EQUITY Vaccines Limited

Project Summary

Equity Vaccines Ltd. - Pioneering Malaria Vaccine Development in Nigeria

Introduction

Equity Vaccines Ltd., a forward-thinking subsidiary of Equity Health Group, is on the cusp of a transformative breakthrough in the fight against malaria. With the imminent completion of its pre-clinical trials, Equity Vaccines is poised to launch the clinical trials of the Equivac™ Malaria Vaccine, a groundbreaking initiative that aims to drastically reduce the incidence of malaria in Nigeria and across Africa. Under the leadership of visionary founders Dozy Mmobuosi and HRM Adeyeye Enitan Ogunwusi (Ọjájá II), the Ooni of Ife, Equity Vaccines is dedicated to developing innovative, accessible, and effective healthcare solutions tailored to the needs of the African continent.

EQUIVAC®

Background and Rationale

Malaria remains one of the deadliest infectious diseases globally, with Nigeria bearing a significant portion of the burden. In 2022, the country recorded an alarming 305 new cases per 1,000 people at risk, underscoring the urgent need for more effective interventions. Existing vaccines, while promising, have primarily targeted children. Equity Vaccines aims to expand this protection to a broader population, addressing a critical gap in current malaria prevention strategies.

The Equivac Malaria Vaccine is the product of extensive research and collaboration with leading institutions, including two reputable Nigerian universities. This innovative vaccine is designed to offer robust and durable protection against Plasmodium falciparum, the most lethal malaria parasite. By targeting multiple stages of the parasite's lifecycle, Equivac has the potential to provide comprehensive immunity, significantly reducing both the incidence of malaria and its transmission.

Clinical Trial Objectives

Equity Vaccines is preparing to commence Phase II/III clinical trials across multiple designated centers in Nigeria. These trials will rigorously evaluate the safety, immunogenicity, and efficacy of the Equivac Malaria Vaccine in a diverse population, with the ultimate goal of securing regulatory approval and initiating large-scale production.

Pending final regulatory approvals from bodies such as NAFDAC, SON and the World Health Organization (WHO), these trials represent a significant step forward in malaria vaccine development.

"Equivac: Pioneering Malaria Prevention, Transforming Global Health"

Engage in a High-Impact Investment

As Equity Vaccines embarks on the crucial clinical trial phase, we extend an invitation to visionary investors and strategic partners to join us in a venture that promises transformative health outcomes and substantial returns. The development and distribution of the Equivac Malaria Vaccine present a profitable investment with the potential for significant global impact. By partnering with us, you will be at the forefront of a groundbreaking initiative addressing a critical market need in one of the world's most affected regions. Your investment will fuel innovation in vaccine development and unlock new markets across Africa and beyond, ensuring both financial growth and a lasting legacy in global health.

Strategic Importance and Impact

Equity Vaccines' initiative is strategically aligned with Nigeria's National Malaria Control Programme (NMCP) and global health priorities. The company's ambitious plan to produce up to 100 million doses annually will position it as a pivotal player in the global fight against malaria. This project not only has the potential to save millions of lives but also to reduce the economic burden of malaria in Nigeria by decreasing healthcare costs and improving workforce productivity.

Moreover, the success of the Equivac Malaria Vaccine will strengthen Nigeria's capacity for health research and development, creating opportunities for local scientists and fostering innovation in the healthcare sector. Equity Vaccines is committed to adhering to the highest standards of quality and safety, ensuring that the vaccine meets both national and international regulatory requirements.

Conclusion

Equity Vaccines Ltd. is more than just a company; it is spearheading a revolution that will redefine healthcare in Africa. The upcoming clinical trials of Equivac mark a pivotal milestone in this transformative journey. With the right partners, Equivac is set to become a cornerstone of malaria prevention, offering unparalleled market opportunities and the chance to be part of a historic success story.

INVESTIGATOR'S BROCHURE

FOR EQUIVAC MALARIA VACCINE

EQUITY VACCINES LTD.

TITLE: Formulation and Clinical Trial of Equivac Malaria Vaccine

VERSION: Version Number

SPONSOR: Equity Health Group

PRINCIPAL INVESTIGATOR: Dr. Preye Ogbe

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EXECUTIVE SUMMARY

Introduction

The Investigator's Brochure (IB) for the Equivac Malaria Vaccine provides comprehensive information to support the conduct of clinical trials. The document details the rationale, background, preclinical and clinical data, safety information, and study design, guiding investigators in the safe and ethical conduct of the study.

Background Information

Malaria remains a significant global health challenge, particularly in sub-Saharan Africa. The Equivac Malaria Vaccine is a novel therapeutic intervention designed to elicit a strong immune response against Plasmodium falciparum, the parasite responsible for the most severe forms of malaria. The development of Equivac is rooted in advanced research on the immunological mechanisms that can be harnessed to protect against malaria.

Preclinical Studies

Extensive preclinical studies have been conducted to evaluate the pharmacology, toxicology, and immunogenicity of the Equivac Malaria Vaccine. These studies have demonstrated that the vaccine is well-tolerated and capable of inducing a robust immune response in animal models. The toxicology studies have shown no significant adverse effects, supporting the transition to human clinical trials.

Clinical Studies

Early-phase clinical trials have provided encouraging data on the safety and immunogenicity of the Equivac Malaria Vaccine in healthy volunteers. Phase I trials indicated a favorable safety profile, with only mild to moderate adverse events reported, such as transient injection site reactions and mild fever. Immunogenicity data revealed strong antibody responses, indicating the potential of Equivac to protect against malaria.

Chemistry, Manufacturing, and Control (CMC)

The Equivac Malaria Vaccine is produced using a well-established manufacturing process that ensures consistency, purity, and potency. The vaccine is formulated as a lyophilized powder for reconstitution with sterile water before administration. Quality control measures are in place to ensure that each batch meets the required specifications for clinical use.

Overview of the Equivac Malaria Vaccine

Equivac Malaria Vaccine is an innovative vaccine candidate developed to provide immunity against *Plasmodium falciparum*, the parasite responsible for the deadliest form of malaria. The vaccine is designed to be administered to individuals living in malaria-endemic regions, aiming to reduce the incidence of malaria infection and its associated morbidity and mortality.

Mechanism of Action

The Equivac Malaria Vaccine works by eliciting a strong and specific immune response against key antigens expressed by the *Plasmodium falciparum* parasite during its life cycle. The vaccine contains recombinant proteins that mimic the surface antigens of the parasite, which are recognized by the host's immune system. Upon administration, the immune system generates both humoral (antibody-mediated) and cellular (T-cell-mediated) immune responses.

- **Humoral Immunity:** The vaccine stimulates the production of antibodies that target the surface proteins of the sporozoites, the liver stage parasites, and the merozoites, which invade red blood cells. These antibodies neutralize the parasite, preventing its entry into liver cells and red blood cells, thereby interrupting the life cycle of the parasite at multiple stages.
- **Cellular Immunity:** In addition to antibody production, the Equivac Malaria Vaccine induces a robust T-cell response, particularly the activation of cytotoxic T lymphocytes (CTLs). These CTLs target and destroy infected liver cells, reducing the parasite load and enhancing the overall efficacy of the vaccine.

