



# Reviews

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## **Abstract Book**

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# **International Workshop on COVID-19 Vaccines 2022**

**Abstracts**

**Oral Presentations**

## #1

### No Pain, More Gain: Microneedle Vaccines for COVID-19 and Influenza.

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**Background:** Most of the current vaccines are administered as intramuscular (IM) injections, which have several drawbacks such as localized pain at the injection site, needle stick injuries, and the requirement of a huge number of trained professionals. The goal of this study was to test the use of microneedles as an effective vaccination strategy for delivering COVID-19 and Influenza vaccines which can ultimately serve as an alternative to IM injections. These MN vaccines can be easily administered via skin and quickly dissolve to release the vaccine in the immune-rich epidermal layer of the skin. Additionally, our vaccine approach encapsulates our vaccine antigens (Influenza Matrix 2 ectodomain protein Virus-like-particles and Heat Inactivated SARS-CoV-2) in biodegradable polymeric microparticles (MPs) for better antigen uptake and presentation to immune cells.

**Methods:** The antigen-loaded MPs were formulated using a double-emulsion method, lyophilized, and characterized for their size, size distribution, shape, surface charge, and encapsulation efficiency. The MNs were prepared using a spin casting method using hyaluronic acid and trehalose gel. The MNs were characterized by their size, shape, dissolvability, mechanical strength, and loading efficiency. In vitro, the pore formation and closure in live murine skin were recorded using a bioimager following the application of dye-loaded microneedles. The vaccine-loaded MNs were prepared and administered to mice to assess the in vivo humoral response. In vivo, mice were immunized separately with M2e VLP MP loaded MN and

inactivated SARS-CoV-2 MP loaded MN. The mice sera were collected bi-weekly and analyzed for antibody levels, including IgG and its subtypes IgG1 and IgG2a, and IgA using enzyme-linked immunosorbent assay (ELISA)

**Results:** The scanning electron microscopy (SEM) images of the microneedles show intact, unbroken sharp needles which dissolve within 5 minutes following in vitro application in murine and porcine skin samples. Methylene blue and H&E staining cross-sections of murine and porcine skin following application of microneedles show the depth of penetrability and the mechanical strength of the needles. After applying dye-loaded patches to live murine skin, the green fluorescence intensity was recorded and showed the pore closure and reduction in fluorescence intensity within four hours. Following in vivo administration, the serum IgG, IgG1, IgG2a, and IgA levels increased significantly compared to untreated mice.

**Conclusion:** The results suggest that microneedles can successfully deliver the vaccine via the skin which was indicated by the development of significantly high antibody titers. Microneedles can be used as an effective vaccination strategy for administering vaccines for both COVID-19 and influenza, which are contagious diseases requiring frequent vaccination. Microneedle vaccines are an attractive alternative to IM injections, which are especially appealing to the pediatric and geriatric population, and can also be self-administered.

## #2

## Microparticulate 3D printed Oral Dissolving Films-based Subunit Vaccine Candidate against COVID-19

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**Background:** Developing an efficacious prophylactic measure for COVID-19 which can be available worldwide is highly critical. Current vaccines face some major challenges such as invasive route of administration, and poor global distribution due to the need for cold-chain storage. Spike S1 receptor-binding domain (RBD) and nucleoprotein RNA binding domain of SARS-CoV-2 are highly immunogenic and thus ideal antigen candidates. Since microparticles (MPs) are highly stable and avoid cold chain storage we propose to formulate a MP vaccine encapsulating RBD protein and nucleoprotein. Further, MPs in fast dissolving oral dissolving films (ODFs) will be beneficial in developing a patient-compliant vaccine strategy by providing a robust systemic and mucosal immune response. Moreover, the use of 3D printing technology to formulate ODFs allows automation of the process.

**Methods:** Microparticles were formulated using the double emulsion method. CELLINK INKREDIBLE plus<sup>®</sup> 3D bioprinter was used for the formulation of ODFs using biodegradable polymers incorporating RBD MPs, nucleoprotein MPs, and adjuvants (Alum + MF59+CpG) MP. Formulated ODFs were characterized for morphology, diameter, weight variation, uniformity of thickness, disintegration time, and surface pH. The ODFs were tested in vivo in murine model to assess for the induction of humoral and cellular immune responses.

**Results:** We successfully formulated the MPs encapsulating the antigens and adjuvant MPs. The formulated ODFs were colorless, and smooth with an average diameter of  $4.34 \pm 0.094$  mm.

