was conducted in a tertiary care center. A total of 377 pregnant women were included in the study. A 21-item questionnaire was used to evaluate the KAP among study participants. Majority of the women were between ages 30 to 40 (42.4%) and were multiparous (36.8%). Majority of the women knew about the symptoms and method of transmission of the corona virus infection (90%). More than 90% of the study participants were concerned about safety of the fetus and themselves. Age, occupation, source of information of corona virus and parity were statistically significant for KAP ⁽⁹⁵⁾.

A meta-analysis was conducted to know the KAP regarding corona virus among pregnant women globally. A total of 53 studies were included in KAP based on the inclusion and exclusion criteria. More than half of the study participants had a good knowledge (59%). Positive attitude and appropriate practice were reported in 57% and 53% of the study participants respectively. The study concluded KAP among pregnant women as low. To improve the KAP, health education programs focusing on pregnant women were advised to be implemented ⁽⁹⁶⁾.

A study aimed to determine the willingness of pregnant women and women planning to get pregnant for receiving corona virus booster dose in Jordan population. A total of 695 study participants were included in the study. Higher knowledge of corona virus was found in women who were older in age, with comorbidities, higher education and income ⁽⁹⁷⁾.

An online survey was conducted among pregnant women and mothers whose children were less than 18 years to understand the acceptance of corona virus vaccine. An overall percentage of 69.2% of the study population were willing to take the vaccine. High vaccine acceptancy was reported in India, Philippines, and Latin American countries. Low acceptance was recorded in USA, Australia, and Russia. The reasons for vaccine hesitancy were the concerns of safety ⁽¹⁰⁰⁾.

A cross-sectional study was conducted among 527 pregnant women who were on antenatal care in Ghana. The study aimed to understand the knowledge and preventative practices towards corona virus. Adequate knowledge and good practices regarding corona virus was reported in 85.6% and 46.6% of the study participants. Factors associated with adequate knowledge were education, locality, and receipt of education session on corona virus. For practice, age, education, presence of comorbidities and locality were the factors associated ⁽¹⁰¹⁾.

Hence, the review of literature mentioned about the corona virus, the causative organism, its structure, types of vaccines available, the advantages and disadvantages of each types of vaccines were included. Also, it includes the pathways to combat the pandemic, the effective strategies among the available strategies were included. The effect of corona virus on pregnancy were included. Finally, included the studies relevant to the current aim of the study.

MATERIALS AND METHODS

Source of data: Pregnant women attending antenatal clinic of KAHER's Dr Prabhakar Kore's Charitable Hospital, Belagavi, Karnataka state were eligible for the study.

Study design: Cross-sectional study

Study period: One year

Sample size: The sample size was calculated as below:

$$N = [(Z_{1-\alpha/2})^2 p(1-p)] / d^2$$

Where,

N=sample size,

$Z_{1-\alpha/2}$ is z-score of degree of confidence which is 1.96,

P is the estimated prevalence (based on the literature review, 60%),

D is the error (for this study, margin was taken as 0.1).

Hence, the sample size for this study is

$$N = [(1.96)^2 \times 0.60 \times 0.40] / (0.1)^2$$

$$= 92.19$$

Hence, rounded upto 92.

We need to expect 20 % exclusion rate. Hence,

$$92 * 0.2 = 19 \text{ subjects were added to the sample size.}$$

So total sample required will be $92+19=111$.

Sampling Technique: All willing pregnant women who were attending the antenatal care clinic of KAHER's Dr Prabhakar Kore's Charitable Hospital, Belagavi, Karnataka State.

Inclusion criteria: Pregnant women who were attending antenatal care clinic of KAHER's Dr Prabhakar Kore's Charitable Hospital and provided consent to participate in the study.

Exclusion criteria

- Pregnant women with history of anaphylaxis reaction to influenza or dengue vaccines
- Pregnant women who were unwilling to participate in the study.

Questionnaire: A questionnaire was developed to administer among the study participants. It includes 4 sections: Socio-demographic details, knowledge, attitude and practice related questions.

Study protocol: A cross-sectional study was conducted in the Antenatal clinic of KAHER's Dr Prabhakar Kore's charitable Hospital, Belagavi, Karnataka state. This study was conducted for a period of one year. All pregnant women attending the outpatient or inpatient department of the clinic were eligible to participate in the study. Eligible participants who provided written informed consent to participate in the study were included. Pregnant women with history of anaphylaxis reaction to influenza or dengue vaccines were excluded from the study.

Pregnant women were educated in their previous visits regarding the risks and benefits of taking corona virus vaccination during pregnancy. Questionnaire was given to the pregnant women to assess the knowledge, attitude and behaviour towards corona virus vaccination.

Data collection procedure

Questionnaire

Annexure 1

STATISTICAL ANALYSIS

Data collected were entered in the Excel sheet and analysed. The chi-square test of independence was performed for comparative analysis of the frequency of participants in different demographics variables. The knowledge, attitude, and behaviour scores and their domain mean scores among the demographic variables was compared with independent sample t-test. The level of statistical significance was set at less than 0.05 for all analysis.

RESULTS

Age

A total of 242 study participants were included in the study. Majority of the study participants were between 26 to 30 years (n=132, 54.5%) (Table 4) (Figure 8).

Table 4: Distribution of age among study participants

AGE CATEGORY	FREQUENCY	PERCENTAGE
18- 22 years	20	8.3%
23-25 years	30	12.4%
26-30 years	132	54.5%
31-40 years	52	21.5%
>40 years	8	3.3%
TOTAL	242	100%

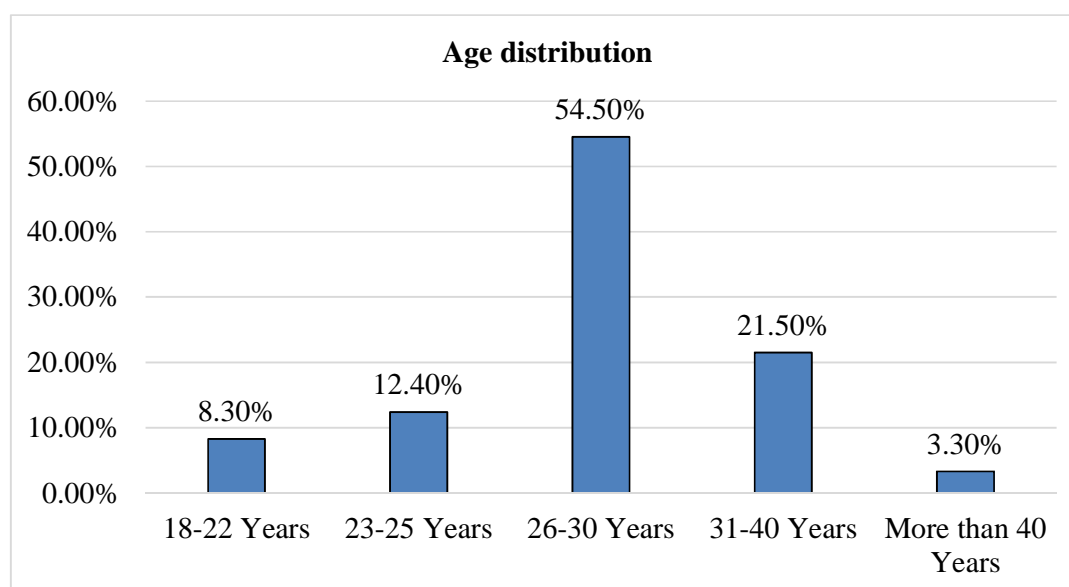


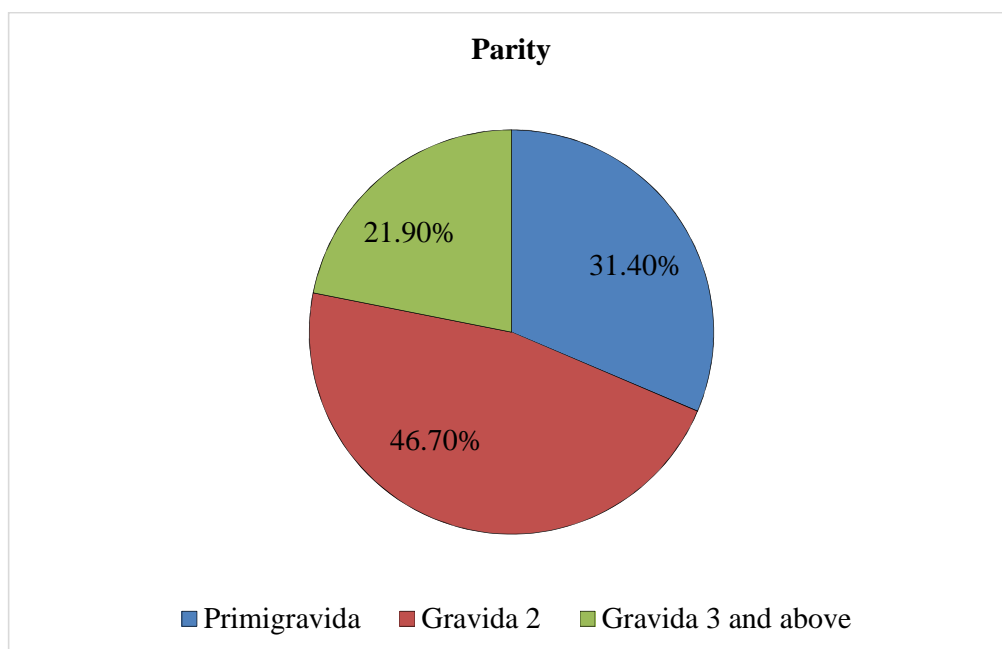
Figure 8: Age distribution among study participants

Parity

Among the study participants, 31.4% (n=76) were primigravida, 46.7% (n=113) were gravida 2 and 21.9% (n=53) were gravida 3 and above (Table 5) (Figure 9).

TABLE 5: Status of Parity

GRAVIDA	FREQUENCY	PERCENTAGE
Primigravida	76	31.4%
Gravida 2	113	46.7%
Gravida 3 and above	53	21.9%
TOTAL	242	100%

**Figure 9: Status of Gravida among study participants**

Socio-economic status

Majority of the study participants were lower-middle class (n=76, 31.4%), followed by 21.9% (n=53) of lower class, 15.7% (n=38) of upper-lower class, 12.3% (n=30) of upper-middle class and 1.23% (n=3) of upper class (Table 6) (Figure 10). The socio-economic status of the study participants was categorized based on education, occupation and monthly income using Modified Kuppuswamy scale.

