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Knowledge And Attitude Towards the Challenges and Limitations in Covid Vaccine Development in Various Countries Among The Dental Population

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ABSTRACT

Introduction: The current Covid-19 pandemic has urged the international scientific community to find solutions in regards to therapeutics and vaccine developments. Around 70 vaccines were being developed at the time of the survey. Any vaccine that is reliable, effective, permanent and accessible to a large population is a good candidate. The aim of this study is to determine the knowledge and attitude towards the challenges and limitations in Covid vaccine development in various countries among the dental population.

Materials And Method: A self structured online questionnaire was distributed among dental students through the platform Surveyplanet. The survey was distributed to 100 participants who were selected using Simple random sampling. The questionnaire consisted of 16 questions pertaining to Covid Vaccine development and its challenges and limitations. The results were tabulated and analyzed using SPSS software by IBM. Pie charts and bar graphs were used to graphically represent the data obtained.

Results: 47% of the participants were aware of the severity of Covid in our country, while 78% were aware that Covid vaccination programs had begun across the country at the time. 51% of the participants thought that Covishield was the most effective vaccine, in comparison to Pfizer, Moderna, Novovax and Covaxin.

36% of the participants believed that India was the frontrunner in vaccine development at the time, followed by the USA (25%). 47% believe that the safety and the testing of the developed vaccines might be hindered due to the time constraints and 69% believe that vaccination and immunisation will be effective against the spread of the coronavirus. Overall, more than 80% of the participants believe that there is a need to be vaccinated against the novel Covid-19.

Conclusion: It can be concluded that the dentists are knowledgeable and aware of the challenges and limitations of Covid vaccine development. This is imperative in guiding the general public and sharing knowledge and providing scientific facts so that the public can take an informed decision with regards to vaccination and immunization against the Sars-CoV-19.

Keywords: *Sars-CoV-19, Covid-19, Covid vaccine, Covid immunization, Coronavirus, novel technology, innovative technology*

INTRODUCTION

The current Covid-19 pandemic has urged the international scientific community to find solutions in regards to therapeutics and vaccine developments(1). The novel Sars-CoV-2 is believed to have emerged from bats originating from Wuhan, China. Since its initial outbreak in September 2019, it has spread to 188 countries and has infected more than 163 million people with 3.3 million deaths(2). Sars-CoV-2 is a highly contagious virus, spreading through inhalation of respiratory aerosols, direct contact with infected individuals, fomites, etc(3). Social distancing, personal hygiene, frequent hand washing or sanitizing using the alcohol (61-70%) based hand-sanitizers, and disinfection of the surfaces are some steps which can protect the individuals from getting infected(4). Many countries have redirected their efforts towards vaccine development and vaccine production(5).

The various vaccine production platforms for Sars-CoV-2 are elaborated below, with their advantages and limitations:

Live attenuated vaccine is derived from cold adapted strain viruses, reassortants, and reverse genetics(6). It has the intrinsic ability to stimulate the immune system by inducing the toll-like receptors(7).

It is limited by its need to undergo extensive accessory testing to establish safety and efficacy. Inactivated virus vaccine is safer and stable when compared to Live Attenuated Vaccine(8). It is advantageous over LAV as the current infrastructure and technology is adequate for its development. It can also be added to other adjuvants to increase their immunogenicity(9). The disadvantages include necessity of a booster dose for increased immunity, difficulty in maintaining the integrity of the immunogenic particles. Subunit Vaccine does not contain any live component of the viral particle and is hence, safer with fewer side effects(10). The limitations include Uncertainty regarding immune memory and the reduced effect of inducing an immune response in the body(11). Viral Vector based vaccine shows a highly specific gene delivery into the host cell with a vigorous immune response(12). It avoids handling of any infectious particle and it has been used widely for MERS-CoV with positive results from the trials(13). Its limitations include reduction of efficacy due to immunity to the viral vector, and integration of viral genome with the host genome may lead to carcinomas(14). A temperature stable and cold chain free synthetic DNA is used in DNA vaccines. It does not require handling of the viral particle and can be mass produced easily(15).