The in vivo studies exhibited induction of significantly higher (\*\*\*\* $p < 0.0001$ ) humoral response demonstrated by the serum titers of IgG, IgG subtypes, and IgA. Cellular immune response was demonstrated by the presence of significantly higher levels of CD4+ and CD8a T lymphocytes. (\* $p < 0.05$ )

**Conclusion:** ODFs incorporated with RBD MPs were able to induce a humoral, mucosal, and cellular immune response. This formulation would be highly patient compliant and can be a potential vaccine candidate for COVID-19.

#2

## Immunization against COVID-19 in a murine model using Subunit Microparticulate Microneedle based Vaccine Candidate

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**Background:** Currently approved vaccines for COVID-19 pose the major drawback of the requirement of cold chain storage and administration through invasive routes such as intramuscular. The SARS-CoV spike (S) glycoprotein is a highly immunogenic antigen and thus a suitable candidate for formulating a vaccine for COVID-19. Microparticles (MPs) are better taken up by antigen-presenting cells and induce a robust immune response against the antigen. Further, quick-dissolving microneedles were formulated using the S glycoprotein MPs. Microparticles in microneedles offer the added advantage of avoiding cold chain storage thus making their availability in developing countries possible. Thus, our vaccine will provide a non-invasive alternative to current COVID-19 vaccines.

**Methods:** Formulation of Spike glycoprotein MPs was done using the double emulsion method and PLGA as polymer. Similarly, adjuvant MPs for Alum and MF59 were also formulated. The MPs were subsequently lyophilized, characterized, and assessed for cytotoxicity, innate and adaptive immune response in vitro. Vaccine MPs were loaded into a hyaluronic acid gel and centrifuged to produce vaccine-loaded microneedles. The efficacy of the vaccine microneedle patches was assessed in vivo in a preclinical murine model to induce a humoral and cell-mediated immune response.

**Results:** Our vaccine MPs were successfully formulated and characterized for their size, surface charge, polydispersity index, and antigen encapsulation efficiency. The vaccine

microparticles induced significantly high (\*\*\*\* $p < 0.0001$ ) nitrite levels, significant (\*\* $p < 0.01$ ) expression of antigen-presenting molecules and their co-stimulatory molecules, and significant expression of autophagosomes in mammalian dendritic cells. Our vaccine formulation was able to induce significantly high levels (\*\*\*\* $p < 0.0001$ ) of IgG, their subtypes, and IgA in a murine model.

**Conclusion:** Our formulated vaccine exhibited high immunogenicity in vitro and in vivo indicating a robust immune response. Thus, our vaccine has the potential to be a promising vaccine candidate in the ongoing COVID-19 pandemic the world is facing currently.

## #3

## Binding Antibody Responses to SARS-CoV-2 Variants from Alpha to Omicron after BNT162b2 Vaccination and Booster in Infection-Naïve and Previously-Infected Individuals

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The Pfizer/BioNTech BNT162b2 mRNA vaccine was designed based on the Spike protein of the original SARS-CoV-2 strain and has been administered to millions of people worldwide. However, concerns about the duration of vaccine protection continue to escalate with the emergence of new variants. This study was conducted to address the impact of vaccination and boosters on binding antibody levels.

We enrolled 56 adults (mean age 42.7 years; 45% White; 71% female) with and without prior SARS-CoV-2 infection (n=27 and n=29, respectively) who received their first dose of BNT162b2 between December 2020 and January 2021. The plasma samples were collected at 7 time points: 0 to 3 days before vaccination, 3 weeks after the first dose (T1), 4 weeks (T2), 5 months (T3), 8 months (T4) after second dose, 2 weeks after booster dose (T5, a booster was given between T4 and T6), and 11 months after second dose (T6). SARS-CoV-2 Spike IgG antibody levels against Wild type (WT), Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), Delta (B.1.617.2), and Omicron (B.1.1.529) strains were measured using the Mesoscale Discovery (MSD) multiplex immunoassay. 2-tailed nonparametric Mann-Whitney tests were applied to test differences between groups.