TABLE 6: Socio-economic status of study participants

CLASS	FREQUENCY	PERCENTAGE
Upper	3	1.23%
Upper middle	30	12.3%
Upper lower	38	15.7%
Middle lower	76	31.4%
Lower	53	21.9%
TOTAL	242	100

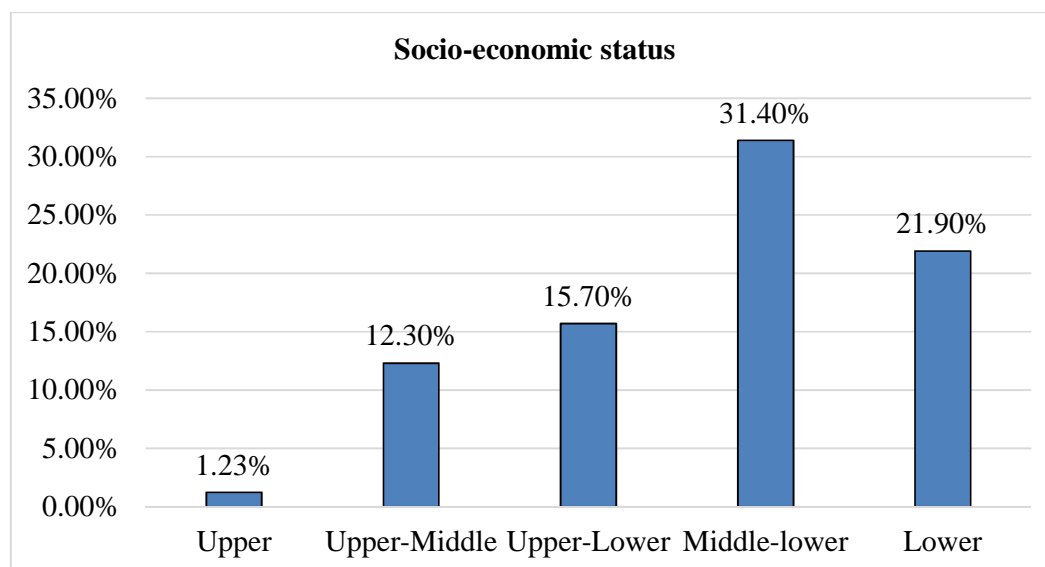


Figure 10: Socio-economic status of study participants

Education status

Among the study participants, majority of them completed primary education (n=127, 52.5%), followed by secondary education of 29.8% (n=72), graduate & above 10.3% (n=25), and illiterate of 7.4% (n=18) (Table 7) (Figure 11).

Table 7: Level of education in study participants

LEVEL OF EDUCATION	FREQUENCY	PERCENTAGE
Illiterate	18	7.4%
Primary education	127	52.5%
Secondary education	72	29.8%
Graduate and above	25	10.3%
TOTAL	242	100%

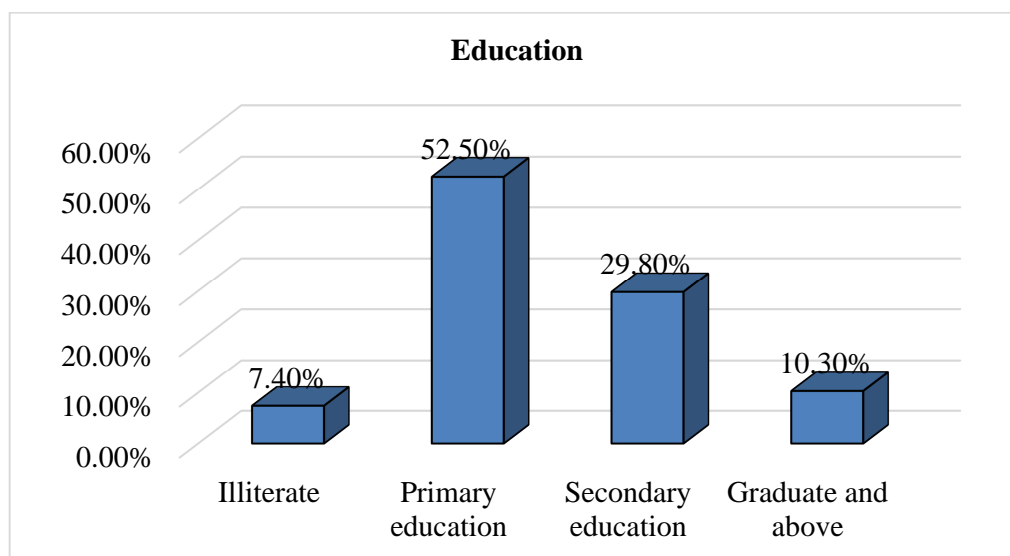


Figure 11: Level of education in study participants

Comorbidities

The prevalence of hypertension was 31.8% (n=77), the highest among the study participants. Prevalence of diabetes, hypothyroidism, asthma, epilepsy and cardiovascular disease (CVD) were 25.6%, 5%, 0.8%, 0.4% and 0.4% respectively. Among the study participants, 36% (n=87) didn't have any co-morbid conditions (Table 8) (Figure 12).

Table 8: Prevalence of co-morbidities among study participants

CO-MORBIDITY	FREQUENCY	PERCENTAGE
Hypertension	77	31.8%
Diabetes mellitus	62	25.6%
Asthma	2	0.8%
Hypothyroidism	12	5%
Epilepsy	1	0.4%
Cardiovascular disease	1	0.4%
Hypertension and Diabetes Mellitus	35	
None	87	36%
TOTAL	242	100

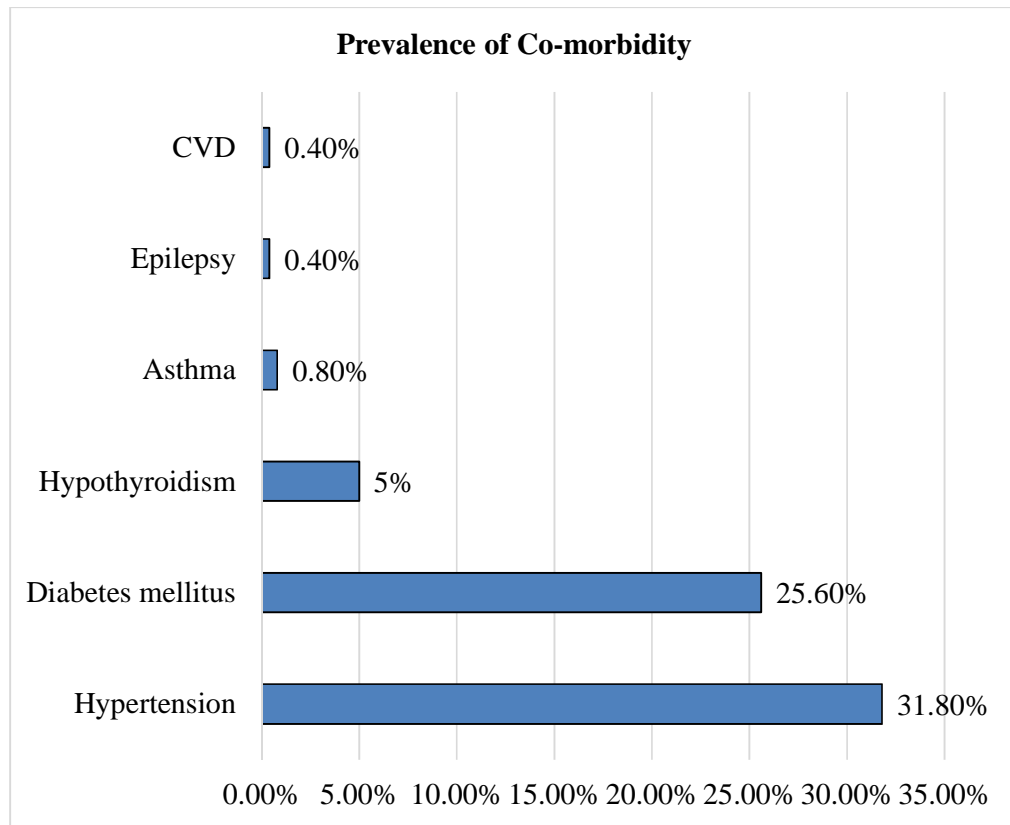


Figure 12: Prevalence of co-morbidities

KNOWLEDGE

Awareness about corona virus infection

Majority of the study participants had an awareness about corona virus infection (n=196, 81%) (Table 9) (Figure 13).

TABLE 9: Awareness about corona virus infection

AWARENESS ABOUT CORONA VIRUS INFECTION	FREQUENCY	PERCENTAGE
Yes	196	81%
No	46	19%
TOTAL	242	100

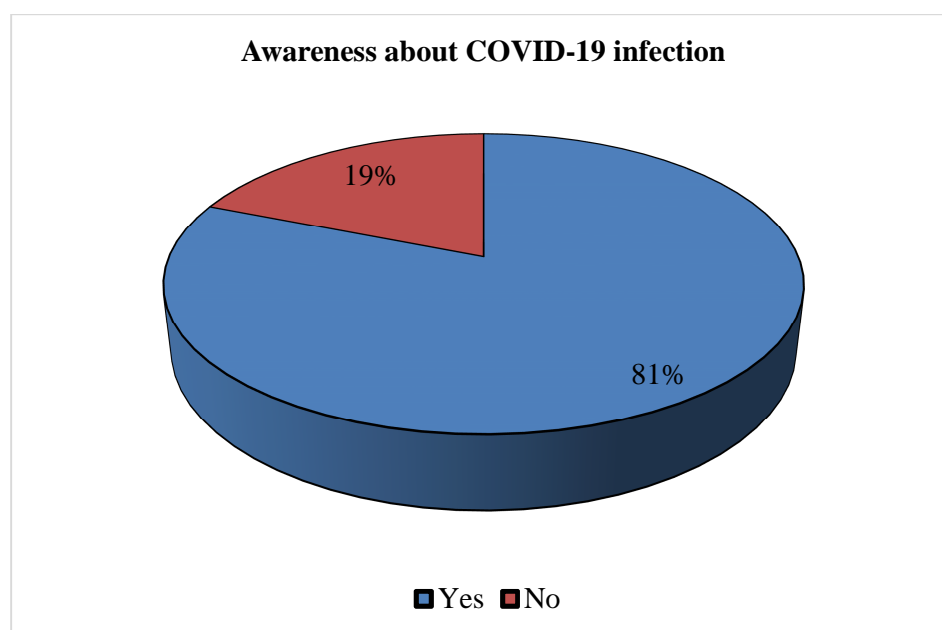


Figure 13: Awareness about corona virus infection among study participants

Awareness about availability of corona virus Vaccine

More than half of the study participants were aware about availability of CORONA VIRUS vaccine (n=136, 56.2%) (Table 10) (Figure 14).

Table 10: Awareness about availability of corona virus vaccine

AWARENESS	FREQUENCY	PERCENTAGE
Yes	136	56.2%
No	106	43.8%
TOTAL	242	100

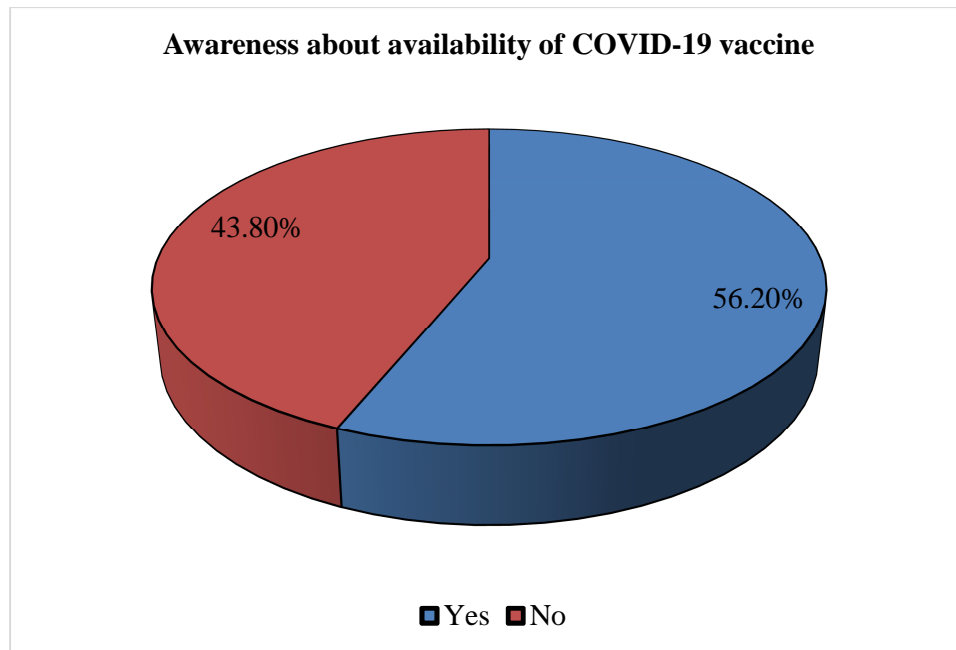


Figure 14: Awareness about availability of corona virus vaccine

Awareness on place of vaccination

Majority of the study participant's awareness on place of vaccination was primary health center (PHC) accounting to 71.1% (n=172) followed by 18.6% (n=45) of vaccination at community health center (CHC), 5% (n=12) vaccination at general practitioner (GP), 3.7% (n=9) of vaccination at antenatal clinic and 1.2% (n=3) of vaccination at tertiary care center (Table 12) (Figure 16).