Its limitations include eliciting low antibody titre, it may induce self antibody production in the host, and cellular abnormalities(16). RNA vaccine is similar to DNA vaccine. It avoids integration of viral DNA into the host DNA as mRNA production will occur in the cytoplasm(17). Yet, it is highly unstable and has been reported with safety issues and reactogenicity.

Our team has extensive knowledge and research experience that has translate into high quality publications (18–27)

Usually, development of a safe vaccine usually takes years of research and development before the product can be clinically tested. Typically a vaccine development has the following phases:

Phase I- Preclinical phase, involves testing on cells and animals, and then a small group of people to test its immune system stimulation(28).

Phase II- Testing in hundreds of people, including children and the elderly to establish safety and efficacy(29).

Phase III- Phase III trial involves testing in thousands of people. In this phase, scientists give vaccines to the volunteers and wait to see how many become infected in the placebo and vaccine group(30).

Around 70 vaccines were being developed at the time of the survey and various vaccines were starting to get approval for mass immunization, the forerunners being Moderna and Pfizer(31). Any vaccine that is reliable, effective, permanent and accessible to a large population is a good candidate. However, viral particles can mutate, which can make vaccines ineffective; therefore it is important to create a secure and reliable vaccine in advance for future outbreaks of SARS-CoV-2 variants(32).

The aim of this study is to determine the knowledge and attitude towards the challenges and limitations in Covid vaccine development in various countries among the dental population.

MATERIALS AND METHOD

The study is an online based cross-sectional survey. Data was collected by circulating a Self structured questionnaire consisting of 16 questions. 100 students were selected based on simple random sampling. This is done to minimise bias. The results were tabulated and analysed using Windows version SPSS version 20. Frequency and Chi-Square test was done for the data obtained. Pie charts and bar graphs were used to depict the results.

RESULTS

Among the 100 participants, 20% were 19 years of age, 21% were 20 years of age, 30% were 21 years of age and 29% were 22 years of age; 53% were males and 47% were females. 47% of the participants were aware of the severity of Covid in our country (Fig. 1), while 78% were aware that Covid vaccination programs had begun across the country at the time (Fig. 2). 51% of the participants thought that Covishield was the most effective vaccine (Fig. 3), in comparison to Pfizer, Moderna, Novovax and Covaxin. 36% of the participants believed that India was the frontrunner in vaccine development at the time, followed by the USA (25%) (Fig. 4). 53% of the participants responded correctly that the Live Attenuated Vaccine is developed by using the whole virus. The responses were mixed when asked about which type of virus production is most effective. 47% believe that the safety and the testing of the developed vaccines might be hindered due to the time constraints (Fig. 5) and 69% believe that vaccination and immunisation will be effective against the spread of the coronavirus (Fig. 6). 50% believe that animal testing is essential in determining the efficacy and the safety of the drug and 73% believed at the time that the country has been efficient in regards to the vaccine development.

Overall, more than 80% of the participants believe that there is a need to be vaccinated against the novel Covid-19 (Fig. 7). The correlation between the responses and the demographic data was found to be statistically insignificant, meaning that the participants' knowledge and awareness about the vaccine development around the world is independent of their age or gender. (Fig. 8-12)

DISCUSSION

Vaccine development requires scientific, empirical evidence backing it. A study conducted by Anon in 2020, found that Moderna vaccine was found to be predominantly safe in 25μg and 100μg and it was well tolerated by the participants, with three patients experiencing grade 3 systemic symptoms after their second dose of 250μg[33]. Thus the safety margin for Moderna was established. The Pfizer vaccine clinical trials have revealed higher serum titres of Ig-G antibodies, but with moderate local reactions in the participants with no adverse reactions[34]. The Pfizer and Moderna vaccines were found to be 95 and 94.1% effective, respectively, after the second dose in adults aged 16 years and older[35]. The two vaccines' potential side effects are almost identical and include injection site pain, swelling, redness, tiredness, headache, muscle pain, joint pain, chills, fever and nausea/vomiting[36]. Covishield vaccine is reported to produce mild dizziness, headache, myalgia, nausea and tenderness at injection site. The fever resolves upon the use of Paracetamol within 12 hours[37]. Passive immunisation using Convalescent plasma therapy and monoclonal antibody for the critically ill has been studied[38]. A possible explanation for the efficacy of this classic adoptive immunotherapy is that the neutralizing immune-globulins from CP may conquer viremia, block new infection, and accelerate clearance of the infected cells[39].