The IgG levels against WT and all variants increased significantly from T1 to T2 in the infection-naïve individuals (on average 4.47-fold,  $p < 0.001$ ), but not in the previously-infected individuals ( $p = 0.786$ ). All IgG levels in previously-

infected individuals were on average 2.72-fold higher ( $p < 0.001$ ) than the infection-naïve individuals at T2. By T4, all IgG levels decreased continuously by 5.24- and 7.89-fold ( $p < 0.001$ ) on average in the infection-naïve and the previously-infected individuals, respectively. Although the previously-infected group showed a higher fold decrease, their IgG levels were 1.79-fold ( $p < 0.001$ ) on average higher than the infection naïve group. We followed 16 infection-naïve and 9 previously-infected individuals after their booster dose (T5). Comparing the levels at T4, all IgG levels at T5 showed an average 17.78- and 8.85-fold increase ( $p < 0.001$ ) in the infection-naïve and the previously-infected group, respectively. The infection-naïve group showed a higher fold increase, but there is no significant difference between the IgG levels of the two groups. For those who received booster dose (n=10 and n=2, respectively), their IgG levels remains high at T6. For those who did not receive a booster (n=5), both the infection-naïve and the previously-infected individuals had dramatic decreases in all their IgG levels at T6 compared to T3. Across all time points tested, IgG levels against Omicron were the lowest among all variants. Specifically, Omicron IgG levels were 3.80- and 3.75-fold lower ( $p < 0.001$ ) at T2, 2.94- and 3.38-fold ( $p < 0.001$ ) lower at T5, and 2.83- and 3.25-fold lower ( $p < 0.001$ ) at T6 in infection-naïve individuals and previously-infected individuals, respectively.

The BNT162b2 vaccine induced less IgG binding activity against Omicron compared to other variants. Antibody levels continued to fall over the period that the participants were followed. A booster dose increases binding antibody levels for all variants including omicron. All individuals, regardless of previous infection status, should receive three doses to maximize the levels and duration of binding antibody levels.

## #4

## Operationalization of Model for Dynamics of COVID-19 in Kenya - Trajectory of Omicron Wave in Kenya

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**Introduction:** Kenya has experienced five COVID-19 surges driven by the original variant, Alpha, Beta, Delta (2X), and Omicron. We demonstrate that These waves are accurately predicted by the OTOI-NARIMA model. This was further substantiated by data from a unique public-private COVID-19 monitoring effort. Consequently, in Kenyan Lake Region Economic Block (LREB), private sector and NGO partnerships have been forged to strengthen regional health systems and prepare effectively for the epidemic resurgence: vaccine roll-out being part of preparedness. The co-development and implementation of the so-called 'LREB COVID-Dx' digital platform informed far-reaching preparedness. This platform enables efficient, comprehensive, semi-real time data collection providing epidemic intelligence that can empower policymakers to make better-informed decisions monitoring in semi-real time, referral of patients, optimal use of limited resources, and community of practice among regional health practitioners. In this paper, we describe the practical implementation of the OTOI-NARIMA model and the COVID-Dx digitized platform in Kenyan COVID-19 reality, with emphasis on the latest Omicron wave.

**Method:** 612 data points of daily COVID-19 case infections is used. The order of moving average is calculated and corresponds to reproduction number,  $R_0$ . The series are normalized, superimposed, and used to derive OTOI-NARIMA model. The model is estimated and interpreted. Test statistics including Ljung-Box test, ACF, and PACF are conducted.

**Results:** The OTOI-NARIMA model in general established successfully the periodicity and

seasonality of COVID-19 resurgences in Kenya. The model was also used to predict the latest Omicron wave two months before it was experienced. During alert stages of the wave, on December 4, 2021, the model was reused to nowcast the trajectory of the wave. Differences between predicted and actual Omicron wave dynamics were in 1-3 weeks range. Omicron wave was projected to peak in Kenya between November 23 2021, and January 4, 2022. The wave showed strong likelihood of declining after January 29, 2022. In reality Omicron wave was experienced from November 27 2021, to January 29, 2022. The model also predicted that Omicron variant will have run its full course by June 22, 2022. Omicron will and possibly be replaced by another (sub-)variant or sub-variant. OTOI-NARIMA estimated the total number of Kenyan Omicron infections; patients (symptomatic or asymptomatic patients) during Omicron resurgence was estimated to be at ~4.5 million. The total number of patients hospitalized during the wave is estimated to be ~2,000 hospitalisations.

**Conclusions:** Effective, efficient, and economical response to Omicron resurgence in LREB benefitted from meticulous infusion of mathematical modelling combined with a public-private semi-real time digital epidemic monitoring approach. The LREB model of digital epidemic preparedness can serve as a blueprint for scaling.