Table 11: Awareness on place of vaccination

PLACE	FREQUENCY	PERCENTAGE
PHC	172	71.1%
CHC	45	18.6%
General practitioner	12	5%
Antenatal clinic	9	3.7%
Tertiary care center	3	1.2%
TOTAL	242	100%

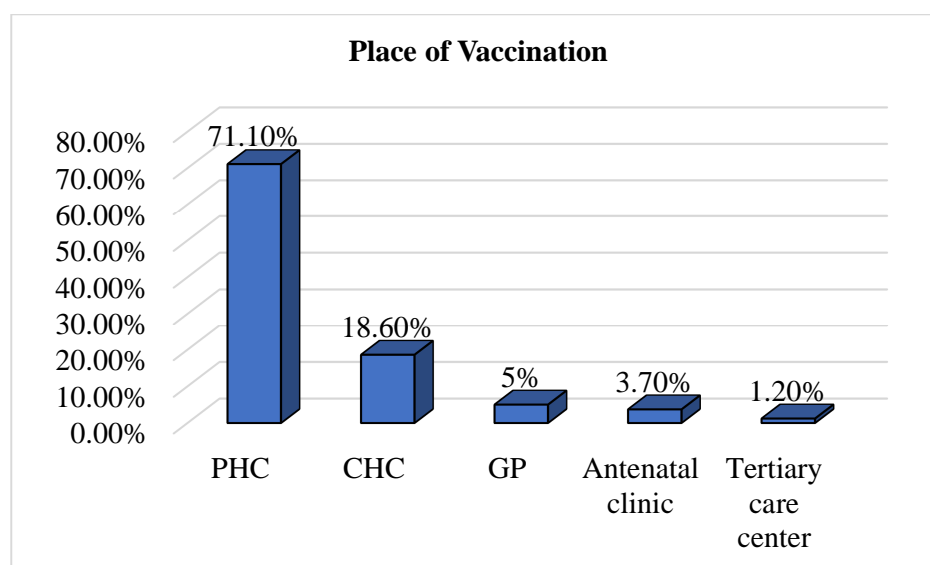


Figure 15: Awareness on place of vaccination of study participants

Availability of type of corona virus vaccine

Majority of the study participants were aware of Covaxin vaccine (n=112, 46.3%), followed by Covishield (n=101, 41.7%) and other vaccines like Sputnik (n=29, 12%) (Table 11) (Figure 15).

Table 12: Awareness of Type of vaccine available

VACCINE	FREQUENCY	PERCENTAGE
COVISHIELD	101	41.7%
COVAXIN	112	46.3%
OTHERS	29	12%
TOTAL	242	100%

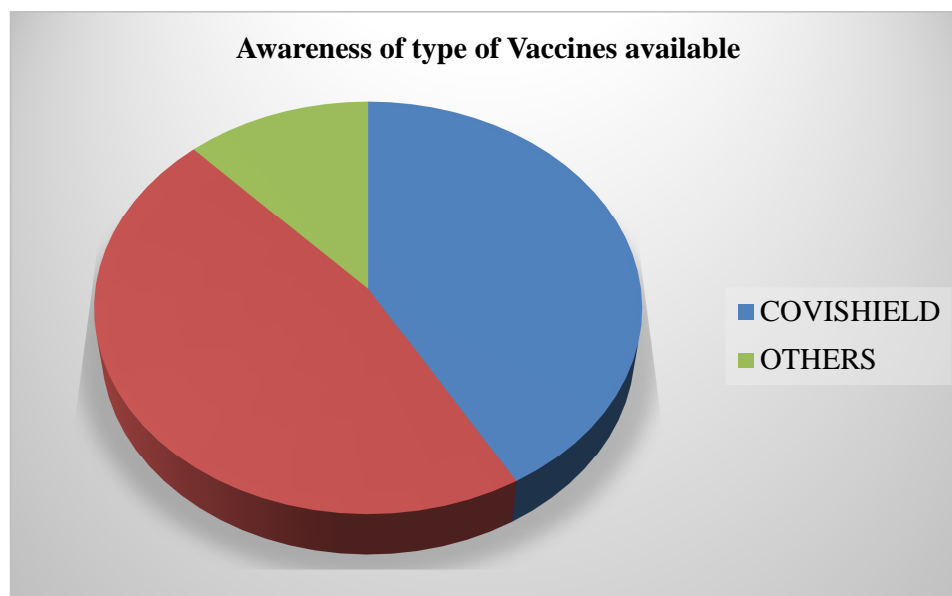


Figure 16: Awareness of type of vaccines available for corona virus

Awareness of number of doses of vaccination

More than half of the study participants reported they were aware of only one dose for corona virus vaccination (n=135, 55.8%). Among the study participants, 38% (n=92) were aware of two doses for corona virus vaccine and 6.2% (n=15) were aware about three doses or booster dose required for corona virus vaccination (Table 13) (Figure 17).

Table 13: Awareness on number of doses of vaccination

NO. OF DOSES	FREQUENCY	PERCENTAGE
1	135	55.8%
2	92	38%
3/ Booster doses	15	6.2%
TOTAL	242	100%

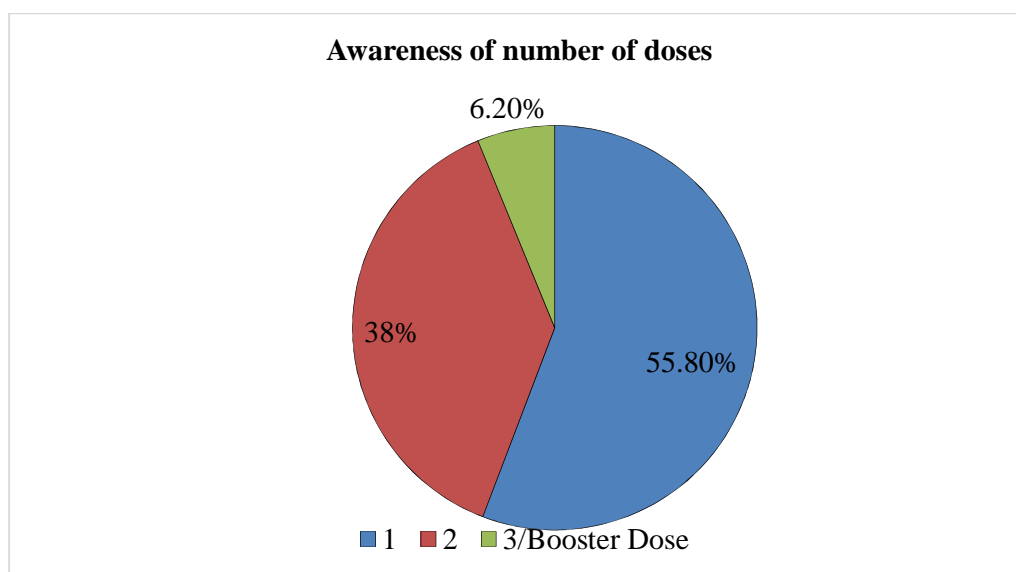


Figure 17: Awareness among study participants on number of corona virus vaccination

Safety of corona virus Vaccination in pregnancy

Majority of the study participants reported that corona virus vaccine is unsafe during pregnancy (n=144, 59.5%). Only 40.5% (n=98) pregnant women mentioned the vaccine is safe during pregnancy (Table 14) (Figure 18).

Table 14: Safety of corona virus vaccination on pregnant women

SAFETY	FREQUENCY	PERCENTAGE
Yes	98	40.5%
No	144	59.5%
TOTAL	242	100%

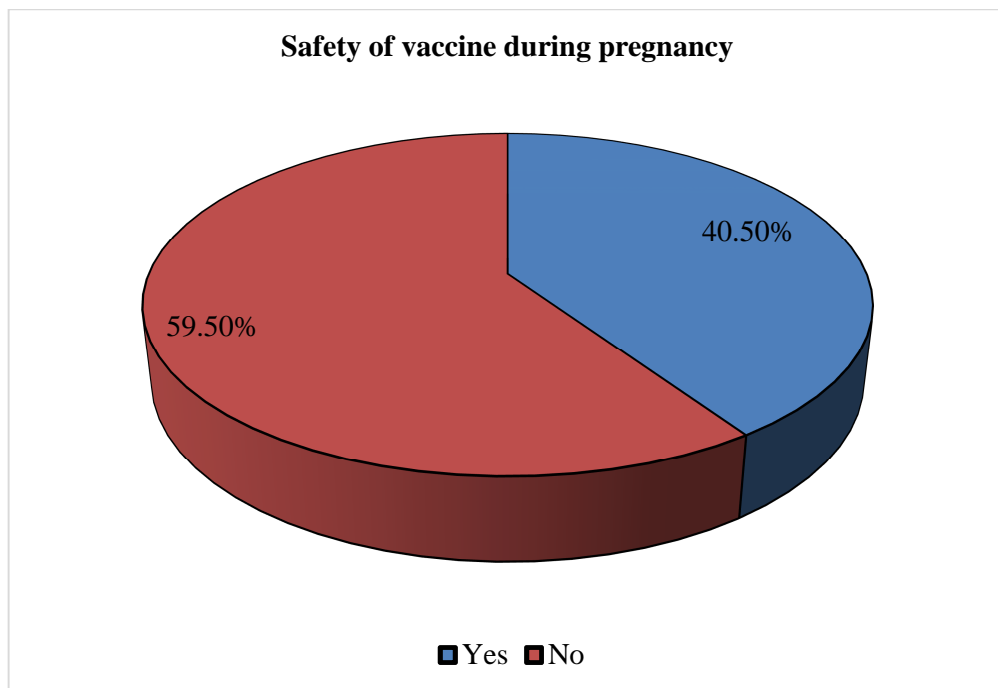


Figure 18: Safety of corona virus vaccine during pregnancy

Safety of corona virus vaccination on lactating women

Among the study participants, 68.9% (n=168) recorded corona virus vaccine is unsafe on lactating women. Only 31.1% (n=76) of the individuals think the vaccine is safe on lactating women (Table 15) (Figure 19).