administration of the neutralizing antibodies in the critically ill patients led to the amelioration of the clinical status in all patients without any deaths[40]. The dosage prescribed for the CP therapy has not been standardized yet and needs Randomised Clinical Trials not only to eliminate the effect of other medicines but also to evaluate the efficacy and safety of CP therapy[41]. The use of mAb in the prevention and treatment of infectious diseases can overcome various drawbacks which are cognate with the convalescent plasma therapy in terms of specificity, safety, low risk of blood-borne infection, purity, and other factors[42]. A wide array of monoclonal antibodies have already been developed which are implemented in the anti-tumor, anti-platelet, or antiviral therapy[43].

Knowledge about vaccine development and its limitations mainly arise from the individual's own curiosity and the media[44]. Hence it is important to share the right information[45]. The role of a dentist in mass vaccination is delivering proper scientific information to the public[46].

In India alone, six biotech ventures i.e. Serum Institute of India, ZydusCadila, Biological E, Indian Immunologicals, Bharat Biotech, and Mynvax are working in collaboration with various international vaccine developers[47]. They are working on DNA vaccines, live attenuated recombinant measles vaccines, inactivated viral vaccines, subunit vaccines, and the vaccines developed by codon-optimization[48]. Furthermore, the academic institutes like National Institute of Immunology (NII), Indian Institute of Science (IISc), International Center for Genetic Engineering and Biotechnology (ICGEB) New Delhi, Translational Health Science and Technology Institute (THSTI), etc. are attempting to develop the vaccines, and therapies, and the SARS-CoV-2 animal models to restrain the pandemic shortly.

The need of the hour is to develop a safe and effective COVID-19 vaccine which can induce an appropriate immune response to terminate this pandemic. It is the universal priority to spot the international funding mechanisms to support the development, manufacturing, and stockpiling of the coronavirus vaccines.

CONCLUSION

It can be concluded that the dentists are knowledgeable and aware of the challenges and limitations of Covid vaccine development. This is imperative in guiding the general public and sharing knowledge and providing scientific facts so that the public can take an informed decision with regards to vaccination and immunization against the Sars-CoV-19.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

SOURCE OF FUNDING

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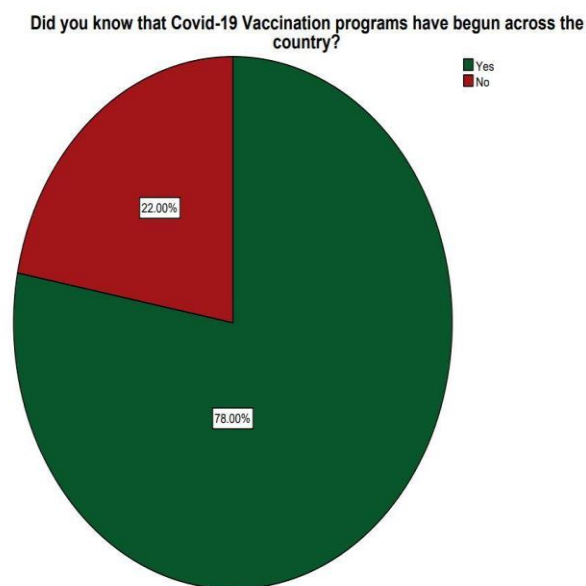
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Are you aware of the severity of COVID in our country?