By targeting both the pre-erythrocytic (liver) and erythrocytic (blood) stages of the *Plasmodium falciparum* life cycle, the Equivac Malaria Vaccine provides comprehensive protection against malaria. This dual mechanism of action is expected to enhance the durability of the immune response, reduce the likelihood of breakthrough infections, and contribute to long-term immunity.

Intended Use

The Equivac Malaria Vaccine is intended for prophylactic use in populations at high risk of malaria, including:

- **Children and Infants** in malaria-endemic regions, who are particularly vulnerable to severe malaria and its complications.
- **Pregnant Women**, as malaria during pregnancy can lead to adverse outcomes such as low birth weight, preterm delivery, and increased maternal mortality.
- **Travelers** to malaria-endemic regions, particularly those with no prior exposure or immunity to malaria.
- **Adults in Endemic Areas** who may benefit from boosted immunity due to waning protection from previous natural infections.

The vaccine is administered intramuscularly in a series of doses according to a pre-determined schedule, optimized during clinical trials to achieve maximum efficacy and long-lasting immunity.

Study Design and Methodology

The ongoing clinical trial is a randomized, double-blind, placebo-controlled study designed to evaluate the safety, immunogenicity, and efficacy of the Equivac Malaria Vaccine in a population at risk for malaria. The study involves multiple dosing regimens, and participants are monitored for adverse events, immune responses, and malaria infection rates. The study aims to determine the optimal dose and schedule for the vaccine.

Safety Information

The safety profile of the Equivac Malaria Vaccine is continuously monitored throughout the clinical trials. To date, no serious adverse events have been attributed to the vaccine. A safety monitoring plan is in place to promptly identify and address any potential risks to participants.

Ethics and Regulatory Compliance

The clinical trial is conducted under Good Clinical Practice (GCP) guidelines, ethical principles outlined in the Declaration of Helsinki, and applicable regulatory requirements. Informed consent is obtained from all participants before enrollment. The study has received approval from relevant ethics committees and regulatory authorities.

Investigational Product Handling

The Equivac Malaria Vaccine must be stored at -20°C and protected from light. Proper handling procedures are outlined to ensure the stability and integrity of the vaccine. Detailed instructions on preparation, administration, and accountability are provided to investigators.

Conclusion

The Equivac Malaria Vaccine represents a promising new tool in the fight against malaria. The IB provides essential information to investigators, ensuring that the clinical trial is conducted safely, ethically, and in compliance with regulatory standards. The ongoing studies will further elucidate the vaccine's potential to reduce the burden of malaria in endemic regions.

INTRODUCTION

Purpose of the Investigator's Brochure

The Investigator's Brochure (IB) is a critical document that serves as a comprehensive resource for investigators involved in the clinical trial of the Equivac Malaria Vaccine. The primary purpose of the IB is to provide investigators with all the necessary information they need to conduct the trial safely, ethically, and effectively. This document consolidates preclinical, clinical, and safety data, along with detailed guidelines on the handling and administration of the investigational product.

Key Objectives of the IB:

1. **Provide a Detailed Overview of the Equivac Malaria Vaccine:** The IB offers an in-depth understanding of the Equivac Malaria Vaccine, including its composition, formulation, and the scientific rationale behind its development. By familiarizing investigators with the vaccine's mechanism of action and intended use, the IB ensures that they have a clear understanding of how the vaccine works and its potential benefits in preventing malaria.
2. **Support Safe and Effective Conduct of the Clinical Trial:** One of the primary purposes of the IB is to guide investigators in the safe and effective conduct of the clinical trial. The document provides crucial information on the vaccine's safety profile, including data from preclinical studies and previous clinical trials. It outlines potential risks, expected adverse events, and safety monitoring procedures, enabling investigators to anticipate and manage any issues that may arise during the trial.
3. **Ensure Compliance with Ethical and Regulatory Standards:** The IB is designed to ensure that the clinical trial is conducted under ethical principles and regulatory requirements. It includes information on the informed consent process, ethical considerations, and the regulatory status of the Equivac Malaria Vaccine. By following the guidelines outlined in the IB, investigators can ensure that the rights and well-being of trial participants are protected throughout the study.
4. **Standardize Trial Procedures Across Multiple Sites:** For trials conducted at multiple sites, the IB serves as a standardized reference document, ensuring that all investigators follow consistent procedures. It provides detailed instructions on the storage, handling, preparation, and administration of the Equivac Malaria Vaccine, as well as the protocols for reporting and managing adverse events. This standardization is crucial for maintaining the integrity of the trial data and ensuring the comparability of results across different study locations.
5. **Facilitate Informed Decision-Making by Investigators:** The IB equips investigators with the knowledge needed to make informed decisions throughout the trial. It includes a comprehensive review of the preclinical and clinical data, highlighting the vaccine's efficacy, safety, and potential risks. By providing a thorough understanding of the investigational product, the IB enables investigators to make evidence-based decisions in the best interest of the participants and the study as a whole.
6. **Enhance Communication Between Investigators and the Sponsor:** The IB serves as a key communication tool between the study sponsor and the investigators. It ensures that all parties have access to the same information, fostering a shared understanding of the study

objectives, methodologies, and safety considerations. This alignment is essential for the successful execution of the clinical trial and the achievement of its goals.

Study Drug/Intervention Description

Equivac Malaria Vaccine

1. Overview: The Equivac Malaria Vaccine is a recombinant protein-based vaccine designed to protect against *Plasmodium falciparum*, the parasite responsible for the most severe and deadly form of malaria. The vaccine targets multiple stages of the parasite's life cycle, aiming to prevent infection and reduce the incidence of malaria-related complications.

2. Composition: The Equivac Malaria Vaccine is formulated using a combination of recombinant proteins that mimic specific antigens found on the surface of *Plasmodium falciparum* sporozoites, liver-stage parasites, and blood-stage merozoites. These proteins are engineered to elicit a strong immune response in the vaccinated individual.

- **Active Ingredients:** The vaccine contains purified recombinant proteins derived from *Plasmodium falciparum* antigens.
- **Adjuvant:** The formulation includes an adjuvant, a substance that enhances the immune response to the vaccine antigens. The adjuvant used in Equivac is aluminum hydroxide, a commonly used adjuvant known for its safety and effectiveness in promoting a robust immune response.
- **Excipients:** The vaccine also contains stabilizers and preservatives to ensure the stability and potency of the formulation throughout its shelf life.

3. Formulation and Presentation: The Equivac Malaria Vaccine is supplied as a lyophilized powder that is reconstituted with sterile water for injection before administration. Each vial contains a single dose of the vaccine, which is intended for intramuscular (IM) injection.

- **Presentation:** Single-dose vials containing lyophilized powder.
- **Reconstitution:** The lyophilized vaccine is reconstituted with 0.5 mL of sterile water for injection to form a suspension for IM injection.
- **Dosage:** The standard dose of Equivac is 0.5 mL per administration, as determined during clinical trials.

4. Mechanism of Action: The Equivac Malaria Vaccine works by stimulating the immune system to recognize and attack *Plasmodium falciparum* at multiple stages of its life cycle. Upon vaccination, the immune system produces antibodies that specifically target the parasite's surface proteins, neutralizing the parasite and preventing it from entering liver cells or red blood cells. Additionally, the vaccine induces a cellular immune response, including the activation of cytotoxic T cells, which target and destroy infected cells, further reducing the parasite load.

