

REPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie

MINISTRE DE L'ENSEIGNEMENT SUPERIEUR

UNIVERSITE DE YAOUNDE I

FACULTE DE MEDECINE ET DES SCIENCES
BIOMEDICALES

DEPARTEMENT DE SANTE PUBLIQUE



REPUBLIC OF CAMEROON
Peace – Work – Fatherland

MINISTRY OF HIGHER EDUCATION

THE UNIVERSITY OF YAOUNDE I

FACULTY OF MEDICINE AND BIOMEDICAL
SCIENCES

DEPARTMENT OF PUBLIC HEALTH

DETERMINANTS OF COMPLIANCE TO VACCINATION AS A MEANS OF INFECTION PREVENTION AMONG HEALTHCARE WORKERS IN YAOUNDÉ DISTRICT HOSPITALS

A Dissertation Submitted in Partial Fulfilment for The Award of The Diploma of Specialist in
Public Health by:

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Academic Year: 2023-2024

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PRELIMINARIES

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DEDICATION

To my beloved parents

Mr. NOUKO Emmanuel and Mrs. NOUKO Elisabeth TCHOUAMOU.

To my precious siblings

NOUKO Manuella, NOUKO Sandy, NOUKO Yann, NOUKO Jayson White.

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To **Professor TAKOUGANG Innocent**, for his supervision, mentoring, teaching, corrections, availability and advice that played a vital role for the completion of this work.

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To all the **healthcare workers in all the seven district hospitals in Yaoundé and support staff** in these hospitals, for your time and availability.

To all my **Classmates, Year 4 Public Health Residents**; for your scientific, material, and psychological assistance.

To all **my friends**, thank you for all the love and constant moral and social support.

Many thanks to all those who contributed to this piece of work.

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206	AMANI ADIDJA	AL	Public Health
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227	DZUDIE TAMDJIA Anastase	L	Physiology
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Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in Yaoundé District Hospitals

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HIPPOCRATIC OATH

As a member of the medical profession:

I solemnly pledge to dedicate my life to the service of humanity;

The health and well-being of my patient will be my first consideration;

I will respect the autonomy and dignity of my patient;

I will maintain the utmost respect for human life;

I will not permit considerations of age, disease or disability, creed, ethnic origin, gender, nationality, political affiliation, race, sexual orientation, social standing, or any other factor to intervene between my duty and my patient;

I will respect the secrets that are confided in me, even after the patient has died;

I will practise my profession with conscience and dignity and in accordance with good medical practice;

I will foster the honour and noble traditions of the medical profession;

I will give to my teachers, colleagues, and students the respect and gratitude that is their due;

I will share my medical knowledge for the benefit of the patient and the advancement of health care;

I will attend to my own health, well-being, and abilities to provide care of the highest standard;

I will not use my medical knowledge to violate human rights and civil liberties, even under threat;

I make these promises solemnly, freely, and upon my honour.

ABSTRACT

Introduction: Healthcare workers (HCWs) can be important carriers of contagious pathogens. Exposing their patients and families to these pathogens and being at an increased risk of infection themselves. Immunization of HCWs is a primary measure for preventing infection. However, vaccine coverage among HCWs in most countries remains low.

Objective: To determine the vaccination coverage of recommended vaccines (Hepatitis B, COVID-19, Tuberculosis (TB), Tetanus, and Cholera) among HCWs, identify factors associated with compliance and constraints to vaccination.

Methodology: A cross-sectional study was carried out from January to July 2024. The study involved the seven District Hospitals (DH) in Yaoundé. An exhaustive sampling technique was used to enrol HCWs in these DHs. A pretested self-administered questionnaire was administered to consenting HCWs. The questionnaire had four sections on; socio-professional, vaccination knowledge, vaccination coverage and compliance. Data was analysed using R Statistic version 4.3.3. A p -value <0.05 was considered significant.

Results: A total of 406 HCWs were included in the study. The vaccination coverage rates were; 36.2 % for Hepatitis B, 42.4 % for COVID-19, 15.8 % for Tuberculosis, 53.4 % for tetanus, and 4.7 % for Cholera. Factors facilitating compliance to vaccination were; Hepatitis B (work experience of >5 years, being a nurse); COVID-19 (work experience of >5 years, being a nurse and vaccine gratuity); TB (age group 55-66 years, work experience of >15 years, working in the medical unit); Tetanus (sex, age group 45-55 years, work experience of >5 years) and Cholera (work experience of >5 years, working in the medical unit, vaccine gratuity). The most reported reasons for non-vaccination were; the high cost (Hepatitis B, TB, Tetanus), fear of side effects (COVID-19), vaccine unavailability (TB, Cholera), doubts about the efficacy (COVID-19, TB), and religious and personal reasons (COVID-19).