■ Yes
■ No

53.00%   47.00%
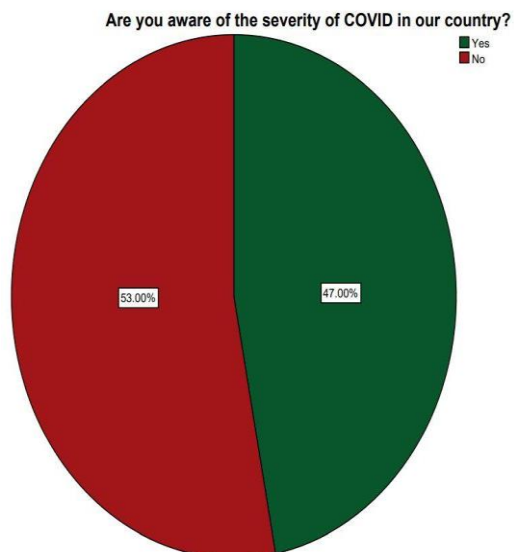
FIG. 1. Shows the awareness regarding severity of Covid in the country. 47% participants were aware and 53% participants were not aware. Red indicates not aware and green indicates aware.

Did you know that Covid-19 Vaccination programs have begun across the country?

■ Yes
■ No

22.00%

78.00%

FIG. 2. Shows the awareness regarding Covid-19 vaccination programs in the country. 78% were aware of it and 22% are not aware. Green indicates aware and red indicates not aware.

Which vaccine do you think is most effective?
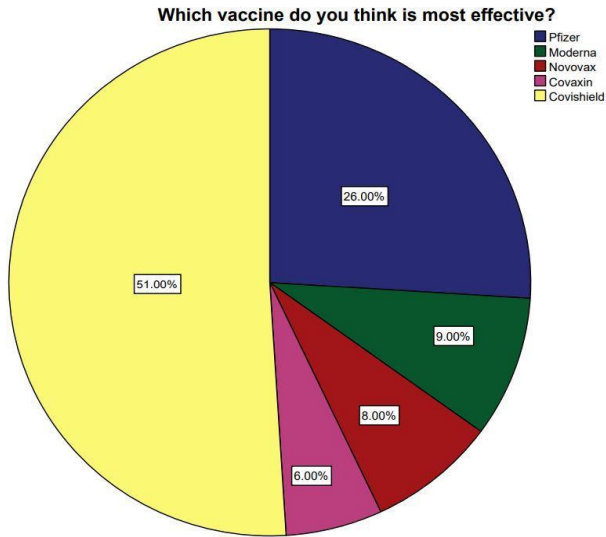
FIG. 3. Shows which vaccine the participants think is the most effective. 51% responded with covishield; 28% responded with Pfizer, 9% responded with moderna, 8% responded with novovax and 6% responded with Covaxin. Yellow indicates Covishield, blue indicates Pfizer, green indicates Moderna, red indicates Novovax and pink indicates Covaxin.

Which country do you think is leading in regards to vaccine development?
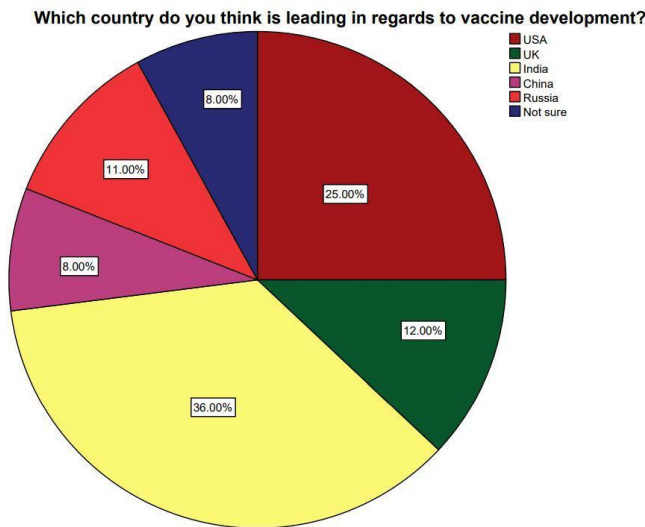
FIG. 4. Shows which country the participants think is leading in regards to vaccine development. 36& responded with India, 25% responded with the USA, 12% responded with the UK, 11% responded with Russia, 8% responded with China and 8% were not sure. Yellow indicates India, red indicates the USA, green indicates the UK, orange indicates Russia, pink indicates China and blue indicates not sure.