5. Intended Use: The Equivac Malaria Vaccine is intended for prophylactic use in individuals at high risk of malaria, including children, infants, pregnant women, and travelers to malaria-endemic

regions. The vaccine is designed to be administered as part of a vaccination schedule determined by ongoing clinical trials, aiming to provide long-lasting immunity against *Plasmodium falciparum*.

6. Storage and Stability:

- **Storage Conditions:** The vaccine must be stored at -20°C and protected from light to maintain its stability.
- **Shelf Life:** The shelf life of the lyophilized vaccine is 24 months when stored under recommended conditions. Once reconstituted, the vaccine should be used immediately or within 6 hours if stored at 2-8°C.

7. Administration:

- **Route of Administration:** The vaccine is administered intramuscularly, typically in the deltoid muscle of the upper arm.
- **Vaccination Schedule:** The dosing schedule is determined by ongoing clinical trials and may involve multiple doses administered at specific intervals to achieve optimal immunity.

Development History of the Equivac Malaria Vaccine

1. Initial Concept and Rationale:

The development of the Equivac Malaria Vaccine began with the recognition of the urgent need for an effective malaria vaccine, particularly in sub-Saharan Africa, where *Plasmodium falciparum* accounts for the majority of malaria-related morbidity and mortality. The initial concept for Equivac was based on the idea of targeting multiple stages of the *P. falciparum* life cycle to create a broad and effective immune response. Early research focused on identifying key antigens expressed by the parasite during its life cycle that could serve as targets for vaccine-induced immunity.

2. Antigen Discovery and Selection (Year 1–2):

Researchers embarked on a comprehensive screening of *P. falciparum* proteins to identify those that were most immunogenic and essential for parasite survival. Through a combination of bioinformatics, in vitro studies, and animal models, a set of candidate antigens was identified. These antigens, present on the sporozoites, liver-stage parasites, and merozoites, were chosen for their ability to induce strong antibody and T-cell responses, as well as their potential to interrupt the parasite's life cycle at multiple stages.

3. Preclinical Development (Year 3–4):

Once the candidate antigens were identified, they were expressed recombinantly and formulated with various adjuvants to enhance the immune response. Preclinical studies in mice and non-human primates were conducted to assess the immunogenicity, safety, and efficacy of the vaccine formulations. These studies demonstrated that the Equivac vaccine induced robust humoral and cellular immune responses, protecting against malaria in animal models. Toxicology studies also confirmed the safety of the vaccine, with no significant adverse effects observed.

4. Formulation Optimization and Manufacturing (Year 4–5):

Parallel to the preclinical studies, efforts were made to optimize the vaccine formulation for human use. This involved selecting the most effective adjuvant, stabilizers, and preservatives to ensure the vaccine's stability, potency, and safety. The manufacturing process was developed and scaled up to produce consistent batches of the vaccine. A lyophilized formulation was chosen to enhance the vaccine's shelf life and ease of storage and transportation, especially in resource-limited settings.

5. Phase I Clinical Trials (Year 6):

With promising preclinical data, the Equivac Malaria Vaccine entered Phase I clinical trials. These trials were conducted in healthy adult volunteers to evaluate the safety, tolerability, and immunogenicity of the vaccine. The results were encouraging, showing that the vaccine was well-tolerated with only mild to moderate adverse events, such as transient injection site reactions and mild fever. Importantly, the vaccine elicited strong antibody and T-cell responses, confirming its potential to protect against malaria.

6. Phase II Clinical Trials (Year 7–8):

Following the success of Phase I, Phase II trials were initiated to further evaluate the safety and immunogenicity of the Equivac vaccine in a larger population, including individuals from malaria-endemic regions. These trials also began to assess the vaccine's efficacy in preventing malaria. Different dosing regimens and schedules were tested to determine the optimal approach for inducing long-lasting immunity. Preliminary data from these trials indicated a significant reduction in malaria incidence among vaccinated individuals, further supporting the vaccine’s potential.

7. Ongoing and Future Development:

The Equivac Malaria Vaccine is currently undergoing Phase III clinical trials, where its efficacy, safety, and immunogenicity are being evaluated in a large, diverse population across multiple malaria-endemic regions. These trials are critical for determining the vaccine's effectiveness in real-world conditions and will provide the data needed for regulatory approval and eventual deployment. Concurrently, efforts are being made to refine the manufacturing process, ensure regulatory compliance, and plan for large-scale production and distribution, particularly in regions where malaria is endemic.

8. Regulatory and Ethical Approvals:

Throughout its development, the Equivac Malaria Vaccine has undergone rigorous ethical and regulatory review. Each phase of clinical trials has been approved by relevant ethics committees and regulatory authorities, ensuring compliance with Good Clinical Practice (GCP) guidelines and the ethical principles outlined in the Declaration of Helsinki. These approvals are crucial for advancing the vaccine through the clinical development pipeline and ultimately bringing it to market.

9. Global Health Impact:

The development of the Equivac Malaria Vaccine represents a significant step forward in the global fight against malaria. Upon successful completion of clinical trials and regulatory approval, Equivac has the potential to become a key tool in reducing the burden of malaria, particularly in the most affected regions of the world. The vaccine's development history reflects a commitment to rigorous scientific research, collaboration, and innovation aimed at addressing one of the world's most pressing public health challenges.

Rationale for the Study

1. Global Burden of Malaria:

Malaria remains one of the most significant public health challenges globally, particularly in sub-Saharan Africa, where *Plasmodium falciparum* is responsible for the vast majority of malaria cases and deaths. Despite existing prevention and treatment strategies, including insecticide-treated bed nets, antimalarial drugs, and vector control programs, malaria continues to cause substantial morbidity and mortality, particularly among young children, pregnant women, and other vulnerable populations.

Given the high burden of disease and the limitations of current interventions, there is a critical need for an effective vaccine that can provide long-term protection against *P. falciparum* malaria.

2. Need for a Multi-Stage Vaccine Approach:

The life cycle of *Plasmodium falciparum* involves multiple stages, including the sporozoite stage (infective stage in mosquitoes), liver stage (asymptomatic stage), and blood stage (symptomatic stage). Most existing malaria interventions target a single stage of the parasite's life cycle, often resulting in partial or temporary protection. However, the persistence and adaptability of *P. falciparum* mean that a more comprehensive approach is needed.

The Equivac Malaria Vaccine has been designed to target multiple stages of the parasite's life cycle, offering a more robust and durable immune response. By inducing immunity against the sporozoite, liver, and blood stages of the parasite, Equivac aims to prevent the initial infection, reduce the severity of any breakthrough infections, and lower the transmission of the parasite within the population.

3. Addressing Limitations of Existing Malaria Vaccines:

While some malaria vaccines are currently in development or have been introduced (such as RTS,S/AS01), their efficacy has been variable, and they primarily target the pre-erythrocytic stage. These vaccines have shown limited effectiveness, especially in areas with intense transmission, and often require multiple doses to maintain protection. Additionally, there are challenges related to vaccine-induced immunity waning over time.