#5

## Uptake and Perceptions of COVID Vaccine among People Living with HIV in Zimbabwe: A Cross-Sectional Study

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**Background:** Vaccine uptake in Africa has been affected by hesitancy in the population and vaccine inequity. In Zimbabwe, the Sinopharm, Sinovac, and Sputnik V vaccines are approved for use. By April 2022, almost six million first doses had been administered covering 54% of the population. By April 2022, people aged 12 years and above were eligible for COVID-19 vaccination in Zimbabwe.

With support from PEPFAR through USAID Zimbabwe, OPHID is supporting the Ministry of Health and Child Care in accelerating COVID-19 vaccination under the COVID-Go program in 24 districts of Zimbabwe. However, the rate of uptake had begun to plateau with the end of the 4th wave. Despite widespread vaccine availability at public health facilities, the vaccine uptake has been less than expected. Vaccine uptake among people living with HIV (PLHIV) in Zimbabwe has not been quantified. The study sought to explore the factors associated with vaccine hesitancy in Chitungwiza and identify differences in vaccine uptake among people living with HIV (PLHIV).

**Method:** In April 2022, a cross-sectional study was conducted. Data were collected by community health workers from 361 PLHIV using interviewer-administered questionnaires. Data were entered onto open data kit (ODK) on mobile devices used by the community health workers. Quantitative data were analysed using Stata 15.

**Results:** We enrolled 361 clients (65% female) into the study, with a median age of 41 years (IQR

25-52 years). Four per cent had no education, 9% had primary, 74% secondary and 12% tertiary education. 74% of clients had been vaccinated against COVID-19 with 5% with one dose, 70% with 2 doses and 23% with 3 doses.

29% of respondents had heard negative information about the vaccine within one month preceding the study. The information included that it is not safe for PLHIV (21%), decreases libido and fertility (38%) and that their life span would be shortened (31%). Reasons for non-vaccination included, fear of side effects (21%), not knowing what is in the vaccine (9%) and religious' reasons (7%). Also, 43% did not trust the health providers that recommend the vaccine, while 49% thought that the vaccine is not safe. However, 50% of all respondents thought that the vaccine was important to protect themselves against COVID-19, with 73% of those who were unvaccinated indicating that they will not get vaccinated.

Associations were found between vaccination status and demographic factors such as age, level of education, and previous COVID infection ( $p < 0.05$ ). Perceptions including concern on having COVID-19, perceived importance of getting the vaccine, and vaccine safety were associated with getting vaccinated ( $p < 0.05$ ). External influences including having friends/family who were vaccinated, having a health worker recommend the vaccine, and having school/work require proof of vaccination were associated with vaccination uptake ( $p < 0.05$ ).

**Conclusions and Recommendations:** The findings demonstrate that there is mistrust of the COVID-19 vaccine among PLHIV. Concerns about vaccine contents and safety have to be addressed in this population. Further research is recommended on ways to improve uptake, including information needs for PLHIV.



## #6

## Intent to Vaccinate against Sars-Cov-2 and Its Determinants across Six Ethnic Groups Living in Amsterdam, the Netherlands: A Cross-Sectional Analysis of the Helius Study

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**Background:** Ethnic minority groups experience a disproportionately high burden of infections, hospitalizations, and mortality due to COVID-19, and therefore should be especially encouraged to receive SARS-CoV-2 vaccination. This study aimed to investigate the intent to vaccinate against SARS-CoV-2, along with its determinants, in six ethnic groups residing in Amsterdam, the Netherlands.

**Methods:** We analyzed data of participants enrolled in the population-based HELIUS cohort,

aged 24 to 79 years, who were tested for SARS-CoV-2 antibodies and answered questions on vaccination intent from November 23, 2020 to March 31, 2021. This was shortly before people aged <76 years were gradually offered their first vaccination in the Netherlands. Vaccination intent was measured on a 7-point Likert scale and categorized into low, medium, and high. Using ordinal logistic regression, we examined the association between ethnicity and lower vaccination intent. We also assessed a broad range of potential determinants of lower vaccination intent per ethnic group, including general sociodemographic, psychosocial, comorbidity, and access-to-health related determinants, and specific COVID-19 related determinants such as testing, perceptions, and communication.