Do you think the safety and testing of the developed vaccines might be hindered due to the time constraint?
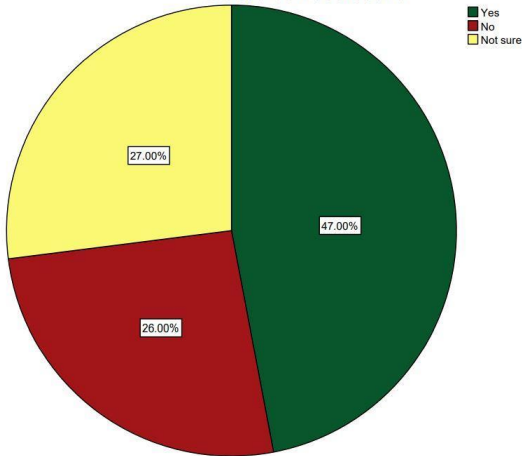

FIG. 5. Shows participants thoughts on whether the safety and testing of the developed vaccines might be hindered due to the time constraints. 47% of the participants responded yes, 28% responded no and 27% of the participants were not sure. Green indicates yes, red indicates no and yellow indicates not sure.

Do you think vaccinisation and immunisation will be effective against the spread of coronavirus?
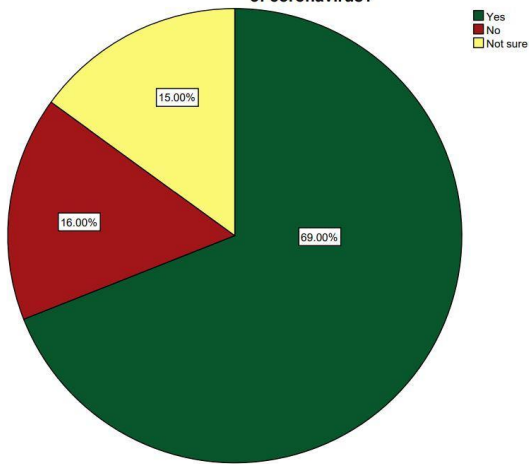
FIG. 6. Shows the participants thoughts on whether vaccination and immunisation will be effective against the spread of Covid-19. 69% of the participants responded yes, 16% responded no and 15% of the participants were not sure. Green indicates yes, red indicates no and yellow indicates not sure.
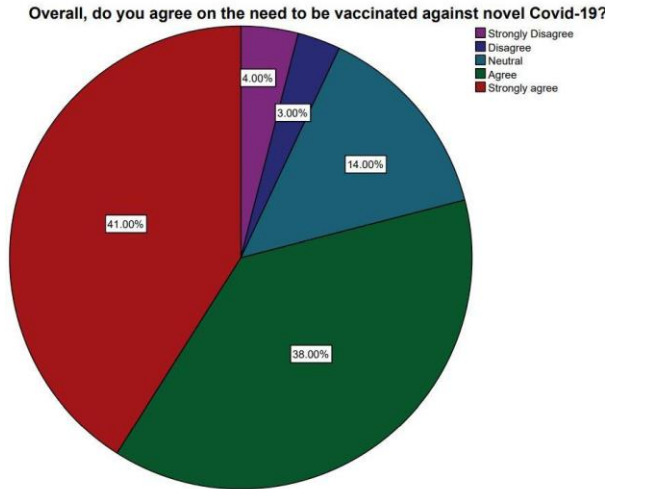
FIG. 7. Shows the participants' thoughts on the need to be vaccinated against the novel Covid-19. 41% of the participants strongly agree, 38% of the participants agree, 14% of the participants were neutral and 7% of the participants disagreed. Red indicates strongly agree, green indicates agree, blue represents neutral. Dark blue and purple indicate disagree and strongly disagree respectively.
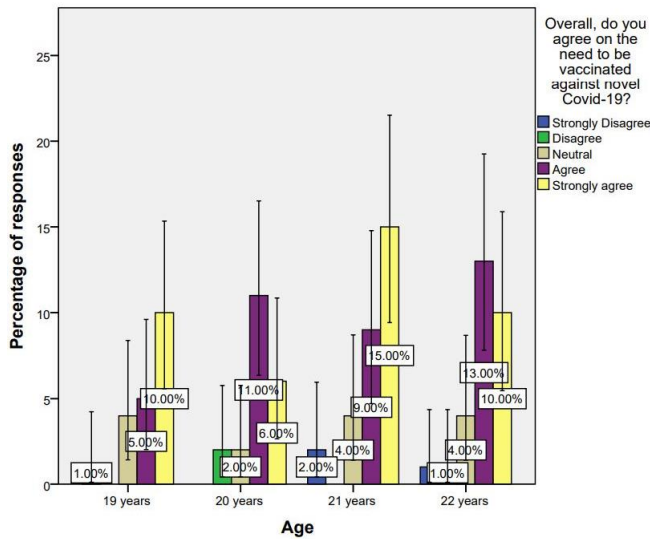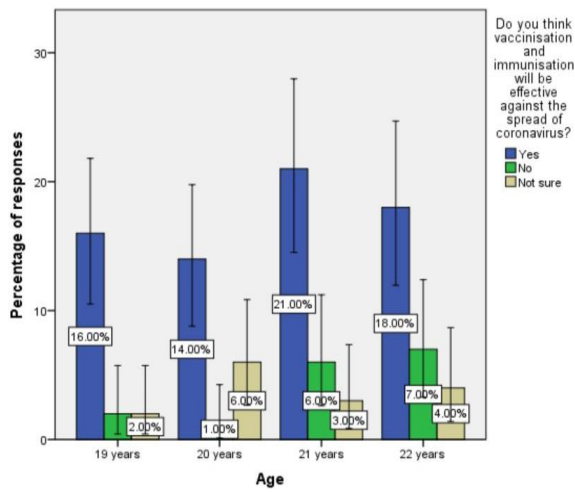