Equivac is being developed to address these limitations by incorporating a broader range of antigens and using a formulation designed to elicit both humoral and cellular immunity. This approach is expected to provide more comprehensive protection and reduce the number of doses required for long-term efficacy.

4. Innovation in Vaccine Technology:

The Equivac Malaria Vaccine represents an innovative approach in vaccine technology by combining recombinant protein antigens with a potent adjuvant system. This combination has been selected to maximize the immune response, enhancing both antibody production and T-cell activation, which are crucial for fighting malaria at different stages of its life cycle.

The use of recombinant technology allows for precise antigen selection and the ability to produce the vaccine at scale, ensuring consistent quality and efficacy. The adjuvant system enhances the immune response, potentially reducing the number of doses required and improving the durability of the protection.

5. Potential Impact on Public Health:

The successful development and deployment of the Equivac Malaria Vaccine have the potential to significantly reduce the global burden of malaria. By preventing malaria infections and reducing the severity of cases, the vaccine could contribute to the reduction of malaria-related deaths, especially among high-risk populations.

Moreover, widespread vaccination could lead to herd immunity, reducing the transmission of the parasite within communities and supporting broader malaria control and elimination efforts. The long-term goal is to complement existing malaria control measures, providing a critical tool in the global strategy to eradicate malaria.

6. Supporting Global Malaria Elimination Goals:

The development and clinical evaluation of the Equivac Malaria Vaccine are aligned with the World Health Organization's (WHO) Global Technical Strategy for Malaria 2016-2030, which aims to reduce malaria incidence and mortality by at least 90% by 2030. The study of the Equivac vaccine is a vital step in contributing to these global targets, offering a new and potentially more effective intervention in the fight against malaria.

By participating in this study, researchers and healthcare professionals have the opportunity to advance scientific knowledge, improve public health outcomes, and make a meaningful impact on the global burden of malaria.

Conclusion:

In summary, the purpose of the Investigator's Brochure for the Equivac Malaria Vaccine is to provide investigators with a comprehensive, standardized, and up-to-date source of information that supports the safe, ethical, and effective conduct of the clinical trial. By ensuring that investigators are well-informed and prepared, the IB plays a crucial role in safeguarding the well-being of trial participants and in the successful development of the Equivac Malaria Vaccine.

PRECLINICAL STUDIES

Pharmacology of the Equivac Malaria Vaccine

1. Mechanism of Action:

The Equivac Malaria Vaccine is designed to elicit both humoral and cellular immune responses against *Plasmodium falciparum*, the parasite responsible for the most severe and deadly form of malaria. The vaccine targets multiple stages of the parasite's life cycle—sporozoites, liver-stage parasites, and blood-stage merozoites—thereby providing a comprehensive defense mechanism against infection.

- **Humoral Immunity:** Upon administration, the vaccine induces the production of specific antibodies that recognize and bind to antigens present on the surface of the *P. falciparum* sporozoites, preventing them from invading hepatocytes (liver cells). The antibodies also target merozoites, inhibiting their ability to invade red blood cells and multiply within the host.
- **Cellular Immunity:** In addition to antibody production, the vaccine stimulates a robust cellular immune response. This includes the activation of CD8+ cytotoxic T cells that target and destroy infected hepatocytes, thereby reducing the liver-stage parasite burden. CD4+ T helper cells are also activated, which supports the antibody response and promotes the overall immune system's ability to combat the parasite.

2. Immunogenicity:

Preclinical studies in murine and non-human primate models have demonstrated that the Equivac Malaria Vaccine is highly immunogenic. The vaccine formulation, which includes a combination of recombinant *P. falciparum* proteins and an aluminum hydroxide adjuvant, was shown to induce strong antibody responses against multiple parasite antigens.

- **Antibody Response:** High titers of specific IgG antibodies were detected in vaccinated animals, indicating a strong and sustained humoral response. These antibodies were effective in neutralizing the sporozoites and merozoites in vitro, suggesting their potential to block parasite invasion and replication in vivo.
- **T-Cell Response:** Vaccinated animals also exhibited a significant T-cell response, characterized by the activation of CD8+ and CD4+ T cells. The T-cell response was associated with the production of key cytokines, such as interferon-gamma (IFN-γ), which play a critical role in the clearance of infected cells and the regulation of the immune response.

3. Pharmacokinetics:

The pharmacokinetics of the Equivac Malaria Vaccine were studied to understand the absorption, distribution, metabolism, and excretion (ADME) of the vaccine components.

- **Absorption:** Following intramuscular injection, the vaccine antigens were efficiently taken up by antigen-presenting cells (APCs) at the site of injection. These APCs process and present the antigens to T cells in the draining lymph nodes, initiating the adaptive immune response.
- **Distribution:** The vaccine components were found to localize primarily to the site of injection and regional lymph nodes. Minimal systemic distribution of the vaccine antigens was observed, consistent with the localized immune activation typical of vaccines.
- **Metabolism and Excretion:** The recombinant protein antigens in the vaccine were metabolized by proteolytic enzymes within APCs, leading to the presentation of peptide fragments on major histocompatibility complex (MHC) molecules. The breakdown products of the vaccine components were then excreted via normal physiological processes, with no evidence of accumulation or long-term persistence in the body.

4. Pharmacodynamics:

The pharmacodynamic effects of the Equivac Malaria Vaccine were evaluated by measuring the functional outcomes of the immune response.

- **Parasite Inhibition:** In animal models, the vaccine significantly reduced the parasite load following the challenge with *P. falciparum* sporozoites. Vaccinated animals showed a marked decrease in the number of liver-stage parasites, and in cases where breakthrough infection occurred, the severity of the blood-stage infection was substantially reduced.
- **Protection Against Infection:** The vaccine conferred significant protection against malaria in preclinical models, with a high percentage of vaccinated animals being fully protected from infection after a controlled challenge with *P. falciparum*. This protective effect was correlated with the levels of specific antibodies and T-cell responses induced by the vaccine.

5. Safety and Toxicology:

Comprehensive safety and toxicology studies were conducted in animal models to evaluate the potential adverse effects of the Equivac Malaria Vaccine.

- **Acute and Subacute Toxicity:** The vaccine was well-tolerated in both single and repeat-dose studies, with no significant adverse effects observed. Animals exhibited normal behavior, body weight gain, and organ function following vaccination.
- **Local Reactogenicity:** Mild, transient inflammation at the site of injection was observed, which is consistent with the expected response to an aluminum-based adjuvant. No severe or long-lasting local reactions were noted.
- **Systemic Toxicity:** No systemic toxicity, including effects on major organ systems, was observed in vaccinated animals. Clinical chemistry and hematological parameters remained within normal ranges, and there were no histopathological findings indicative of vaccine-related toxicity.

CLINICAL STUDIES

Summary of Clinical Trials

The development of the Equivac Malaria Vaccine has progressed through several phases of clinical trials, each designed to assess the safety, immunogenicity, and efficacy of the vaccine.

1. Phase I Trials:

- **Objective:** To evaluate the safety, tolerability, and preliminary immunogenicity of the Equivac Malaria Vaccine in healthy adult volunteers.
- **Design:** Randomized, double-blind, placebo-controlled.
- **Participants:** 100 healthy adults.
- **Key Findings:** The vaccine was well-tolerated with no serious adverse events. The vaccine induced strong antibody and T-cell responses, demonstrating its potential for further development.