Table 15: Safety of corona virus vaccination on lactating women

SAFETY ON LACTATING WOMEN	FREQUENCY	PERCENTAGE
Yes	76	31.1%
No	168	68.9%
TOTAL	242	100%

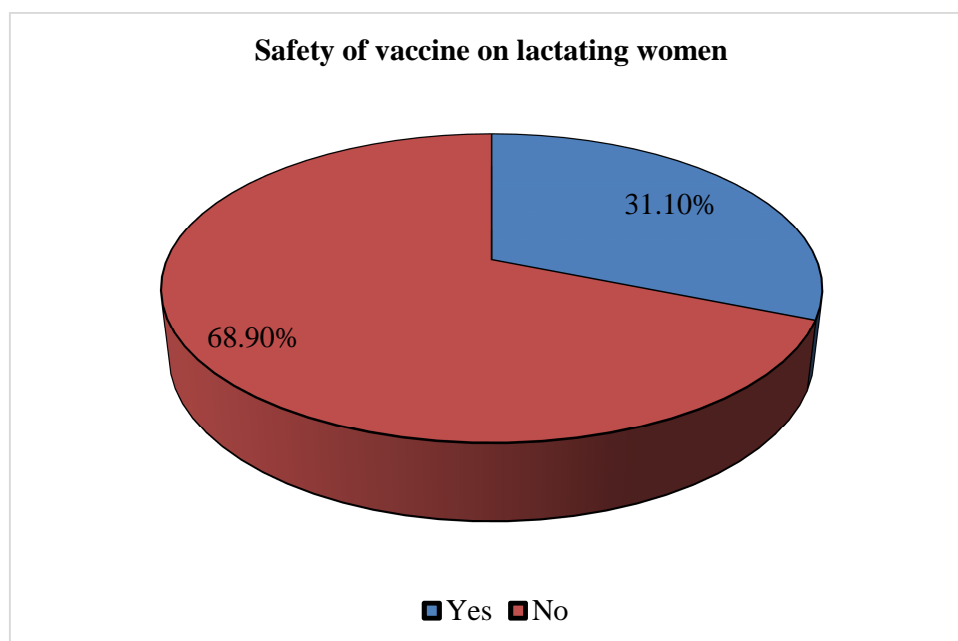


Figure 19: Safety of CORONA VIRUS vaccine on lactating women

Awareness about side effects of corona virus vaccine

Among the study participants, 67.4% (n=163) mentioned they are aware of the side effects of taking corona virus vaccination and 32.6% (n=79) were unaware of the side effects (Table 16) (Figure 20).

Table 16: Awareness about side effects of corona virus vaccine

AWARENESS ABOUT VACCINE SIDE EFFECTS	FREQUENCY	PERCENTAGE
Yes	163	67.4%
No	79	32.6%
TOTAL	242	100%

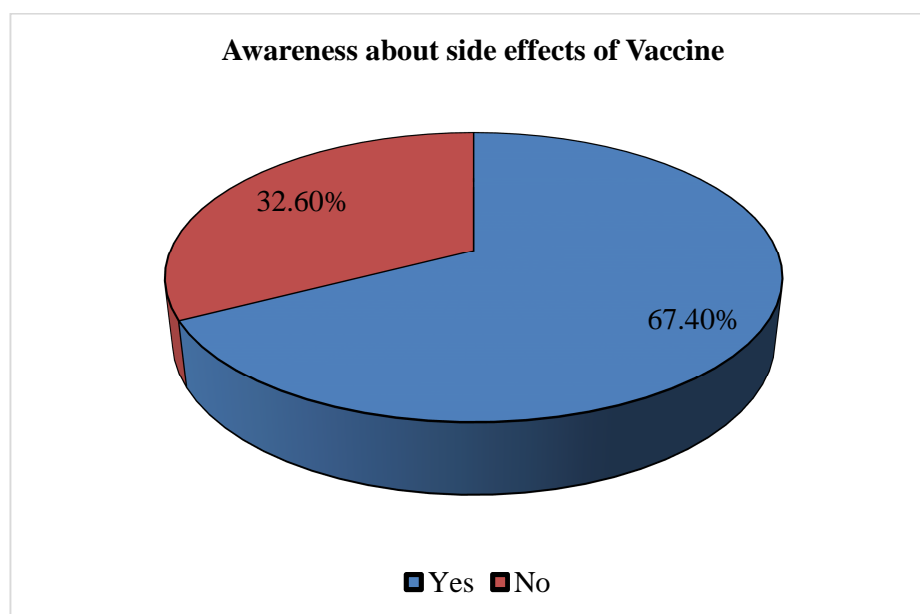


Figure 20: Awareness among study participants on side effects of corona virus vaccination

Source of information

Majority of the study participant’s source of information regarding corona virus were from television (TV) or social media accounting to 28.9% (n=70), followed by 24% (n=58) through family or friends, 21.9% (n=53) through peers, 13.2% (n=32) through healthcare workers, 8.3% (n=20) through online or website and 3.7% (n=9) from their general practitioners (Table 17) (Figure 21).

Table 17: Source of information regarding corona virus

SOURCE	FREQUENCY	PERCENTAGE
TV/ social media	70	28.9%
Family / friends	58	24%
Peers	53	21.9%
Health care	32	13.2%
Online / website	20	8.3%
General practitioner	9	3.7%
TOTAL	242	100%

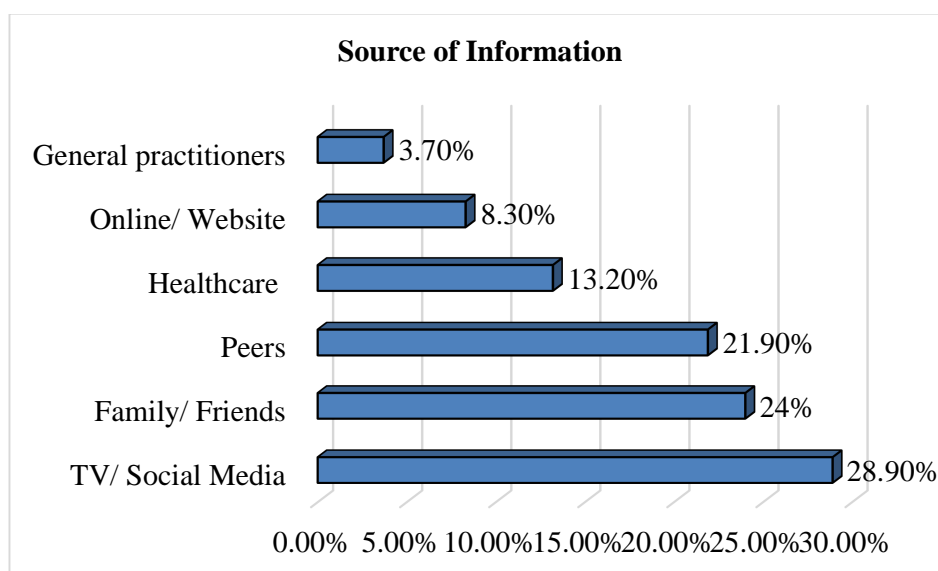


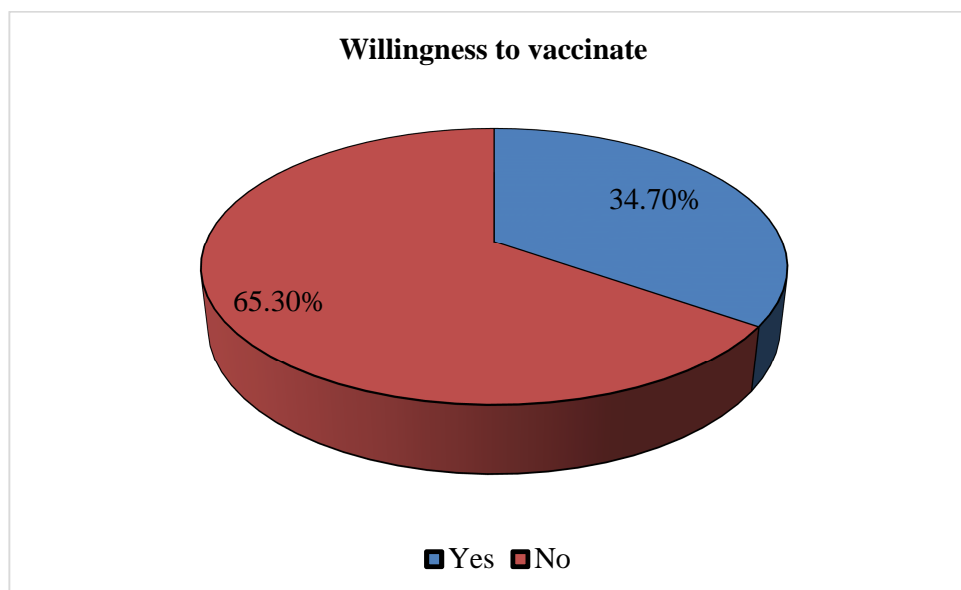
Figure 21: Source of information regarding corona virus

ATTITUDE**Willingness to vaccinate if the vaccine is available and eligible**

Among the study participants, 65.3% (n=158) were not willing to vaccinate provided the availability and eligibility of the vaccine. Only 34.7% (n=84) were reported willing to take the vaccine (Table 18) (Figure 22).

Table 18: Willingness to vaccinate if vaccine is available and eligible

WILLINGNESS TO VACCINATE	FREQUENCY	PERCENTAGE
Yes	84	34.7%
No	158	65.3%
TOTAL	242	100%

**Figure 22: Willingness to vaccinate if available and eligible**

Motivation for willingness to vaccinate

Major reason for willingness among the pregnant women to vaccinate was to protect themselves and their baby (n=40, 37.4%). Other reasons include advice from ANC doctor (n=28, 26.2%), herd immunity (n=13, 12.1%), to increase the number of vaccinated (n=12, 11.2%), advice from Ministry of Health and Family Welfare (MoHFW) (n=9, 8.4%) and trust in the science (n=5, 4.7%) (Table 19) (Figure 23).

Table 19: Motivation for willingness to vaccinate

MOTIVATION FOR WILLINGNESS TO VACCINATE	FREQUENCY	PERCENTAGE
Trust the science	5	4.7%
MoHFW	9	8.4%
ANC Doctor	28	26.2%
To increase the number of vaccinated	12	11.2%
Protect myself and the baby	40	37.4%
Herd immunity	13	12.1%
TOTAL	107	100%

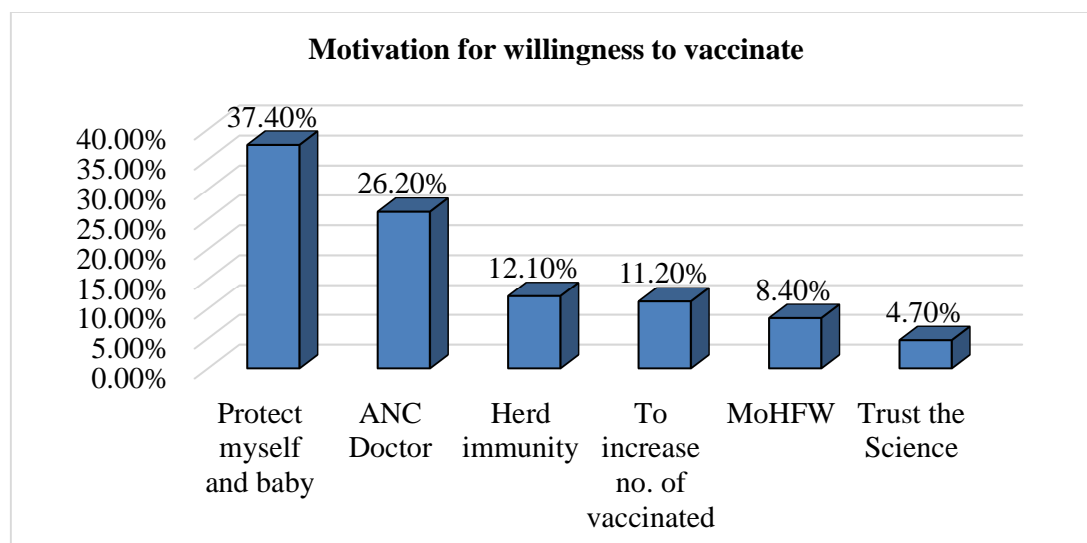


Figure 23: Willingness of study participants to take corona virus vaccination

Reason for not willing to take vaccine

Among the study participants, 49.4% (n=78) were not willing to take vaccine because they were afraid of the side effects. Other reasons the pregnant women were not willing to take corona virus vaccinations were no evidence on safety of vaccination (n=42, 26.6%), afraid of needles (n=12, 7.5%), will never get infected with virus (n=12, 7.5%), corona virus infection itself (n=9, 5.8%), and serious complications in pregnancy (n=5, 3.2%) (Table 20) (Figure 24).