FIG. 8. Bar chart depicting association between age and the participants' opinion on the need to be vaccinated. X axis represents the age of the participants and Y axis represents the Percentage of responses. Chi square test was done and the association was not found to be statistically significant. Pearson's Chi value: 11.742, df: 12, p-value= 0.467 (p>0.05). Hence, not statistically significant, although participants of 21 years of age had a higher percentage of strongly agree (15%).
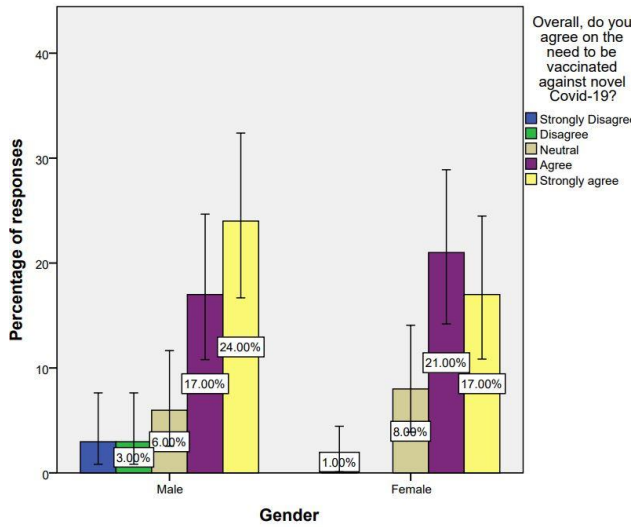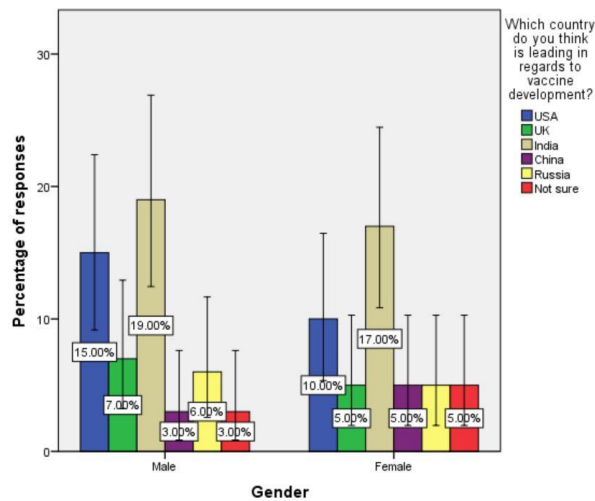
FIG. 9. Bar chart depicting association between gender and the participants' opinion on the need to be vaccinated. X axis represents the gender of the participants and Y axis represents the Percentage of responses. Chi square test was done and the association was not found to be statistically significant. Pearson's Chi value: 5.562, df: 4, p-value= 0.234 (p>0.05). Hence, not statistically significant, although a higher percentage of males had strongly agreed on the need to be vaccinated (24%)
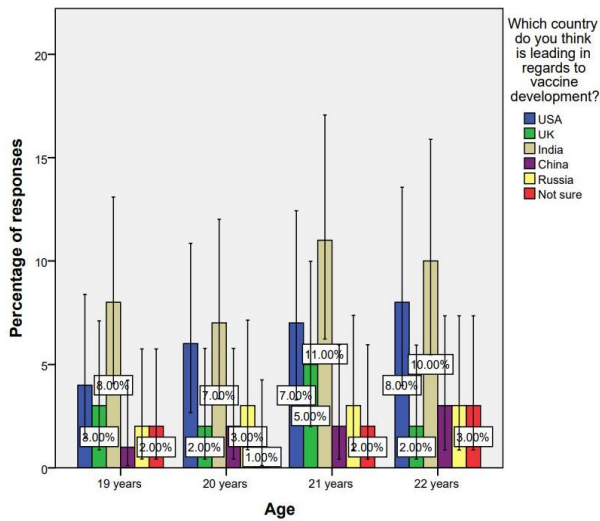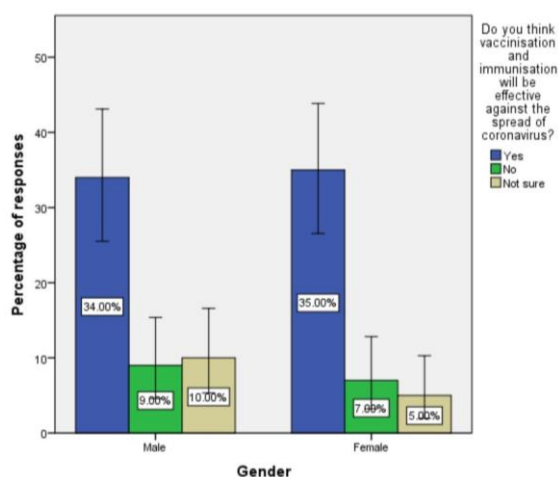