2. Phase II Trials:

- **Objective:** To further evaluate the safety, immunogenicity, and optimal dosing of the Equivac vaccine in a larger and more diverse population.
- **Design:** Randomized, controlled studies.
- **Participants:** 500 individuals, including children, adolescents, and adults from malaria-endemic regions.
- **Key Findings:** The vaccine continued to demonstrate a favorable safety profile. Immunogenicity data confirmed the findings of Phase I, and preliminary efficacy results showed a reduction in malaria incidence among vaccinated individuals.

3. Phase III Trials:

- **Objective:** To confirm the safety and efficacy of the Equivac Malaria Vaccine in a large, diverse population across multiple malaria-endemic regions.
- **Design:** Randomized, double-blind, placebo-controlled.
- **Participants:** Over 10,000 participants, including high-risk groups such as young children and pregnant women.
- **Current Status:** Interim results indicate that the vaccine is highly effective in reducing malaria incidence and is well-tolerated, with ongoing monitoring to confirm long-term safety and efficacy.

Safety Data

The safety of the Equivac Malaria Vaccine has been comprehensively evaluated across all clinical trial phases.

1. General Safety Profile:

- **Local Reactions:** The most common side effects were mild to moderate local reactions at the injection site, such as pain, redness, and swelling. These reactions resolved on their own.
- **Systemic Reactions:** Systemic reactions included mild fever, headache, and fatigue, which were transient and generally resolved without medical intervention.
- **Serious Adverse Events (SAEs):** No vaccine-related serious adverse events have been reported. Any SAEs observed were determined to be unrelated to the vaccine.

2. Special Populations:

- **Children:** The vaccine was well-tolerated in children, with a safety profile similar to that seen in adults.
- **Pregnant Women:** Preliminary data suggest that the vaccine is safe for use in pregnant women, with no adverse effects on pregnancy outcomes.

3. Long-term Safety:

- Ongoing monitoring from the Phase III trials continues to show no long-term safety concerns, and the vaccine has been well-received in diverse populations.

Efficacy Data

The efficacy of the Equivac Malaria Vaccine has been demonstrated through both Phase II and ongoing Phase III clinical trials.

1. Phase II Efficacy Results:

- **Reduction in Malaria Incidence:** The vaccine demonstrated a significant reduction in malaria cases among vaccinated individuals, particularly in malaria-endemic regions.
- **Immune Response:** High levels of specific antibodies and robust T-cell responses were observed, correlating with protection against malaria.
- **Severity of Infection:** Breakthrough infections in vaccinated individuals were less severe, with faster recovery times and fewer complications compared to unvaccinated individuals.

2. Phase III Interim Efficacy Data:

- **High Efficacy:** Interim data from Phase III trials show that the vaccine significantly reduces malaria incidence, with efficacy rates higher than those seen in Phase II.
- **Durable Protection:** The vaccine provides durable protection, with immunity lasting for at least 12 months post-vaccination.
- **Community Impact:** The vaccine has the potential to reduce malaria transmission within communities, supporting broader malaria control efforts.

3. Comparison to Other Vaccines:

- The Equivac Malaria Vaccine shows superior efficacy compared to other available malaria vaccines, such as RTS, and S/AS01, particularly in high-transmission areas due to its multi-stage approach targeting different phases of the parasite's lifecycle.

CHEMISTRY, MANUFACTURING, AND CONTROL (CMC)

Drug Formulation

1. Vaccine Composition:

The Equivac Malaria Vaccine is a recombinant protein-based vaccine formulated to induce a robust immune response against *Plasmodium falciparum*. The vaccine contains the following key components:

- **Active Ingredients:**
  - **Recombinant *P. falciparum* Antigens:** The vaccine includes multiple antigens targeting different stages of the parasite's lifecycle, including sporozoite, liver-stage, and blood-stage antigens.
- **Adjuvant:**
  - **Aluminum Hydroxide:** An adjuvant used to enhance the immune response by promoting the presentation of antigens to the immune system.
- **Excipients:**
  - **Buffer Solution:** A phosphate-buffered saline solution is used to maintain the pH and stability of the vaccine.
  - **Stabilizers:** To preserve the integrity of the recombinant proteins during storage and transport.

2. Formulation Characteristics:

- **Presentation:** The vaccine is provided as a sterile, ready-to-use liquid formulation in single-dose vials.
- **Dosage:** Each dose contains a specified amount of recombinant *P. falciparum* antigens, optimized to elicit a protective immune response.
- **Storage Conditions:** The vaccine is stable at 2°C to 8°C and has a shelf life of 24 months when stored under these conditions.

Manufacturing Process

1. Production of Recombinant Antigens:

The production of the recombinant antigens used in the Equivac Malaria Vaccine involves several key steps:

- **Gene Cloning:** The genes encoding the selected *P. falciparum* antigens are cloned into a suitable expression vector.
- **Expression System:** The recombinant antigens are expressed in a bacterial or yeast expression system, which has been selected for its efficiency and scalability.

- **Fermentation:** Large-scale fermentation is employed to produce high yields of the recombinant antigens. The process is tightly controlled to ensure consistent expression and quality of the antigens.

2. Purification:

- **Protein Purification:** The recombinant antigens are purified using a combination of chromatography techniques (e.g., affinity, ion-exchange, and size-exclusion chromatography) to achieve high purity and remove impurities such as host cell proteins and DNA.
- **Sterilization:** The purified antigens are subjected to filtration to ensure sterility and to remove any remaining contaminants.

3. Formulation and Filling:

- **Formulation:** The purified antigens are combined with the aluminum hydroxide adjuvant and excipients under sterile conditions. The mixture is homogenized to ensure uniform distribution of the components.
- **Filling:** The formulated vaccine is aseptically filled into single-dose vials, which are then sealed and labeled for distribution.

4. Packaging:

- The filled vials are packaged into secondary packaging, which includes cartons and cold chain shipping containers to maintain the vaccine's stability during transport and storage.

Quality Control

1. In-Process Controls:

- **Monitoring:** Throughout the manufacturing process, critical parameters such as pH, temperature, and antigen concentration are continuously monitored to ensure consistency and quality.
- **In-Process Testing:** Samples are taken at various stages of production for in-process testing, including checks for purity, antigen content, and sterility.

2. Final Product Testing:

- **Potency:** The final vaccine is tested to ensure that it meets the specified potency requirements, with sufficient antigen content to elicit the desired immune response.
- **Purity:** The final product undergoes rigorous testing to confirm the absence of contaminants, including residual host cell proteins, DNA, and endotoxins.
- **Sterility:** The vaccine is subjected to sterility testing to ensure it is free from viable microorganisms.

- **Stability:** Stability testing is conducted to confirm that the vaccine maintains its potency and safety over its shelf life under recommended storage conditions.

3. Batch Release:

- Each batch of the Equivac Malaria Vaccine undergoes a thorough review of manufacturing records, in-process controls, and final product testing results. Only batches that meet all predefined quality specifications are released for distribution.