Table 20: Reason for not willing to vaccinate

REASONS FOR NOT WILLING TO VACCINATE	FREQUENCY	PERCENTAGE
Afraid of the needles	12	7.5%
Afraid of the side effects	78	49.4%
No evidence on safety of vaccination	42	26.6%
corona virus infection itself	9	5.8%
Serious complications in pregnancy	5	3.2%
Will never get infected with the virus	12	7.5%
TOTAL	158	100

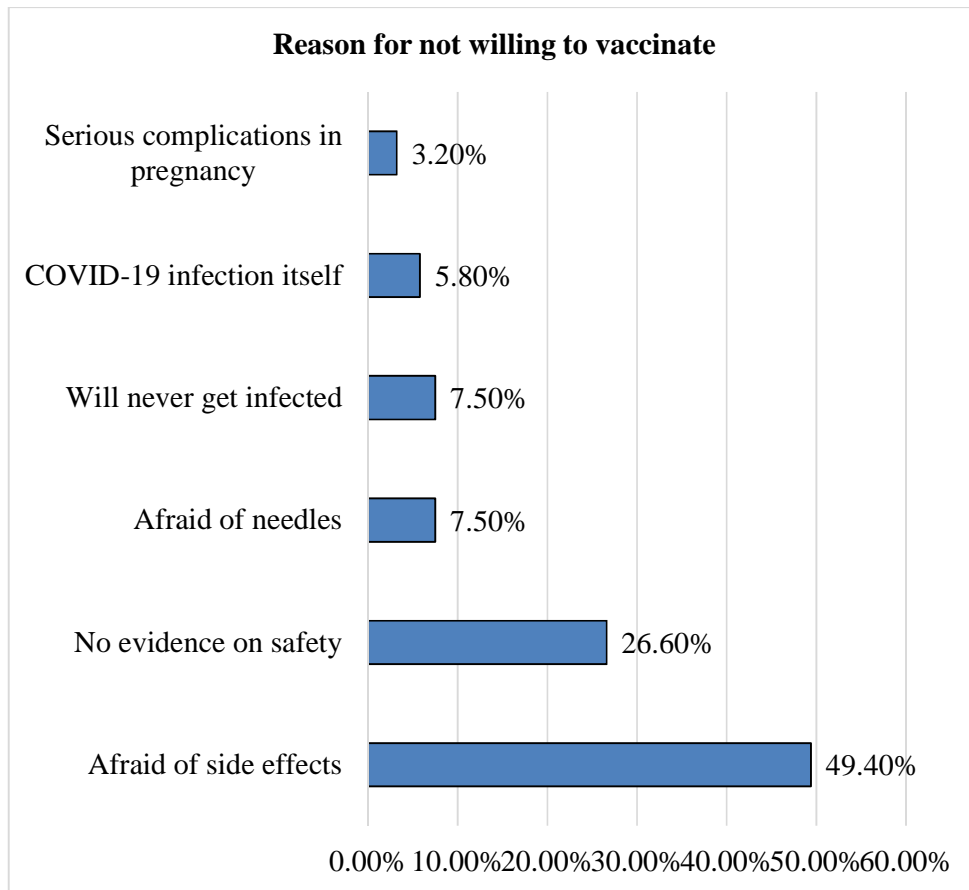


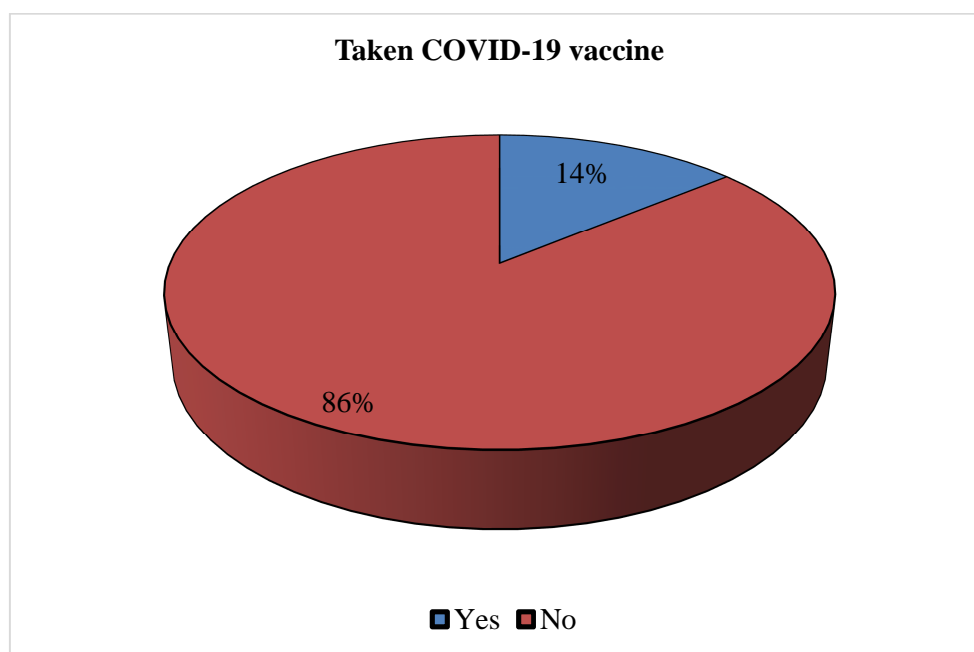
Figure 24: Reasons for not willing to take corona virus vaccination

PRACTICE
Prevalence of corona virus vaccinated study participants

Among the study participants, prevalence of vaccinated individuals was 14% (n=34) (Table 21) (Figure 25).

Table 21: Number of pregnant women who took vaccine

TAKEN CORONA VIRUS VACCINATION	FREQUENCY	PERCENTAGE
Yes	34	14%
No	208	86%
TOTAL	242	100

**Figure 25: Prevalence of women who took corona virus vaccination**

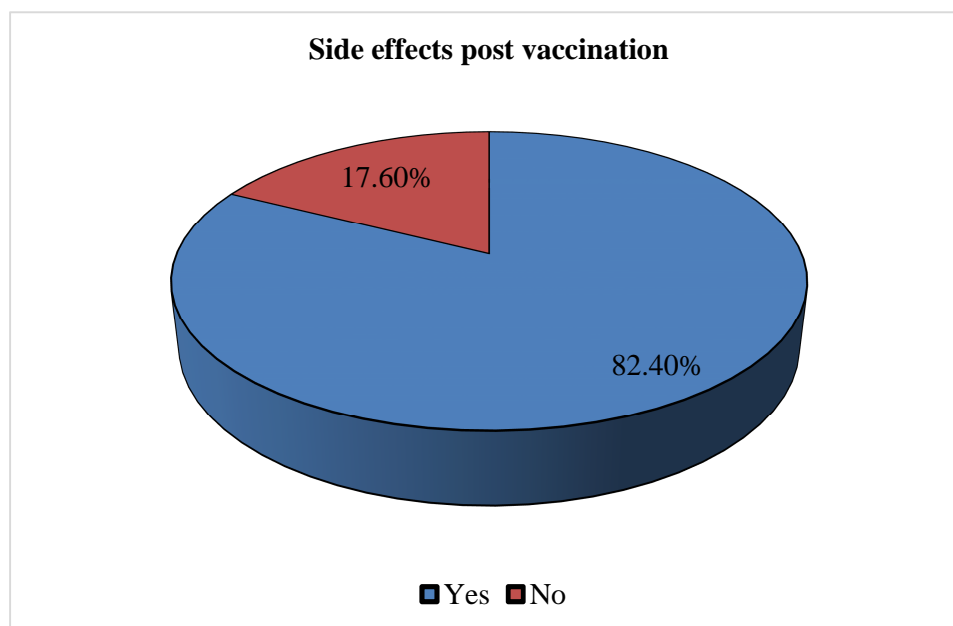
Out of the 34 study participants who took covid 19 vaccination in pregnancy, n=24(70%) had taken booster dose, n=8 (4.25%) had taken two doses, rest had taken single dose only

Side effects of vaccination

Among the study participants, 82.4% (n=28) reported they had side effects after taking corona virus vaccination. Only 17.6% (n=6) reported no side effects post vaccination (Table 22) (Figure 26).

Table 22: Side effects observed post vaccination

SIDE EFFECTS OF VACCINE	FREQUENCY	PERCENTAGE
Yes	28	82.4%
No	6	17.6%
TOTAL	34	100%

**Figure 26: Side effects reported post corona virus Vaccination**

Side effects of corona virus vaccine post-vaccination

Among the study participants, fever was reported as common side-effect post vaccination (n=15, 44.1%). Other side effects reported were injection site pain among 35.3% (n=12), corona virus infection itself among 11.8% (n=4) and myalgia among 8.8% (n=3) of study participants (Table 23) (Figure 27).

Table 23: Side effects of corona virus vaccine post-vaccination

SIDE EFFECTS	FREQUENCY	PERCENTAGE
Pain at injection site	12	35.3%
Myalgia	3	8.8%
Fever	15	44.1%
Covid19 infection	4	11.8%
TOTAL	34	100%

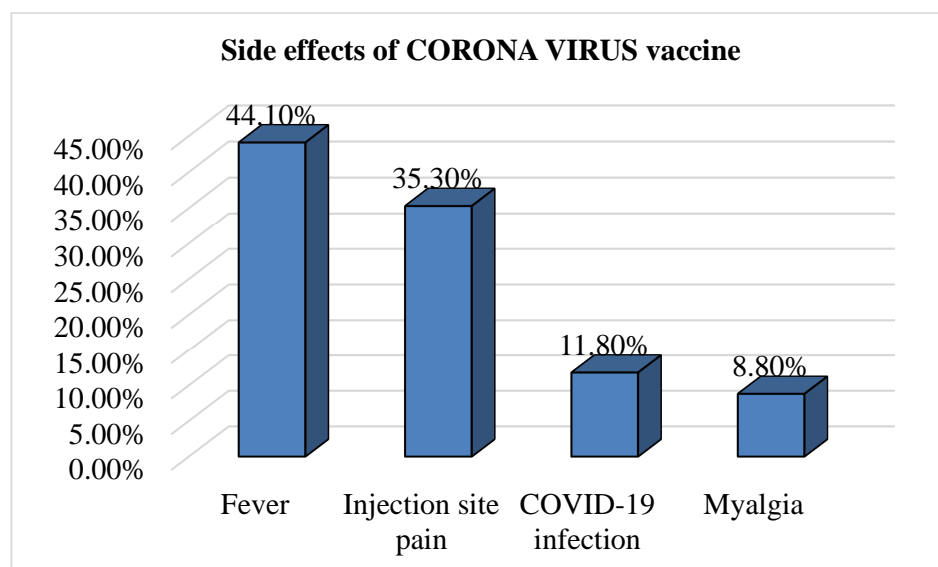


Figure 27: Side effects of corona virus vaccine

Number of pregnant women who took vaccination prior to conception

As per this study, majority of the women 72.5% (n=151) had taken covid-19 vaccine prior to conception, and 27.4% (n=57) had not been vaccinated and was not willing for the same

TABLE 24 Number of women who took vaccine who took vaccine prior to conception

Vaccinated	Frequency	Percentage
YES	151	72.59
NO	57	27.40
	208	100

As per this study, n=151, who had taken vaccine prior to vaccination, n=9(5.96%) had taken only 1 dose, and n =48(31.7%) had taken two doses, whereas the rest had all three booster doses n=94(62.25%)

DISCUSSION

Present study showed the study participants have a good **knowledge** on the corona virus. A moderate knowledge on corona virus vaccination. But their attitude towards the vaccine was very less and they were not willing to take the vaccine. There were still many myths and misinformation among the study participants regarding the vaccine.