**Results:** A total of 2,068 participants were included (median age 56 years, interquartile range 46-63). High intent to vaccinate was most common in the Dutch ethnic group (369/466, 79.2%), followed by the Ghanaian (111/213, 52.1%), South-Asian Surinamese (186/391, 47.6%), Turkish (153/325, 47.1%), African Surinamese (156/362, 43.1%), and Moroccan groups (92/311, 29.6%). Lower intent to vaccinate was more common in all other ethnic groups compared to the Dutch group, and the strongest association with lower vaccination intent was observed in the Moroccan group (odds ratio, adjusted for month of study visit=9.56, 95%CI=6.62-13.81). Being female and believing that COVID-19 is exaggerated in the media were common determinants of lower SARS-CoV-2 vaccination intent across all ethnic groups, except in the Ghanaian group and the South-Asian Surinamese group, respectively. Being under 45 years of age was a determinant of lower SARS-CoV-2 vaccination intent in the South-Asian Surinamese, African Surinamese, and Moroccan groups.

**Conclusions:** Lower intent to vaccinate against SARS-CoV-2 in the largest ethnic minority groups of Amsterdam is a major public health concern. The determinants of lower vaccination intent observed in this study could help shape

interventions and campaigns toward ethnic groups.

# **International Workshop on COVID-19 Vaccines 2022**

**Abstracts**

**Poster Presentations**

## #7

## COVID-19 Vaccine Hesitancy among Healthcare Providers in 23 Countries

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**Background:** Vaccination has been identified as one of the most effective interventions to control the ongoing COVID-19 pandemic. Healthcare professionals play a crucial role not only in the administration of vaccines, but as trusted sources that may encourage or discourage their patients and community members to accept vaccination. Factors for COVID-19 vaccine hesitancy among healthcare professionals identified in the literature include perceptions of low efficacy and safety of vaccines, which are often attributed to the speed of vaccine development, low risk of acquiring COVID-19, and female gender. Many of these investigations were conducted before the widespread availability of COVID-19 vaccines. This study aimed to test these and other sociodemographic (e.g., income level and age) factors for vaccine hesitancy among this important group.

**Material and Methods:** A cross-sectional, structured survey assessed COVID-19 vaccine hesitancy between 25-31 June 2021 among 3,295 healthcare (physicians, nurses, community health workers, and other) providers (HCPs) in 23 countries (Brazil, Canada, China, Ecuador, France, Germany, Ghana, India, Italy, Kenya, Mexico, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the United Kingdom (UK) and the United States (US)). Participants were recruited through online panels via email, telephone or direct mail solicitation with IP addresses and phone numbers used to

verify unique identities. Informed consent was obtained before proceeding to the survey. Vaccine hesitancy was defined as not having received at least one dose of a COVID-19 vaccine and being unsure of or in disagreement with receiving a vaccine if available to them. Multivariable logistic regression reporting odds ratio (OR) assessed the association of vaccine hesitancy with the studied factors.

**Results:** Physicians represented 27% of the sample, nurses 19%, community health workers 24%, and other healthcare providers 30%. 50% was female and 63% lived in a low- or middle-income country (LMIC). 494 (15.0%) of the participants reported hesitancy, of whom 132 (4.0%) would refuse a COVID-19 vaccine. Physicians were the least hesitant group in comparison to other HCPs (6.5% v nurses, 13.6%; community health workers, 16.8%; and other healthcare providers, 22.0 %). More respondents in high-income countries (16.2%) than LMICs (14.4%) reported vaccine hesitancy (p=.143). Hesitancy was more likely to be reported by those with income lower than the national median (2.75 OR) and, to a lesser degree, younger age (0.98 OR). Safety (9.07 OR) and efficacy (5.00 OR) concerns as well as lack of trust that vaccines would be equitably distributed (5.59 OR) were strongly associated with vaccine hesitancy when controlling for sociodemographic factors, less so were concerned about their risks in comparison to COVID-19 disease risks (3.74 OR). We found differences by gender. P-values for all reported ORs were ≤0.001.

**Conclusions:** Our results indicate that safety and efficacy concerns remain strong factors for vaccine hesitancy among HCPs globally, while concerns about vaccine risk and their equitable distribution also persist. Physicians report the lowest vaccine hesitancy when compared to other groups of HCPs. As the COVID-19 pandemic continues, further challenges will include increasing vaccination among HCPs reporting hesitancy

## #8

## Hesitancy in COVID-19 Vaccine Uptake in Kisumu and Siaya Counties

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Vaccine hesitancy is defined as the reluctance to accept or agree to be vaccinated irrespective of the availability and accessibility of the vaccine. The World Health Organization attributes this reluctance to three major factors, i.e., convenience, confidence, and complacency. Vaccine hesitancy is a critical barrier in achieving high uptake of COVID-19 vaccines.

We implemented antenatal care (ANC) based surveillance in Western Kenya starting in August 2021 to understand the uptake of the COVID-19 vaccine among pregnant women attending the first ANC. Data on COVID-19 vaccine uptake and reasons for not taking the vaccine were collected digitally using ScannForm software. Stata version 14 was used to perform descriptive analyses.