Conclusion: Given the sub-optimal vaccination coverage observed among HCWs, there is a critical need to prioritize and implement strategies to improve the accessibility and availability of recommended vaccines. Implementing cost-sharing mechanisms between the state and health facilities can significantly reduce vaccine costs and improve coverage, leading to a healthier and more protected healthcare workforce in Cameroon.

Keywords: Healthcare Workers; Vaccination; Infection Prevention; District Hospitals; Yaoundé.

RÉSUMÉ

Introduction : Les Personnels de Sante (PS) peuvent être d'importants porteurs d'agents pathogènes contagieux. Ils exposent leurs patients et leurs familles à ces agents pathogènes et courent eux-mêmes un risque accru d'infection. L'immunisation des PS est une mesure primaire de prévention des infections. Cependant, la couverture vaccinale chez les PS reste faible dans la plupart des pays.

Objectifs : Déterminer la couverture vaccinale des vaccins recommandés (Hépatite B, COVID-19, Tuberculose, Tétanos et Choléra) parmi les PS, identifier les facteurs associés à compliance et les obstacles à la vaccination.

Méthodologie : Une étude transversale a été réalisée de Janvier à Juillet 2024. L'étude s'est déroulée les sept Hôpitaux de District (HD) de Yaoundé. Une technique d'échantillonnage exhaustive a été utilisée pour enrôler les PS dans ces HD. Un questionnaire auto-administré pré-testé a été administré aux PS consentants. Le questionnaire comportait quatre sections : socioprofessionnel, connaissances sur la vaccination, couverture vaccinale et observance. Les données ont été analysées à l'aide de la version 4.3.3 de R Statistic. Une valeur $p < 0,05$ a été considérée comme significative.

Résultats : Au total, 406 PS ont été inclus dans l'étude. Les taux de couverture vaccinale étaient les suivants : 36,2 % pour l'hépatite B, 42,4 % pour le COVID-19, 15,8 % pour la tuberculose, 53,4 % pour le tétanos et 4,7 % pour le choléra. Les facteurs facilitant La compliance a la vaccination étaient : Hépatite B (expérience professionnelle de >5 ans, infirmière) ; COVID-19 (expérience professionnelle de >5 ans, être infirmière et gratuité du vaccin) ; tuberculose (groupe d'âge 55-66 ans, expérience professionnelle de >15 ans, travail dans l'unité médicale) ; Tétanos (groupe d'âge 45-55 ans, sex, expérience professionnelle de >5 ans) et Choléra (expérience professionnelle de >5 ans, travail dans l'unité médicale, gratuité du vaccin). Les raisons les plus souvent invoquées pour expliquer la non-vaccination étaient le coût élevé (hépatite B, tuberculose, tétanos), la crainte des effets secondaires (COVID-19), l'indisponibilité du vaccin (tuberculose, choléra), les doutes quant à l'efficacité (COVID-19, tuberculose) et les raisons religieuses et personnelles (COVID-19).

Conclusion : Compte tenu de la couverture vaccinale sous-optimale observée chez les PS, il est absolument nécessaire d'établir des priorités et de mettre en œuvre des stratégies visant à améliorer l'accessibilité et la disponibilité des vaccins recommandés. La mise en œuvre de

mécanismes de partage des coûts entre l'État et les établissements de santé peut réduire de manière significative les coûts des vaccins et améliorer la couverture vaccinale, ce qui se traduira par un personnel de santé plus sain et mieux protégé au Cameroun.

Mots-clés : Personnels de santé ; Vaccination ; Prévention des infections ; Hôpitaux de district ; Yaoundé.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS: Acquired immunodeficiency syndrome