Awareness about corona virus infection and availability of corona virus vaccine: The study recorded the knowledge, attitude and practice of corona virus infection and its vaccination among pregnant women. The study participants in this study had an awareness about corona virus infection (n=196, 81%) and only a little above half of the individuals had an awareness about availability of vaccine for corona virus infection (n=136, 56.2%). In a study conducted by Naz S et al, less than 50% of the study participants were aware of the impact of corona virus infection on pregnant women ⁽⁹⁵⁾. In a study conducted among pregnant and post-partum women in Maharashtra, 89.82% of the study participants were aware of the corona virus vaccine availability ⁽⁸⁴⁾. This unawareness among the study participants can be addressed by improving the knowledge by their gynaecologist by providing comprehensive antenatal counselling sessions. Providing appropriate and reliable sources of information regarding the pandemic and the vaccine is important ⁽⁹⁵⁾. A systematic review showed 59% of the individuals had good knowledge on the corona virus infection. This percentage is lesser than the global knowledge level ⁽⁹⁶⁾.

Safety of corona virus vaccine: In the current study, majority of the study participants were reported that corona virus vaccine is unsafe during pregnancy (n=144, 59.5%) and during lactation period (n=76, 31.1%). Around 68% of the study

participants mentioned they are aware of the side effects of the vaccine (n=163). In a study conducted in Maharashtra, 47.56% of the study participants reported the vaccine was effective among pregnant and lactating women ⁽⁸⁴⁾.

Source of information regarding corona virus: The source of information on corona virus were from TV/ social media (n=70, 28.9%), family/ friends (n=58, 24%), peers (n=53, 21.9%), healthcare workers (n=32, 13.2%), online/ website (n=20, 8.3%) and general physician (n=9, 3.7%). Family members and health professionals are those whom the study participants ask advice related to corona virus vaccination in a multi-centre study ⁽⁸³⁾. In Naz S et al, the reason for better knowledge on the corona virus and corona virus infection were due to mass media (television and internet) as majority of the study participants were exposed to mass media as common source of information (76.4%). Among the study participants, the majority of them were residing in the urban region (85.9%) and had a higher education (90%) ⁽⁸⁴⁾. In present study, information on locality and education were not available to make a comparison.

Willingness to take vaccine/ Reason for willing/ not: willing to take vaccine: More than one-third of the study participants were not willing to take the vaccine if it was available and they were eligible to take (n=84, 34.7%).

Individuals who were willing to get vaccinated reported they want to protect themselves and their baby from corona virus as a major reason for willingness to take the vaccine (n=40, 37.4%). And those who were unwilling, mentioned they were afraid of the side effects as a major reason (n=78, 49.4%). Reasons for not taking vaccine among study participants included lack of recommendation by healthcare workers, potential side effects to baby or mother, lack of awareness and non-availability of vaccine to pregnant women ⁽⁸⁴⁾. Majority of the individuals (83%) thought corona virus infection affects their pregnancy ⁽⁸⁶⁾. In Naz S et al, the attitude

towards corona virus was higher unlike present study ⁽⁸⁴⁾. In the systematic review, a positive attitude towards corona virus infection was reported (57%). Good knowledge of corona virus infection paved way for the positive attitude ⁽⁹⁶⁾. Major reason for hesitancy of corona virus vaccine was due to the concerns of harmful effects on their foetus ⁽⁹⁷⁾. People in these groups have been reluctant to receive the corona virus vaccine since there is a dearth of concrete data regarding the effectiveness and safety of the shot in pregnant populations. Strong research studies are therefore required, with a focus on evaluating the efficacy and safety of corona virus vaccines in women who are pregnant or nursing. Comprehensive study can allay worries and provide accurate information to guide vaccination decisions in these communities by bridging these knowledge gaps. In a pre-survey study before the availability of corona virus vaccine, 57% of the study participants showed willingness to take vaccine ⁽⁹⁸⁾.

The positive practice was reported in the Asian region (60%) compared to the African region (50%). The positive practice was directly proportional to the level of knowledge and attitude. The study population with lower knowledge and attitude showed a lower practice. Hence, improving the knowledge by appropriate measures and debunking the myths are important ⁽⁹⁶⁾. Despite having a poor knowledge on the impact of corona virus in pregnancy, the study participants reported positive attitude. The reasons for positive attitude may be fear, anxiety, and concerns in pregnancy for their foetus ⁽⁹⁵⁾.

Prevalence of vaccination: Actual prevalence of vaccination among the study participants was 14% (n=34). In a study conducted in Maharashtra, only 9.16% had taken vaccine ⁽⁸⁴⁾. A multi-country study showed only 12.9% of vaccinations done in Indian subset ⁽⁸³⁾. In Chekol Abebe E et al, only 14% of the study participants were

vaccinated ⁽⁹⁰⁾. This can be due to the knowledge and attitude towards the corona virus vaccination in the study.

This reduced vaccination may be because of less information on vaccine efficacy in pregnant women compared to other groups like elderly groups. This is because of the reasons listed next. Initially, just as expectant mothers were excluded from the vaccine development trials, they were also excluded from government awareness campaigns. In most cases, the vaccination was introduced gradually. For instance, during the initial stage, healthcare professionals were typically the first to receive the corona virus vaccination, followed by senior citizens. Women who were pregnant were excluded from both the public health awareness campaigns and the first corona virus immunisation trials. Pregnant women were not included in the awareness agenda until much later, and public health officials and providers did not provide guidelines, which may have contributed to low knowledge and mistrust regarding the safety and effectiveness of vaccines. Researchers think that pregnant women-focused education programmes are necessary to boost pregnant women's trust in the safety of the corona virus vaccine and to speed up the vaccine's uptake ⁽⁸³⁾.

Reason for not taking vaccine: The reason for low level of vaccination was due to the fear of pregnant women that the vaccine might be harmful to their baby or themselves ⁽⁹⁰⁾, which is the similar reason pregnant women had reported in present study.

Side effects post-vaccination: In present study, 82.4% of the study participants reported side effects post vaccination. But the reason was not reported in present study. The side effects may include fever, headache, fatigue, joint pain, myalgia, chills, nausea, and sweating ⁽⁹⁰⁾. Pain in the injection site (68.1%), and fever (56.4%) were recorded in Walid Al-Qerem et al ⁽⁹⁷⁾. Regarding the safety of the corona virus

vaccine, the Centres for Disease Control and Prevention (CDC) have also noted that most people have experienced mild-to-moderate side effects, such as headaches, fatigue, and soreness at the injection site, which usually go away in a few days, while adults 18 years of age and older are more likely to experience fever and chills⁽⁹⁷⁾.

Although the overall reactogenicity profile was similar, the study observed slight differences in the reporting frequency of specific reactions between pregnant and non-pregnant women (injection site pain was reported more frequently in pregnancy, and other systemic reactions were reported more frequently among non-pregnant women). None of the data that are currently available point to a clear increase in side effects or safety issues with using the corona virus vaccine while pregnant⁽⁹⁸⁾.

Maternal age, education, spouse education level, comorbidities, and socio-cultural and demographic features were associated with the knowledge, attitude and practice of corona virus among pregnant women⁽⁹⁶⁾. Age, marital status, educational status, knowledge, and attitude were statistically associated with the vaccination status⁽⁹⁰⁾. Socio-demographic status, old age, comorbidities, and education were significantly associated with the higher knowledge of corona virus⁽⁹⁷⁾. Age, parity, type of residence, family size, and mass media were the factors associated with positive attitude and good practices among pregnant women⁽⁹⁵⁾.

Higher income was likewise associated with more expertise. This conclusion is probably due to the fact that those with higher incomes typically have easier access to a wider range of information sources, including reliable news websites and subscriptions to scholarly journals. They may be exposed to more accurate and up-to-date information about corona virus as a result of this improved accessibility to information sources, which will eventually raise their level of understanding⁽⁹⁷⁾.

Research endeavours have yielded tactics that have the potential to enhance vaccination acceptance and uptake. These strategies surpass conventional information campaigns that aim to modify behaviour through enhanced understanding. In the context of the present pandemic, research supporting vaccination promotion generally is helpful, but information alone has demonstrated a limited effect on encouraging vaccination uptake. The adoption and utilisation of corona virus vaccinations pose a previously unheard-of obstacle. The Ministry of Health ought to employ such strategies in order to increase vaccination rates. A nationwide media campaign to market the vaccine is one strategy that can be used to enhance the vaccine's adoption. Other strategies include providing free vaccinations to all targeted groups, distributing the vaccine equally and fairly among target groups by high-risk and priority groups, and more. A waiting list for those who are interested in receiving the vaccination but are not in the designated target groups is one way to promote community acceptance and urge people to take the vaccine. Public endorsements from leaders in the government and community are another. Other strategies include highlighting the importance of behavioural science in an effort to effectively reach each group and encouraging community cooperation by hosting frequent teleseminars where members of the public can ask questions and receive direct answers. Increasing vaccination adoption also entails spending more on hiring experts in the sector to undertake professional training in risk communication and community involvement techniques ⁽⁹⁹⁾.

It is important to investigate the cause of the hesitation and correct any false notions. There is a tonne of misleading material on social media regarding the corona virus vaccine. Women should feel comfortable that there is no data indicating any influence on fertility and that there is no conceivable scientific mechanism by which

the vaccine might alter fertility. It is crucial to stress that vaccinations cannot spread corona virus and cannot change an individual's DNA since mRNA does not reach the host cell's nucleus and stays apart from the host DNA. The thorough explanation can reassure some women that they must consent to vaccinations. Citing specific statistics to highlight the vastly greater benefits of vaccination for both mothers and foetuses than the hazards associated with it may be particularly helpful ⁽⁹⁸⁾.

Age

Majority of the study participants in this study were between 26 to 30 years. The mean age of the study participants in Al-Marshoudi et al was 38.27 years (with standard deviation of 10.45 years) ⁽⁹⁹⁾. Majority of the study participants were in 18 to 29 years group (62.7%) in Walid Al-Qerem et al ⁽⁹⁷⁾. Majority of the study participants was in 20 to 35 years group ⁽⁸³⁾. Majority of the study participants were less than 30 years old (55.2%) ⁽⁹⁵⁾.

Parity

Among the study participants in present study, 31.4% (n=76) were primigravida, 46.7% (n=113) were gravida 2 and 21.9% (n=53) were gravida 3 and above. The parity among the study participants in 33.7% with 0 parity, 45.4% with one or two parity and 20.9% with 3 or more parity ⁽⁸³⁾. A parity of zero was found in 23.3%, two to four parities in 38.2%, more than 5 parities in 38.5% was reported ⁽⁹⁵⁾.

Socio-economic status

Majority of the study participants in present study were lower-middle class (n=76, 31.4%), followed by 21.9% (n=53) of lower class, 15.7% (n=38) of upper-lower class, 12.3% (n=30) of upper-middle class and 1.23% (n=3) of upper class.

Majority of the study participants were in middle class (45.2%), followed by 29.3% in lower-middle class, 14.4% in upper-middle class, and 11.2% in poor or low socioeconomic class⁽¹⁰⁰⁾.

Comorbidity

Gestational diabetes was found in 17.6% of the study participants. Prevalence of anaemia was present in 7.7% of the study participants⁽⁸⁵⁾. In present study, the prevalence of hypertension was 31.8% (n=77), the highest among the study participants. Prevalence of diabetes, hypothyroidism, asthma, epilepsy and cardiovascular disease (CVD) were 25.6%, 5%, 0.8%, 0.4% and 0.4% respectively.