FIG. 10. Bar chart depicting association between age and the participants' opinion which country is leading regarding vaccine development. X axis represents the age of the participants and Y axis represents the Percentage of responses. Chi square test was done and the association was not found to be statistically significant. Pearson's Chi value: 3.458, df: 15, p-value= 0.999 (p>0.05). Hence, not statistically significant, although a higher percentage of 21 year old participants think India is leading in vaccine development (11%).

FIG. 11. Bar chart depicting association between Age and the participants' thoughts on whether vaccination and immunisation will be effective against the spread of Covid-19. X axis represents the age of the participants and Y axis represents the Percentage of responses. Chi square test was done and the association was not found to be statistically significant. Pearson's Chi value: 7.622, df: 6, p-value= 0.267 (p>0.05). Hence, not statistically significant, although a higher percentage of 21 year old participants agree (21%).

FIG. 12. Bar chart depicting association between gender and the participants' opinion on which country is leading with regards to vaccine development. X axis represents the gender of the participants and Y axis represents the Percentage of responses. Chi square test was done and the association was not found to be statistically significant. Pearson's Chi value: 2.183, df: 5, p-value= 0.823 (p>0.05). Hence, not statistically significant, although a higher percentage of males believe India is leading in regards to vaccine development (19%).

FIG. 13. Bar chart depicting association between gender and the participants' thoughts on whether vaccination and immunisation is effective against the spread of Covid-19. X axis represents the gender of the participants and Y axis represents the Percentage of responses. Chi square test was done and the association was not found to be statistically significant. Pearson's Chi value: 1.577, df: 2, p-value= 0.455 (p>0.05). Hence, not statistically significant, although a higher percentage of females had agreed (35%).