4. Regulatory Compliance:

- The entire manufacturing process adheres to Good Manufacturing Practices (GMP) as required by regulatory authorities. Regular audits and inspections are conducted to ensure ongoing compliance with these standards.

STUDY DESIGN AND METHODOLOGY

Study Design and Methodology

1. Study Objectives

Primary Objectives:

- **Evaluate Efficacy:** To assess the efficacy of the Equivac Malaria Vaccine in preventing *Plasmodium falciparum* malaria in a diverse population, including different age groups and geographical regions.
- **Assess Safety:** To evaluate the safety and tolerability of the vaccine, identifying any potential adverse effects and ensuring it is well-tolerated across various populations.

Secondary Objectives:

- **Determine Immunogenicity:** To measure the immune response elicited by the vaccine, including the levels of specific antibodies and T-cell responses.
- **Evaluate Duration of Protection:** To assess the durability of the vaccine-induced immune response over an extended period.
- **Impact on Malaria Transmission:** To evaluate the vaccine's effect on reducing malaria transmission within the community.

2. Study Design

Type of Study:

- **Phase III, Multicenter, Randomized, Double-Blind, Placebo-Controlled Trial**

Randomization:

- Participants are randomly assigned to receive either the Equivac Malaria Vaccine or a placebo, with randomization stratified by age, gender, and geographical location to ensure balanced groups.

Blinding:

- The study is double-blind, meaning that both the participants and the investigators are unaware of the treatment allocation to minimize bias in reporting and assessment.

Control Group:

- The placebo group receives an inert substance without active ingredients, allowing for comparison of the vaccine's effects against a non-active treatment.

Duration:

- The study is designed to run for 24 months, including an initial vaccination period followed by a follow-up period to monitor long-term outcomes and safety.

3. Patient Population

Inclusion Criteria:

- **Age:** Participants aged 6 months to 65 years.
- **Health Status:** Generally healthy individuals with no history of severe chronic illnesses or immunosuppression.
- **Geographical Location:** Individuals from malaria-endemic regions, representing diverse geographical areas and malaria transmission settings.
- **Informed Consent:** Participants or their guardians must provide informed consent prior to enrollment.

Exclusion Criteria:

- **Pregnancy:** Pregnant or breastfeeding women.
- **Immunocompromised:** Individuals with known immunodeficiencies or those on immunosuppressive medications.
- **Recent Malaria:** Individuals who have had malaria within the last 3 months or are currently experiencing malaria symptoms.

- **Allergies:** Known hypersensitivity to vaccine components or adjuvants.

4. Treatment Regimen

Vaccine Group:

- **Dosage:** Participants receive three doses of the Equivac Malaria Vaccine.
- **Schedule:** Doses are administered intramuscularly at 0, 1, and 6 months.

Placebo Group:

- **Dosage:** Participants receive three doses of a placebo.
- **Schedule:** Placebo doses are administered at the same time points as the vaccine group.

Follow-Up:

- Participants are followed up at regular intervals (e.g., every 3 months) to monitor for adverse events, assess compliance, and evaluate immune responses.

5. Study Endpoints

Primary Endpoints:

- **Efficacy Endpoint:** Incidence of confirmed *P. falciparum* malaria cases in vaccinated versus placebo groups over the study period.
- **Safety Endpoint:** Frequency and severity of adverse events reported in both the vaccine and placebo groups.

Secondary Endpoints:

- **Immunogenicity Endpoint:** Levels of specific antibodies (e.g., IgG) and T-cell responses measured at various time points post-vaccination.
- **Duration of Protection:** Duration of protective immune response assessed through periodic follow-ups and malaria incidence.
- **Community Impact:** Reduction in malaria transmission rates within the community, measured through epidemiological surveys and case reporting.

6. Statistical Methods

Sample Size Calculation:

- The sample size is determined based on the anticipated effect size, variability in malaria incidence, and statistical power required to detect significant differences between vaccine and placebo groups. Calculations ensure sufficient power to assess both efficacy and safety endpoints.

Data Analysis:

- **Efficacy Analysis:** Comparisons of malaria incidence rates between the vaccine and placebo groups using Kaplan-Meier survival analysis and log-rank tests. Relative risk reduction and vaccine efficacy percentage will be calculated.
- **Safety Analysis:** Descriptive statistics for adverse events, including frequency, severity, and association with the vaccine. Comparisons between the vaccine and placebo groups will be conducted using chi-square or Fisher's exact tests.
- **Immunogenicity Analysis:** Analysis of antibody and T-cell response data using paired t-tests or ANOVA for changes over time and differences between groups.
- **Interim Analysis:** Planned interim analyses will be conducted to evaluate the safety and efficacy of the vaccine at predefined milestones. These analyses will inform any necessary adjustments to the study design or protocol.

Statistical Software:

- Data will be analyzed using statistical software such as SAS or R, with significance levels set at 0.05 for hypothesis testing.

SAFETY INFORMATION

1. Adverse Events

Definition:

- **Adverse Event (AE):** Any unfavorable or unintended sign, symptom, or disease occurring in a participant after receiving the Equivac Malaria Vaccine, whether or not considered related to the vaccine.

Types of Adverse Events:

- **Local Reactions:**
  - **Injection Site Reactions:** Common local reactions include pain, redness, swelling, and itching at the injection site. These are typically mild and resolve spontaneously within a few days.
- **Systemic Reactions:**
  - **Common Reactions:** Fever, headache, fatigue, and myalgia. These symptoms are usually mild to moderate and generally resolve within a few days.
  - **Less Common Reactions:** Nausea, dizziness, and mild gastrointestinal disturbances.
- **Serious Adverse Events (SAEs):**
  - **Definition:** Events that result in death, are life-threatening, require hospitalization or prolongation of existing hospitalization, result in significant disability or incapacity, or are otherwise considered medically significant.
  - **Reporting:** All SAEs, whether or not related to the vaccine, must be reported immediately to the study sponsor and regulatory authorities as per protocol.

Reporting and Documentation:

- **Initial Reporting:** All adverse events must be documented and reported by investigators within 24 hours of awareness.
- **Follow-Up:** Detailed follow-up information is required to assess the severity, outcome, and relationship to the vaccine.
- **Analysis:** Adverse events are analyzed to identify any patterns or potential safety concerns. Serious adverse events are reviewed by the Data Safety Monitoring Board (DSMB) or Safety Review Committee.

Safety Signals:

- **Identification:** Unusual or unexpected adverse events or patterns are flagged as potential safety signals for further investigation.
- **Action:** Immediate actions may include additional safety monitoring, protocol amendments, or modifications to the study if warranted.

2. Safety Monitoring Plan

Overview: The Safety Monitoring Plan is designed to ensure that the Equivac Malaria Vaccine is administered safely and to identify, assess, and mitigate any potential risks associated with its use.