Availability of type of Corona virus vaccine

Majority of the study participants were aware of Covaxin vaccine (n=112, 46.3%), followed by Covishield (n=101, 41.7%) and other vaccines like Sputnik (n=29, 12%). To our knowledge, there were no studies showing similar data on knowledge of type of corona virus vaccines availability.

Place of vaccination

Majority of the study participant's place of vaccination was primary health center (PHC) accounting to 71.1% (n=172). To our knowledge, there were no studies showing similar data on knowledge of type of corona virus vaccines availability.

Awareness of number of doses of vaccination

Among the study participants, 45% of them knew about two doses of vaccines⁽⁹⁹⁾. More than half of the study participants reported they were aware of only one dose for corona virus vaccination (n=135, 55.8%).

Among the 34 participants who took vaccine in pregnancy, majority of them had taken booster doses 70%, and among those who had taken vaccine prior to conception, all three booster doses were taken 62.25%

Education

In present study, majority of them completed primary education (n=127, 52.5%), followed by secondary education of 29.8% (n=72), graduate & above 10.3% (n=25), and illiterate of 7.4% (n=18). In a study conducted by Skjefte et al, 6.2% never attended school, 11.9% attended high school, 17.7% attended college, 37.9% have a diploma or degree, 26.4% had professional degree or masters degree (100). In Al-Marshoudi et al, 8.04% were illiterate, 54.64% attended pre-secondary school, 37.32% had a post-secondary school and higher education ⁽⁹⁹⁾. In Naz S et al, 1.1% of the study participants had no formal education, 6.6% had a basic education, 31.6% had a college degree, and 60.7% had a university degree ⁽⁹⁵⁾.

Strengths and Limitations

The study included information on socio-economic status of the study participants. The study also has limitations on the fact that not many took the vaccine due to weaning off of corona virus disease. Currently, corona virus is not a major concern or the disease spread in pandemic nature. Majority of the population were taking booster doses right now. The sample size of the study population was small and lack of information on education were few other limitations of the current study.

CONCLUSION

The study showed low acceptance of corona virus vaccine among study participants during pregnancy. Even though the knowledge on corona virus and the vaccination availability is high, the vaccine hesitancy is higher. Recommendations from the healthcare workers on knowledge on safety of vaccines among the pregnant and lactating women and its importance should be provided as counselling. Providing knowledge on the side effects, safety, and complications in pregnancy should be counselled by healthcare workers or general physician to increase the vaccine acceptancy among the study participants.

SUMMARY

A cross-sectional study conducted among pregnant women on knowledge, attitude, and behaviour on corona virus infection and corona virus vaccination at KAHER's Dr Prabakhar Kore Medical hospital and Charitable centre, Belagavi with majority of the age group varying between 26 to 30 years. Majority of the study participants were gravida 2, (n=113, 6.7%), and belonged to lower middle class (n=76, 31.4%)

The study participants had an awareness about corona virus infection n=196 81%, and only little above half of the individuals had awareness about availability of corona virus vaccine n=136 56.2%.

Majority of the study participants reported that corona virus vaccine is unsafe in pregnancy n=144 59.5%, owing to the lack of studies done on vaccination in pregnancy and lactation.

Around 68% of the study participants mentioned they were about the side effects post vaccination if vaccinated

The source of information on corona virus were from Tv/ Social media (n=70, 28.9%), family friends peers (n=53, 21.9%), online and website (n=20, 8.3%) Actual prevalence of vaccination in the study participants was 14% n=34, as there were no proper guidelines

More than 1/3rd of the study participants were not willing to take the vaccine even if it was available at free of cost and were eligible to take (n=84, 34.7%)

Participants who were willing to vaccinate reported the major drive for vaccination was to protect themselves and the baby from the deadly corona virus

(n=40, 37.4%), and those who were unwilling mentioned that they were not willing to vaccinate as they were afraid of the side effects (n=78, 49.4%)

Majority of the study participants thought corona virus will affect this pregnancy(83%).Major reason for hesitancy of corona virus vaccine was ue t the harmful effects on their fetus.

In the present study 82.4%, of the study participants, whoever had taken vaccine reported side effects. The major side effects included pain at injection site (68.1%), and few reported fever and myalgia post vaccination.

This study showed a good knowledge on corona virus infection. However, knowledge on corona virus vaccine was comparatively low. The attitude was good. However, the vaccination rate was 14% among the study participants. There was a high hesitancy among study participants for taking corona virus vaccination. The main reason reported by the study participants for the same was due to the fear of side effects to their foetus after taking the vaccine. However, this study also noted the major reason for willingness to vaccination was due to protect their baby and themselves from the infection.

Hence, awareness program, antenatal counselling sessions should be provided to the pregnant women to reduce the hesitancy. Counselling to the pregnant women and her family should be done to increase the rate of vaccination. This emphasises the necessity of ongoing community-based health education for expectant mothers to increase their understanding of corona virus, and it also calls for more research to determine the disease's effects on pregnancy and feto-maternal outcomes.

As vaccination programmes continue around the world, tracking acceptance and its determinants will give decision-makers important information about public

willingness and help them craft effective policies. Countries where there is a pandemic-related public mistrust must work quickly to restore public trust in vaccines by engaging the community effectively and communicating openly. corona virus vaccination education efforts should not only focus on the safety and effectiveness of the vaccine, but also on the pandemic as a whole and the issues that communities are facing. As more detailed information about these susceptible populations becomes accessible, there will be more chances to affect the important factors we found and raise public confidence in the stringent approval of future vaccines.

Majority of the study participants were hesitant to take vaccine due to questionable safety. Reluctance to receive the vaccine will be lessened with increased investigation into the safety of the shot in expectant mothers as well as the health of the foetus and newborn. In order to develop successful strategies and policies to enhance vaccine acceptability during this expanding epidemic, it will be helpful to identify the main causes of vaccination reluctance within this community. Improving vaccine acceptability will require developing a uniform vaccination schedule for expectant and nursing mothers.

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ANNEXURE: I-INFORMED CONSENT FORM

Name of Student/Principal Investigator:

Name of Guide/Co Investigators:

Objective: To assess the level of knowledge, attitude and behaviour towards covid-19 vaccination in pregnant women.

Withdrawal from participation in the study: Participation in this study is voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will/will not have nor get any benefits by participating in this study. The data gathered will help the population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person from identifying you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study. **Authorization for publication of aggregated data:** Results obtained after processing of the aggregated data will be published for scientific purposes and or presented to scientific groups.

However, your identity will never be revealed.

Questions: In case of any questions with regard to this study, you are free to contact: “Name of student/PI, mobile number, email ID” If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study “**KNOWLEDGE, ATTITUDE AND PRACTICE OF COVID-19 VACCINATION IN PREGNANCY**”. My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANNEXURE – II - PROFORMA

KNOWLEDGE, ATTITUDE AND PRACTICES OF COVID-19 VACCINATION AMONG
ANTENATAL WOMEN AT A TERTIARY CARE

S.NO: _____

DATE: _____

OP NO: _____

NAME: _____

AGE: _____

EDUCATION:

Illiterate	
Primary education	
Secondary education	
Graduate and above	

OCCUPATION:

Housewife	
Private sector	
Government sector	
Self employed	
Farmer	

HUSBAND EDUCATION:

Illiterate	
Primary education	
Secondary education	
Graduate and above	

HUSBAND OCCUPATION:

Self employed	
Private sector	
Government sector	
Farmer	

INCOME (PER CAPITA):

>7863	
3931-3930	
2359-7862	
1179-2358	
<1179	

SOCIO ECONOMIC STATUS (MODIFIED B G PRASAD CLASSIFICATION)

I	
II	
III	
IV	
V	

ADDRESS: _____

MOBILE NO: _____

Urban	
Rural	

Obstetric history:

Gravid: _____ Para: _____ Living: _____ Abortion: _____

LMP: _____ EDD: _____ POG: _____

H/O Covid-19 vaccination: Yes/No

Covid 19 vaccine taken :

Number of vaccine doses taken :

Vaccination pregnancy interval :

General examination:

Built: Nourishment: BMI :

PR: BP:

Pallor: Edema: Icterus:

P/A:

PART A

1) Did you get the flu vaccination during pregnancy?

- Yes
- No
- I'm waiting to run it

2) In the answer is no to the previous question, what is the reason for not vaccinating?

- I was not advised to do so
- I was afraid of the side effects on me and the baby
- I do not consider it necessary
- I couldn't find it

3) Did you have information on the effects of Covid-19 (SARS-COV 2) in pregnancy?

- No
- Yes from my gynaecologist, general practioner
- I read on internet/ Journal, Television

4) Did you have any information on the effects of Covid 19 vaccine in pregnancy?

- No
- Yes from my gynaecologist, general practioner
- I read on internet/ Journal, Television

5) In a range of 1-5, how worried are you that the Covid 19 vaccine could cause malformation on your baby?

6) In a range of 1-5, how worried are you that the Covid 19 vaccine could cause premature birth?

7) In a range of 1-5, how worried are you that the Covid 19 vaccine could cause growth restriction?

8) Covid 19 infection is highly contagious?

- Surely not
- I do not think so
- I do not know
- I think so
- Surely

9) Covid 19 infection can sometimes be severe enough to require hospitalization?

- Surely not
- I do not think so
- I do not know
- I think so
- Surely

10) Pregnant women are at higher risk of having to be hospitalized due to Covid 19 infection than adults

- Surely not
- I do not think so
- I do not know
- I think so
- Surely

11) Pregnant women run the same risk of complications from Covid 19 infection as women who are not pregnant?

- Surely not
- I do not think so
- I do not know
- I think so
- Surely

12) The Covid 19 vaccine is safe?

- Surely not
- I do not think so
- I do not know
- I think so
- Surely

13) The Covid 19 vaccine is effective?

- Surely not
- I do not think so
- I do not know
- I think so
- Surely

14) The Covid 19 vaccine is safe in pregnancy?

- Surely not
- I do not think so
- I do not know
- I think so
- Surely

15) You would like to have the covid 19 vaccination during pregnancy?

- Surely not
- I do not think so
- I do not know
- I think so
- Surely

16) What importance do you give to the start of -Covid 19 vaccinations?

- turning point in the pandemic
- useless
- propaganda
- I have no idea

17) If answer to question number 15 was yes , why did you get the Covid 19 vaccine ?

- I trust the science
- It is recommended be the Mohfw,
- It was recommended by health care professionals during antenatal check up
- To increase the number of vaccinated people in pregnancy
- To protect myself and my baby from severe Covid 19 complications
- Evidence now states that Covid 19 vaccine is safe in pregnancy
- Vaccinations represent the primary prevention against diseases

18) If answer to question number 15 was no, why did you not get Covid 19 vaccine?

- Afraid of the needles
- Afraid of the side effects on myself
- Afraid of the side effects on my baby
- Vaccine would have led me to infection

- It will not cause any serious complications in pregnancy
- I'm at a low risk to get Covid 19 infection
- Family members avoided me to take vaccine in pregnancy
- Friends avoided me to take Covid vaccine in pregnancy
- Healthcare professionals advised me against the vaccine
- Lack of data about Covid 19 vaccine safety in pregnancy

19) Do you think you have had enough information about Covid 19 vaccine in pregnancy?

- Yes
- No

20) If the answer to quest number 19 was yes, where did you get the information?

- Health care professional in pregnancy
- General practitioner
- Family /friends
- Ministry of health website
- Scientific paper
- Tv/ social media

21) In a scale of 1 to 5, what is the risk perception related to Covid 19 vaccination for yourself?

22) In a scale of 1 to 5, what is the risk perception related to Covid19 vaccination for your baby?