Overall, 2,704 pregnant women were asked if they have ever received the COVID-19 vaccination. The vast majority (2,329; 88%) had not received the vaccine. Among these, 820/2,339 (35.2%) would not take the COVID-19 vaccine if offered, with 95% (n= 724) citing concern about the side effects of the vaccine as the reason. 34 (4.15%) did not give any response. A small proportion (22, 2.6%) stated they would not take the vaccine if it were offered to them because they were not worried about getting COVID-19, and 40 (4.8%) stated other reasons

To better assess how to address these concerns, a qualitative evaluation was done; analysis is in process, and results will be presented. A high proportion of people interviewed were hesitant to take the COVID-19 vaccine, primarily due to fear of side effects. Understanding how to respond to peoples' concerns most effectively is critical to reach high vaccine coverage.

#9

## A Survey on Factors Influencing COVID-19 Vaccine Hesitancy in the Bamenda-Cameroon

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**Background:** Vaccine hesitancy has been a longstanding and complex public health attitude amongst the population. Despite the numerous benefits of the COVID-19 vaccine, COVID-19 vaccine hesitancy remains a major problem. While the importance of vaccine hesitancy is widely acknowledged, comparatively little is known about vaccine hesitancy in Bamenda. We, therefore, sought to examine individuals' willingness to accept the COVID-19 vaccines in order to understand and address the community-specific concerns and misconceptions. **Study Methodology:** This was a community-based cross-sectional study carried out in Bamenda-Cameroon from April to May 2021. Paper-based, pre-tested open-close questionnaires were administered to consented participants. Data were analyzed using SPSS version 23.

**Results:** A total of 2531 participants of both sex were included in the study with a mean age of 23.63±7.52years. Vaccine hesitancy was 97.6% (2,161). The main reason for vaccine hesitancy was safety concerns 72.3% (1786). Univariate analysis showed significant differences among the age groups, towns, marital status, monthly income, and religion. The multivariate model identified age group 20-29 years (OR 4.8, CI 1.82-12.53), Christians (OR 21.61, CI 4.92-94.94), Muslims (OR 8.67, CI 1.42-52.82), rural area (OR 2.9, CI 1.58-5.38), monthly income > 100,000 FFCFA (OR 0.28, CI 0.09-0.87) and those who attained primary education (OR 0.36, CI 0.14-0.92) as predictors of vaccine hesitancy (p<0.05).

**Conclusion:** The major reasons for vaccine hesitancy were misinformation and lack of trust.

Therefore a reduction in the COVID-19 vaccine hesitancy rate mandates collaborative efforts of governments, health policymakers, and media sources to provide useful information that will address the people's concerns and misconceptions.

## #10

## Understanding Motivators and Barriers to Taking the COVID-19 Vaccine among Vaccinated and Unvaccinated Participants in Zimbabwe

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**Background:** Zimbabwe started the COVID-19 vaccination program in February 2021, however, vaccine hesitancy has hampered Zimbabwe's goal to achieve 60 % herd immunity against COVID-19 by December 2021. A rapid assessment was conducted to understand the primary motivators and barriers to taking the COVID-19 vaccine among vaccinated and unvaccinated adult participants.

**Methods:** Convenience sampling was used for the survey: vaccinated individuals (n=100) and unvaccinated individuals (n=150). Site selection was based on COVID-19 data provided by the MOHCC. Quantitative data analyses were conducted using STATA.

**Results:** Primary motivators to vaccinate included the need to protect one's health (62%); COVID-19 vaccine information (10%) and a desire to protect the health of family and friends (8%). The main barriers to vaccination reported were lack of trust for the mandated vaccines in Zimbabwe, specifically the Chinese vaccines (31.4%); a compromised immune system (20%); conspiracy theories (20%), and fear of side effects (17%). Majority of unvaccinated survey participants preferred to wait and see how other people respond to the current vaccines before getting vaccinated (63%). Respondents from rural areas reported health care providers as their trusted source for information, while those in urban areas preferred the radio, television, and social media other than WhatsApp. Religious and community

leaders were reported as the least preferred sources of COVID-19 vaccine information. 17% of all the vaccinated participants were people living with HIV and 19.3% of all the unvaccinated participants were also people living with HIV showing that living with HIV does not affect the choice to vaccinate. Young people (18-34 years) constituted 54% of all the unvaccinated participants.