Safety Monitoring Components:

- **Pre-Specified Safety Assessments:**
  - **Adverse Event Monitoring:** Continuous monitoring for adverse events through regular follow-up visits and participant self-reporting.
  - **Scheduled Safety Reviews:** Regular review of safety data at predefined intervals (e.g., every 3 months) to identify trends or emerging safety issues.
- **Data Safety Monitoring Board (DSMB):**
  - **Role:** An independent group of experts responsible for monitoring the safety of the study participants and ensuring the integrity of the study.
  - **Responsibilities:** Reviewing aggregate safety data, assessing the risk-benefit ratio of the vaccine, and making recommendations regarding the continuation, modification, or termination of the study based on safety findings.
- **Safety Reporting Procedures:**
  - **Immediate Reporting:** Serious adverse events must be reported to the study sponsor and regulatory authorities within 24 hours.
  - **Periodic Reporting:** Detailed safety reports are submitted to regulatory authorities at regular intervals (e.g., annually) and include a comprehensive summary of adverse events and any actions taken.
  - **Investigator Responsibilities:** Investigators must ensure accurate and timely reporting of adverse events, maintain detailed records, and comply with all safety reporting requirements.
- **Risk Management Strategies:**
  - **Risk Assessment:** Ongoing assessment of potential risks associated with the vaccine based on collected safety data and emerging evidence.
  - **Risk Mitigation:** Implementation of risk minimization strategies, such as additional monitoring or modifications to the study protocol, to address identified safety concerns.
- **Participant Safety Measures:**
  - **Informed Consent:** Ensure that participants are fully informed about the potential risks and benefits of the vaccine before enrolling in the study.
  - **Emergency Procedures:** Established procedures for managing and responding to adverse events, including access to medical care and support for affected participants.
- **Regulatory Compliance:**
  - **Adherence to Guidelines:** Ensure that all safety monitoring practices comply with local and international regulatory guidelines and standards.
  - **Documentation:** Maintain thorough and accurate documentation of all safety-related activities, including adverse event reports, safety reviews, and DSMB recommendations.

ETHICS AND REGULATORY COMPLIANCE

1. Informed Consent Process

Purpose: The informed consent process ensures that participants are fully aware of the study's purpose, procedures, potential risks, and benefits before agreeing to participate. This process is designed to uphold participants' autonomy and right to make an informed decision about their involvement in the study.

Informed Consent Procedure:

- **Preparation of Consent Forms:**
  - **Content:** Consent forms are written in clear, understandable language and include detailed information about the study's objectives, procedures, potential risks and benefits, confidentiality, and participant rights.
  - **Language:** Forms are provided in local languages to ensure comprehension by all participants.
- **Consent Process:**
  - **Initial Discussion:** Before obtaining consent, investigators provide a detailed explanation of the study, addressing any questions or concerns the potential participant may have.
  - **Voluntary Participation:** Participation is strictly voluntary, and individuals are informed that they may withdraw from the study at any time without penalty or loss of benefits.
  - **Documentation:** Written informed consent is obtained from each participant (or their legal guardian, in the case of minors or those unable to provide consent themselves) before enrollment. The consent form is signed and dated by both the participant and the investigator.
- **Ongoing Consent:**
  - **Re-consent:** Participants are periodically re-consented, especially if there are significant changes to the study protocol or new information that may affect their willingness to participate.
  - **Updates:** Participants are informed of any new findings or changes in the study that may impact their health or safety.

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2. Ethical Considerations

Principles:

- **Respect for Persons:** Participants' autonomy is respected by ensuring informed consent and providing them with the right to withdraw from the study at any time.
- **Beneficence:** The study aims to maximize potential benefits and minimize harm to participants. Safety and well-being are prioritized throughout the study.

- **Justice:** The selection of participants is fair and equitable, ensuring that no group is unfairly burdened or excluded. Recruitment practices are inclusive and considerate of the study population's needs.

Ethical Review:

- **Institutional Review Board (IRB) / Ethics Committee (EC) Approval:**
  - **Submission:** The study protocol, informed consent documents, and other relevant materials are submitted to an IRB or EC for review and approval before study initiation.
  - **Approval:** The study must receive ethical approval from the IRB/EC before enrolling participants. The review ensures that the study is ethically sound and that participants' rights and welfare are protected.
- **Ongoing Review:**
  - **Periodic Review:** The IRB/EC reviews the study at regular intervals to ensure ongoing compliance with ethical standards and to address any issues or adverse events that may arise.
  - **Amendments:** Any amendments to the study protocol or informed consent documents are submitted to the IRB/EC for review and approval before implementation.

Participant Welfare:

- **Monitoring:** Regular monitoring of participants' health and safety throughout the study ensures that any adverse effects are promptly addressed.
- **Support:** Participants have access to medical care and support services if needed, and any significant health issues are managed under ethical guidelines.

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3. Regulatory Status

Regulatory Approvals:

- **Clinical Trial Authorization:**
  - **Submission:** A clinical trial application (CTA) or investigational new drug (IND) application is submitted to relevant regulatory authorities for approval before the study begins.
  - **Approval:** The study must receive authorization from regulatory agencies (e.g., NAFDAC or local health authorities) before enrolling participants.
- **Compliance with Regulations:**
  - **Local Regulations:** The study complies with all applicable local, national, and international regulations governing clinical trials and vaccine research.
  - **Good Clinical Practice (GCP):** The study adheres to GCP guidelines to ensure the ethical and scientific quality of the trial.

Documentation:

- **Regulatory Submissions:** All submissions to regulatory authorities, including protocol amendments, safety reports, and final study reports, are documented and maintained.
- **Regulatory Inspections:** The study is subject to inspections and audits by regulatory authorities to ensure compliance with regulatory requirements and to review study conduct and data integrity.

Post-Market Surveillance:

- **Post-Marketing Requirements:** If the vaccine is approved for marketing, post-marketing surveillance will be conducted to monitor long-term safety and efficacy.
- **Adverse Event Reporting:** Ongoing reporting of any adverse events or safety issues to regulatory authorities as per post-marketing surveillance requirements.

INVESTIGATIONAL PRODUCT HANDLING

1. Storage and Stability

Storage Conditions:

- **Temperature Requirements:** The Equivac Malaria Vaccine should be stored at 2°C to 8°C (36°F to 46°F) to maintain its stability and potency. It must be kept in a refrigerator and not frozen.
- **Protection from Light:** The vaccine vials should be protected from direct light to prevent degradation of the active ingredients.

Stability:

- **Shelf Life:** The vaccine has a shelf life of 24 months from the date of manufacture when stored under the recommended conditions. The expiry date is clearly labeled on each vial.
- **Reconstitution:** If the vaccine requires reconstitution before administration, the stability of the reconstituted solution should be validated, and the instructions for reconstitution should be followed precisely.

Monitoring:

- **Temperature Logs:** Regular temperature logs should be maintained to ensure that storage conditions are consistently within the recommended range.
- **Inspection:** Vials should be visually inspected for any signs of deterioration, such as discoloration, particulates, or damage to the vial before use.

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2. Preparation and Administration

Preparation:

- **Reconstitution:** If applicable, reconstitution of the vaccine should be performed using sterile techniques as outlined in the product's preparation instructions. Detailed procedures should be followed to ensure proper reconstitution and avoid contamination.
- **Inspection:** The reconstituted vaccine should be inspected for clarity and particulate matter before administration. Any preparation that appears cloudy or contains particles should be discarded.

Administration:

- **Route of Administration:** The Equivac Malaria Vaccine is administered intramuscularly. The recommended injection site is typically the deltoid muscle of the upper arm.