23) Do you think minor side effects post vaccine are possible and are acceptable?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

24) What were the complications related to Covid 19 vaccination in pregnancy

- Injection site reaction
- Fever
- Myalgia
- Sore throat
- Hypotension
- Hairfall
- Covid 19 infection

25) Place of vaccination

- Antenatal clinic
- PHC/ CHC
- Tertiary care centre

26) If given a choice, which Covid 19 vaccine would you like to take?

- Covaxin
- Covishield
- Sputnik V

27) Are you aware about the number of doses of vaccination

- Single dose
- Two doses
- Booster dose

28) Did you know you can register yourself for Covid 19 vaccination

- Yes
- No

29) After getting a Covid 19 vaccine, I don't need to follow preventive measures like wearing a mask, sanitisation and social distancing

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

30) Did you anytime refuse to get vaccinated because you considered it as useless or dangerous?

- Yes
- No

31) Have you recommended about Covid 19 vaccine to your fellow pregnant women?

- Yes
- No

ANNEXURE – III
MASTER CHART

s no	op/ip no	age	gravida	socioeconomic status	comorbidities	awareness on infection	awareness on vaccine	type of vaccine	place of vaccine	number of doses of vaccination	safety on covid 19 vaccination in pregnancy	safety of covid 19 vaccine in lactation	awareness on side effects	source of information	willingness to vaccinate if available and eligible	motivation for willingness	reason for no vaccination	pregnant women who took vaccine	did not take vaccine in pregnancy	side effects post vaccination
1	10054812	2	1	4	2	1	2	1	1	1	2	2	1	6	2		4	2	1	
2	7350896	3	4	5	7	1	1	1	2	1	2	2	1	2	2		2	2	1	
3	10054870	2	3	4	7	1	2	1	1	1	2	2	1	6	2		7	2	1	
4	10054534	2	3	3	7	1	1	2	1	1	2	2	1	2	2		6	2	1	
5	10053832	2	3	4	2	1	1	2	1	2	1	1	2	2	2		5	2	1	
6	7248620	1	1	3	2	1	1	1	1	1	1	1	1	6	2		6	2	1	
7	10054482	2	2	3	2	2	2	2	4	1	1	1	1	5	2		6	2	1	
8	7289783	1	1	4	7	1	1	1	3	2	2	2	1	4	2		5	2	1	
9	7276336	2	2	3	7	1	1	1	2	2	2	2	1	4	2		1	2	1	
10	7049286	1	1	3	7	1	1	1	2	1	2	2	2	1	2		6	2	1	
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12	7170853	3	1	4	2	1	1	1	1	1	2	2	2	2	2		6	2	1	
13	7279494	1	1	4	1	1	1	2	2	1	2	2	1	4	2		6	2	1	
14	6680745	3	2	4	1	2	2	3	1	1	2	2	2	5	2		5	2	1	
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17	7260495	2	2	2	1	2	1	2	2	1	1	1	1	1	1	1		1	2	1
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20	10053551	3	1	5	1	1	1	1	1	1	2	2	1	6	1	3		1	2	
21	5475973	1	1	3	3	1	1	2	1	2	2	2	1	3	2		3	2	1	
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23	10053684	2	1	4	7	1	1	2	1	2	2	2	1	4	2		2	2	1	
24	10054364	2	3	4	7	1	1	1	2	1	2	2	1	2	1		3	1		1
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47	10053512	3	1	2	1	1	1	2	2	4	1	2	1	5	2		5	1		1
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106	7326907	4	1	5	2	1	2	1	1	2	2	2	1	3	2		5	2	1	
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116	7211474	2	1	3	1	1	2	3	2	2	2	1	1	5	1	5		2	1	
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131	7246251	1	1	3	2	2	1	2	4	1	2	1	2	2	2		2	2	1	

132	7282783	2	1	4	1	1	2	2	1	2	1	2	2	2	2		1	2	1	
133	7371877	3	1	5	7	1	1	2	4	1	2	1	1	2	2		5	2	1	
134	7298642	1	1	3	2	1	2	1	1	2	1	2	2	5	2		4	1		1
135	7354932	2	2	5	4	1	1	3	4	2	2	1	1	4	2		3	2	1	
136	6067738	3	1	4	7	1	2	1	1	2	1	2	2	1	2		5	2	1	
137	7251912	4	3	2	1	1	1	1	2	2	2	1	1	6	2		6	2	1	
138	10054001	5	1	3	7	1	2	1	1	1	1	2	2	6	1	3		2	1	
139	10054285	2	1	2	1	1	1	2	2	3	2	1	1	6	2		2	2	1	
140	10054357	3	1	2	7	1	2	1	4	2	1	2	1	5	2		1	1		1
141	10052934	1	2	3	1	1	1	3	1	1	1	1	2	5	1	5		2	1	
142	10053684	2	1	4	7	1	2	1	4	1	1	2	1	4	2		2	2	1	
143	7320359	3	1	5	1	1	1	2	2	1	1	1	2	1	1	2		1		1
144	5475473	4	2	5	7	1	2	2	4	1	1	2	1	2	2		2	2	1	
145	10053551	2	3	5	7	1	1	2	1	1	1	1	2	1	1	5		2	1	
146	7395598	3	1	3	7	2	1	1	2	1	1	2	2	2	2		3	2	1	
147	1002831	1	2	3	7	1	1	2	1	1	1	1	1	1	1	2		2	1	
148	7225062	6	3	5	1	2	2	1	2	1	1	2	2	3	2		6	2	1	
149	10052429	2	1	2	7	2	1	2	1	1	2	1	1	5	1	4		2	1	
150	7203878	3	1	3	2	1	2	1	1	1	2	2	2	4	2		3	2	1	
151	7089306	5	1	2	7	1	2	2	2	1	2	1	1	6	1	5		2	1	
152	10053369	2	1	3	2	1	1	2	1	2	2	2	1	5	2		2	1		1
153	7276336	1	1	2	1	1	2	3	2	1	2	1	1	5	1	6		2	1	
154	4556074	3	2	2	2	1	1	1	1	2	1	2	1	5	1	6		2	1	
155	7198359	1	3	3	2	1	2	3	2	1	2	1	1	5	1	2		2	1	
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157	7240695	2	2	2	7	1	2	2	2	1	2	1	1	4	1	1		2	1	
158	7932221	3	1	1	2	1	1	3	1	2	1	2	2	1	2		5	2	1	
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160	7295615	5	1	2	7	1	1	1	1	2	1	1	2	5	1	2		1		1
161	10054479	2	1	2	2	1	2	3	2	1	2	2	1	1	2		2	2	1	
162	6272706	3	2	2	7	1	1	1	1	2	1	2	1	5	1	6		2	1	
163	7322034	1	2	3	2	1	2	3	2	1	2	1	1	4	2		5	2	1	
164	6253974	2	3	5	1	1	1	2	1	2	2	2	1	1	1	2		2	1	
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168	7139604	2	2	5	7	1	1	2	1	5	1	2	2	4	2		1	2	1	
169	7116579	3	3	2	2	2	2	1	2	1	2	1	1	3	2		2	2	1	
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172	7282783	1	2	5	2	1	1	2	2	1	1	1	2	2	2		5	2	1	
173	10054856	2	3	4	7	2	2	1	1	2	2	2	1	2	1	6		2	1	
174	7104973	3	1	4	2	1	2	2	1	1	1	1	2	4	2		2	2	1	
175	6736219	4	2	3	1	1	1	1	2	2	1	2	1	2	2		1	2	1	
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179	1005484	1	2	4	1	1	1	2	3	1	2	1	1	2	2		2	2	1	
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181	10054870	3	2	2	7	1	1	2	1	1	2	1	1	1	2		2	2	1	
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186	7276366	2	3	3	7	1	1	1	1	3	1	2	2	2	2		5	2	1	
187	72111828	1	2	4	7	1	1	2	2	1	2	1	1	3	2		5	1		1

188	7311323	2	1	3	2	1	1	1	1	2	1	2	2	2	2	2	2	1	
189	4069887	3	2	4	7	1	1	1	2	1	2	1	1	1	1	3	2	1	
190	10053837	2	3	5	1	1	1	2	1	2	1	2	2	5	1	2	2	1	
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193	5076544	2	3	2	2	1	1	1	1	1	2	1	2	2	2	5	2	1	
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195	7316031	5	2	3	7	1	1	3	3	3	2	1	1	3	1	5	1		1
196	7248620	1	3	4	2	2	2	2	4	2	1	2	1	2	1	2	2	1	
197	10054862	2	1	4	2	1	1	3	5	1	2	1	1	1	2	2	2	1	
198	7304089	3	2	4	7	1	1	1	4	2	1	1	1	5	1	5	2	1	
199	7112704	2	1	5	2	1	1	1	1	1	2	1	2	3	2	2	2	1	
200	7323457	1	2	4	1	1	1	1	2	1	1	1	1	2	1	2	2	1	
201	10054086	2	2	5	7	2	2	1	1	1	2	1	2	1	2	3	2	1	
202	7350896	3	2	5	2	1	1	1	2	1	1	2	1	5	2	2	2	1	
203	7203878	4	1	4	1	2	2	2	1	2	2	2	2	2	2	5	1		1
204	7320121	2	1	5	7	1	1	1	1	4	1	1	1	3	1	2	2	1	
205	6956301	3	3	5	2	1	1	1	2	1	2	1	2	5	2	2	2	1	
206	7049286	4	1	5	7	1	1	2	1	2	1	1	1	2	1	5	2	1	
207	7317617	2	1	3	1	1	1	1	3	5	2	2	2	3	2	2	2	1	
208	7289783	4	1	5	2	1	1	2	4	2	1	1	1	1	1	2	2	1	
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214	7033614	3	2	3	7	1	1	2	1	2	1	1	1	1	2	1	2	1	
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216	703324	4	1	2	1	1	1	2	2	1	1	1	1	5	2		3	2	1	
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222	10052429	3	1	5	7	1	1	1	3	2	2	2	2	3	1	3		2	1	
223	10054787	1	2	4	2	1	1	2	1	1	1	1	1	2	1	5		2	1	
224	7317366	4	3	5	1	2	2	1	4	1	1	2	2	5	1	5		2	1	
225	100543064	2	2	4	7	1	1	2	1	1	1	1	2	2	1	2		2	1	
226	10054479	3	1	5	7	1	2	1	3	1	2	1	1	3	2		5	2	1	
227	7298731	2	2	4	7	2	1	3	4	1	2	1	2	5	1	3		1		2
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229	7310903	2	2	2	1	1	1	1	3	2	1	2	2	1	5	1	1		2	1
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232	7296038	3	1	3	1	1	1	2	1	5	2	1	2	5	2		5	2	1	
233	10053369	2	1	4	2	1	1	1	1	1	1	2	1	4	2		2	2	1	
234	100554108	3	2	5	1	1	1	1	2	2	2	2	2	2	2		1	2	1	
235	7240206	2	3	5	2	1	2	2	1	1	1	1	1	2	2		2	2	1	
236	63837218	1	2	4	1	1	1	1	2	5	2	2	1	3	2		5	2	1	
237	7225202	3	1	5	2	1	1	2	1	2	1	2	1	5	2		1	2	1	
238	7080378	5	3	4	1	1	2	1	1	5	2	1	1	2	1	3		1		2
239	6909656	2	3	3	1	1	1	2	2	2	1	2	1	3	2		6	2	1	
240	7072073	3	1	2	2	1	2	1	5	1	2	1	1	4	1	5		2	1	
241	5909941	1	2	1	7	1	1	2	1	4	1	2	2	5	2		2	2	1	
242	7198359	2	3	5	1	1	2	1	2	1	1	2	1	2	2		2	2	1	