**Conclusions:** To gain public trust, it is imperative that accurate, timeous, and reliable information related to COVID-19 vaccines be provided regularly through trusted sources. With the majority of respondents in the "wait and see" category, there is an opportunity to partner with civil society organizations to develop clear messages that are tailored to community concerns. There is also a need to intensify risk communication and engagement through implementing partners. Findings from this rapid assessment can help inform strategies for increasing uptake of novel vaccines in development, such as HIV.

## #11

## Enablers and Perceived Risks of COVID-19 Vaccine Uptake among Health Care Providers in Nigeria

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Vaccines found to be highly effective will enable uptake than those with low effectiveness. Health care providers in Nigeria aged 18 years and above participated in this study. The study was conducted to assess the enablers and perceived risks of Covid-19 vaccination among healthcare providers in Nigeria. A snowball sampling technique was relied upon in the distribution of the online questionnaires sent in the form of a link through social media outlets such as Whatsapp, Face book and emails within four weeks interval. The analysis was performed using the Statistical Software Package SPSS version 22.0. Four Hundred and forty-five respondents filled the questionnaire from the six geopolitical zones of the country. It was observed that safety of the vaccine, proven efficacy and good knowledge of the vaccine were enablers to the Covid-19 vaccine uptake.

This finding shows that a higher proportion of health care providers was in support of the covid-19 vaccine under the presumption that the vaccine was proven effective. 243(54.6%) perceived that a clinical sequelae may result later after they take the Covid-19 vaccine, 207(46.5%) perceived that the clinical trial of the Covid-19 vaccine was inadequate and 187(42.0%) perceived that a new virus strain may emerge and therefore, bring about another vaccine. In addition, 180(40.4%) respondents perceived that

the Covid-19 vaccine might worsen their co-morbidities and 61(13.7%) showed concerns as they think the Covid-19 vaccine may affect their immune systems and make them more susceptible to new viral strains. Proven vaccine safety, proven efficacy and good knowledge were identified as enablers of the covid-19 vaccine while clinical sequelae and inadequate clinical trials were noted as the perceived risks of covid-19 vaccine uptake among health care providers.



#12

## SARS-CoV-2 Infection among Vaccinated Healthcare Workers in Bulgaria

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**Background:** Medical personnel are at a higher risk of COVID-19 in comparison to the general population. In Bulgaria the vaccination program started with prioritizing the healthcare workers (HCWs) in December 2020. With the emergence of new variants and improved sequencing capacity, Bulgaria established a surveillance system for sequencing of a subset of SARS-CoV-2.

**Material and Methods:** Blood samples of two HCWs, from different hospitals, fully vaccinated with the Pfizer-BioNTech COVID-19 vaccine (BNT162b2) and subsequently diagnosed with postvaccination SARS-CoV-2 were tested for anti-SARS-CoV-2 IgG antibodies 70- and 23-days post vaccination respectively with: VIDAS SARS-CoV-2 IgG ELFA (Biomérieux, France) and SARS -CoV-2 II Quant Abbott Architect (Abbott, USA). Viral RNA was extracted from 400 ul of nasal swabs using an ExiPrep 48 Viral DNA/RNA Kit and ExiPrep 48 Dx (Bioneer, Korea). Real-time polymerase chain reaction was performed using GeneFinder™ COVID-19 Plus RealAmp Kit (OSANG Healthcare Co., Ltd, Korea). Whole genome next generation sequencing was performed by using a modified ARTIC v3 tailed amplicon method. Sequencing was performed on Illumina MiSeq, USA. Pangolin COVID-19 Lineage Assigner Tool was used to define the variant classification. S gene was used to reconstruct the phylogenetic tree. The dataset for the phylogenetic analysis contained sequences from both samples under investigation together with 112 other randomly selected SARS-

CoV-2 sequences isolated in Bulgaria and the reference sequence employed by GISAID (EPI\_ISL\_402124). Sequence alignments was performed using the MUSCLE algorithm implemented in AliView version 1.23. Approximate maximum likelihood (ML) phylogenies were reconstructed by using the GTR nucleotide substitution model in FastTree v2.1.10.