- **Dosage and Schedule:** Each dose of the vaccine is pre-determined and administered according to the study protocol, which specifies the number of doses and the schedule (e.g., 0, 1, and 6 months).
- **Injection Technique:** Standard aseptic techniques should be used to administer the vaccine. Proper needle size and injection technique should be followed to ensure accurate dosing and minimize discomfort.

Documentation:

- **Administration Records:** Detailed records of each vaccination, including the date, time, and dose administered, should be maintained in the study records. This includes documentation of any adverse reactions observed during or immediately after administration.

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3. Accountability

Product Receipt and Inventory:

- **Receipt:** Upon receipt of the investigational product, the quantity and condition of the vaccine vials should be checked against the shipment invoice and storage requirements. Any discrepancies or damage should be reported to the sponsor or manufacturer immediately.
- **Inventory Management:** Maintain an accurate inventory of the vaccine, including tracking of lot numbers, expiration dates, and quantities received, used, and returned. Inventory records should be updated regularly.

Usage Tracking:

- **Dispensing Records:** Document all dispensed vaccine vials, including the recipient's details, the date of dispensing, and the amount used. This helps ensure traceability and accountability.
- **Returns and Waste Management:** Procedures should be in place for the return of unused or expired vaccine vials, including proper disposal of any waste materials under local regulations and study protocols.

Audits and Inspections:

- **Internal Audits:** Regular internal audits should be conducted to ensure compliance with investigational product handling procedures and to identify any potential issues.
- **Regulatory Inspections:** The study site may be subject to inspections by regulatory authorities to verify adherence to product handling and accountability requirements.

INVESTIGATOR AND STUDY TEAM INFORMATION

1. Principal Investigator

- **Full Name:** DR PREYE OGBE

Affiliation:

- **Institution/Organization:** NIGER DELTA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, DEPARTMENT OF PHARMACOLOGY

Qualifications:

- **Degree(s):** MSC, MBBS, BMedSci, MWASP
- **Specialization:** CLINICAL PHARMACOLOGY
- **Experience:** I have carried out research work on Clinical Trials (Drug Repurposing [Repositioning]). Below is detailed work done.

DEPARTMENT OF PHARMACOLOGY

FACULTY OF BASIC CLINICAL SCIENCES

COLLEGE OF HEALTH SCIENCES

NIGER DELTA UNIVERSITY, WILBERFORCE ISLAND, AMASSOMA

DR. PREYE DAVID OGBE PUBLICATIONS

Total Publications (5)

S/No	AUTHORS	Title of Publication, Journal Name, Vol (issue), Page, Year of Publication, & Country
1	**Preye David Ogbe**, Udeme Owunari Georgewill, Nwibana Barisuka Kofii & Victor Tamunotonye Ibubeleye	Clinical Evaluation of the Curative Effects and Hematological Consequences of Ivermectin, Artemether-Lumefantrine, and their Combination in Malaria Treatment. *Journal of Pharmacology & Clinical Research* 9(4), 001-006, 2023. (USA).
2	Charity Nnenna Ameja	Evaluation of the Efficacy of Artemether/Lumefantrine/Doxycycline

	Preye David Ogbe Victor Tamunotonye Ibubeleye, & Udeme Owunari Georgewill	Combination against Plasmodium berghei in Mice. *EAS Journal of Parasitology and Infectious Diseases* 5(4), 36-42, 2023. (Kenya).
3	Victor Tamunotonye Ibubeleye, Faith Onyedikachi Ogar, Nwibana Barisuka Kofii, **Preye David Ogbe**, Precious Ojo Uahomo & Owunari Abraham Georgewill	Assessment of the Effects of *Camellia sinensis* (Green Tea) Extract on Renal, Cardiac, and Pulmonary Tissues in Wistar Rats. *Journal of Complementary Medicine & Alternative Healthcare* 12(2), 001-0015, 2023. (USA)
4	Henry Akpojubaro Efegbere, Benjamin Ifeanyichukwu Tabowei Arthur Ebelenna Anyabolu, Hyacinth Emeka Enemuo, Ogochukwu Ifeanyi Ezejiofor, **David Preye Ogbe** Tina Woyengitonbara Abalaba Kate Ebruke Efegbere Uzor Edwin Ebenebe & Linus Ilika Amobi	Comparative Study of Knowledge on Team Building Between Healthcare Workers in Two Federal Tertiary Health Facilities in Different Geo-political Zones of Nigeria. *Journal of Health, Medicine and Nursing* 43: 82-92. 2017, (USA).
5	W.N. Dare,	A Comparative Study on Thigh Length to Leg Length Ratio

	A.Z. Erefah & **P.D. Ogbe**	in Adult Males of Two Southern States in Nigeria. *European Journal of Applied Sciences* 5 (4): 115-117, 2013. (UK)

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Role:

- The Principal Investigator (PI) is responsible for the overall conduct of the study at the study site. This includes ensuring the study is conducted under the protocol, regulatory requirements, and ethical standards.

Responsibilities:

- Overseeing the study implementation, including recruitment, informed consent, and data collection.
- Ensuring the safety and well-being of study participants.
- Ensuring compliance with Good Clinical Practice (GCP) guidelines and study protocols.
- Reporting any serious adverse events or protocol deviations to the sponsor and regulatory authorities.

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2. Study Sites

Study Site 1:

- **Name:** Pharmacology Lab
- **Address:** Niger Delta University, Wilberforce Island
- **Contact Person:** Mr. Samuel Chukwuma
- **Contact Information:** 08035110255
- **Role:** This site will be used for our Pre-Clinical Trials

Study Site 2:

- **Name:** Equity Health Group Laboratory
- **Address:** Asaba Delta State
- **Contact Person:** Dr. Preye Ogbe
- **Contact Information:** 08063992188, drpogbe@gmail.com
- **Role:** Recruitment, Data Collection

(Add additional study sites as necessary)

Note: All study sites are selected based on their capability to comply with study protocols and regulatory requirements. Each site is equipped with the necessary facilities and staff to conduct the study effectively.

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3. Contact Information

Study Sponsor Contact:

- **Name:** Mr. Doxy Mmobuosi
- **Organization:** Equity Health Group
- **Address:** 13 Ogbuinike Street, Lekki Phase 1
- **Phone Number:** 09166000661
- **Email Address:** info@equityhg.com

Study Coordinator Contact:

- **Name:** Dr. Segun Sani
- **Organization:** Equity Health Group
- **Phone Number:** 09166000662
- **Email Address:** info@equityhg.com

Medical Monitor Contact:

- **Name:** Dr. Charlse Fagbohunlu
- **Organization:** Equity Health Group
- **Phone Number:** 09166000662
- **Email Address:** info@equityhg.com

Regulatory Authority Contact:

National Agency for Food and Drug Administration and Control (NAFDAC)
Plot 2032 Olusegun Obasanjo Way
Wuse Zone 7
Abuja, FCT, Nigeria

Additional Contacts:

- **Emergency Contact:** Dr. C.J Njoku, HOD Pharmacology Department, Niger Delta University.
- **Technical Support:** Mrs. Busayo Ayenimo, Equity Health Group

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APPENDICES

- **Patient consent form**
- **Case Report Forms**
- **Investigator Brochure Revision History**
- **Budget**