**Results:** Alpha (B.1.1.7) variant was identified in both postvaccination cases. The phylogenetic analysis revealed that the sequences isolated from the two HCWs were phylogenetically similar and fall into the branch formed by the largest number of sequences. The sequences isolated from various geographical locations were dispersed throughout the topology of the phylogenetic tree across different branches. Sequence analysis indicated that both postvaccination SARS-CoV-2 alpha (B.1.1.7) isolate exhibited 7 non-synonymous mutations in the spike protein, D614G and 6 substitutions which are the defining SNPs of the alpha (B.1.1.7) lineage. Two deletions were found in the spike protein: H69\_V70del (ACATGT) which has been reported to be associated with this variant, and Y144del (TAT), both located in the N-terminal domain. In addition, amino acid substitutions were found in the spike protein that have been reported in other variants of concern, including N501Y which occurs in the beta and gamma lineages and also P681H in the delta.

**Conclusions:** Vaccination has been shown to be highly effective in preventing the symptoms and severe course of COVID-19. However, efficacy is not always guaranteed and in rare cases symptomatic or asymptomatic postvaccination infection may occur even in fully vaccinated individuals. At the same time, emerging mutations could compromise vaccines and accelerate the spread of the disease. This is why it is important to carefully investigate cases of postvaccination COVID-19 and viral variants associated with these cases.

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#13

## COVID-19 Vaccine Acceptance and Decision-Making among Healthcare Workers in Four Provinces, South Africa: A Qualitative Study

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**Introduction:** Mass vaccination against COVID-19 remains a key strategy to ensure adequate protection against current and future variants. Healthcare workers (HCWs) remain high priority populations for vaccination, given their occupational risk of SARS-CoV-2 infection and their role in encouraging the public to vaccinate. Little is known about HCWs' decision-making around and attitudes towards COVID-19 vaccination in South Africa.

**Methods:** Between September 2021 and January 2022, 34 individual in-depth interviews (IDIs) were conducted with frontline HCWs in four South African provinces: Gauteng, Eastern Cape, KwaZulu Natal, and Free State. Participants included Nurses, Counsellors, Doctors, Community Health Workers, Linkage Officers, and Pharmacists. All IDIs were recorded, transcribed verbatim, and analysed using qualitative analysis software (NVivo) and a thematic approach.

**Results:** Twenty-six out of 34 HCWs had been vaccinated at the time of interviewing, three intended to vaccinate, and five had no intention of vaccinating. Almost a third of those vaccinated reportedly felt they had been forced or pressured to vaccinate. Motivations for vaccination included a desire to protect loved ones and colleagues from illness and death, occupational risk, and fear of loss of employment from non-vaccination.

Reasons for non-vaccination or for questioning COVID-19 vaccines included fear of long-term side effects and perception of inadequate scientific evidence on vaccine efficacy and safety. Most HCWs believed that COVID-19 vaccination should not be mandatory.

**Conclusion:** Although the vaccination rate in this sample was high, many HCWs had unanswered questions about COVID-19 vaccines and felt vaccination had not been a choice. Interventions to update HCWs' knowledge on vaccine development, safety and efficacy may assist with increased uptake, particularly amongst the most vulnerable HCWs

#14

## COVID-19 Vaccine Knowledge and Acceptability among Healthcare Providers in Nigeria

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**Background:** The Covid-19 pandemic has posed enormous challenges and has become a burden of morbidity and mortality while severely disrupting economic activities around the world. Vaccines for the disease has been discovered; however, there exists misconceptions and mistrusts among health workers which may constitute barriers to Covid-19 uptake.

**Aim:** The study aimed to determine the knowledge and acceptability of the Covid-19 vaccine among health care provider and to determine the association between the socio-demographic variables and Covid-19 acceptability. Study Design: A snowball sampling technique was relied upon in the distribution of the questionnaires. Place and Duration: Online questionnaires sent in the form of a link through social media outlets such as Whatsapp, Facebook and emails within four weeks interval.

**Methodology:** Health care providers in Nigeria aged 18 years and above participated in this study. The analysis was performed using the Statistical Software Package SPSS version 22.0. Four hundred and forty-five respondents filled the questionnaire from the six geopolitical zones of the country.

**Results:** There was a good knowledge of the Covid-19 vaccination as 411(92.4%) knew about the vaccine. However, only 53.5% of respondents were willing to get vaccinated against the disease. The most identified perceived barrier to covid-19

vaccine acceptance was fear of side effects 309 (69.4%) and there was no association between socio-demographic characteristics and covid-19 vaccine acceptability.

**Conclusion:** Healthcare providers recommendation and confidence in a vaccine plays an influential role in their patients' vaccination behaviour. They serve as an important source of information for the general populace and their consultation can also be a key factor in patients' decision to get vaccinated or not.

# **International Workshop on COVID-19 Vaccines 2022**

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