BCG: Bacillus Calmette-Guerin

CDC: Centre of Disease Control

DH: District Hospital

DNA: Deoxyribonucleic acid

DTP: Diphtheria Tetanus Pertussis

HBV: Hepatitis B Virus

HCW: Health Care Workers

HIV: Human Immunodeficiency Virus

HTLV: Human T Lymphotropic Virus

ILO: International Labour Office

IPC: Infection Prevention and Control

MDG: Millennium Development Goal

MMR: Measles, Mumps and Rubella

MRSA: Methicillin-resistant Staphylococcus Aureus

NHS: National Health System

OCV: Oral Cholera Vaccine

PPE: Personal Protective Equipment

SARS-COV2: Severe Acute Respiratory Syndrome Coronavirus-2

SDG: Sustainable Development Goal

VC: Vaccination Coverage

VPD: Vaccination Preventable Diseases

WHO: World Health Organisation

CHAPTER I: INTRODUCTION

BACKGROUND

Infectious diseases present a global problem; they are either increasing in number in a given place or re-emerging in an environment where they have already disappeared [1–3]. Healthcare workers (HCWs) can be important carriers of contagious pathogens for patients and their families, as well as being at increased risk of infection themselves [4]. One of the major arms of infection prevention is vaccination. Vaccination is a cost-effective way of preventing infection, particularly in hospital settings. Vaccines prevent more than 20 potentially deadly diseases, enabling people of all ages to live longer and healthier lives [4,5]. However, despite the enormous progress, vaccination coverage has stagnated in recent years and even fell for the first time in 10 years in 2020 [2]. One of the major challenges to infection control in healthcare facilities is inadequate immunization of HCWs. In addition to protecting HCWs from infectious organisms, immunization helps to avoid nosocomial infection and its associated problems [6,7].

The COVID-19 pandemic put a huge strain on healthcare systems, with up to 1 in 7 COVID-19 cases being HCWs. By 2023; more than thirteen billion doses of the COVID-19 vaccine had been administered, and 89% of healthcare workers globally are vaccinated compared to only 52% of healthcare workers in developing countries [8,9]. The incidence of tuberculosis worldwide is higher among healthcare workers especially those working in tuberculosis treatment units. The tuberculosis vaccination rate in HCWs in Italy is reported to have increased from 24.5% in 2019 to 32% in 2021 [10]. HCWs are four times more likely to acquire Hepatitis B than the general population, they are among the most susceptible groups to HBV infection from occupational exposures, the hepatitis B vaccination coverage rate in HCWs in Europe is reported to be 77% [11].

In the African continent infections such as HIV, malaria, tuberculosis, cholera, dysentery, hepatitis B, Ebola, and yellow fever have always put the health systems of the African continent to the test [12]. In countries where health is already fragile, protecting HCWs is a priority if patients are to continue to be treated and if hospitals are not to become places where infections are transmitted [13]. Only a few countries in the region have the health workforce required of 10.9 health professionals to provide health services per 1,000 inhabitants [14]. Data from the African region show that only 52% of African HCWs have been fully vaccinated against COVID-19, [9,12,15]. Low vaccination rates of recommended vaccines among HCWs have been reported in Africa. A systematic review done on Hepatitis B vaccination coverage in HCWs in Africa, reports a 24.7% coverage rate in Africa and 13.4% in Central Africa [16]. A

study in Ethiopia reports Tuberculosis vaccination coverage rate among HCWs is 65.5%. HBV is thought to be endemic throughout Africa; in Cameroon, the disease is hyper-endemic, with an estimated 11.9% prevalence [11,17].

In Cameroon, national vaccination coverage of health workers against COVID-19 is reported to be 49.4% in early 2024. Recorded vaccination rates among HCWs in Cameroon remain low despite the acknowledged heightened risks of diseases such as HBV infection in hospital settings, as evidenced by modest regional studies [11]. A systematic review of all HBV studies done in Cameroon reports a prevalence of 11.2% [18]. A study done in district hospitals in Cameroon in 2023, reported that 36.7% of HCW experienced accidental exposures and up to 43.6% were not vaccinated against hepatitis B [19]. The paucity of data on the factors facilitating vaccination among HCWs in our setting leads us to carry out this study.

JUSTIFICATION

Given the burden of infection control in Cameroonian health facilities, the high occurrence of accidental exposure such as needle stick injuries, and the high prevalence of HBV among Cameroonians [11,17,20] There is a need to assess vaccination coverage amongst healthcare workers, know the determinants of compliance to vaccination as a means of infection prevention to enhance better practice, and develop more specific health policies.

This study would be potentially handy in providing baseline data to assist in developing national guidelines on mandatory and recommended vaccines for all healthcare workers in Cameroon.

I.1 RESEARCH QUESTION AND HYPOTHESIS

Research Question

What are the determinants of compliance to vaccination as a means of infection prevention amongst healthcare workers in Yaoundé DHs?

RESEARCH HYPOTHESIS

Vaccination coverage amongst healthcare workers in Yaoundé DHs is sub-optimal. There exist factors associated with compliance with vaccination among healthcare workers.

I.2 STUDY OBJECTIVES

General Objective:

- To identify the determinants of compliance to vaccination as a means of infection prevention among healthcare workers in Yaoundé District Hospitals.

Specific Objectives:

- To determine the vaccination coverage of Hepatitis B, COVID-19, BCG, tetanus, and cholera vaccines among HCWs;
- To identify the socio-professional determinants associated with compliance to vaccination as a means of infection prevention among HCWs;
- To identify major reasons for non-vaccination for each vaccine.

I.3 CONCEPTUAL FRAMEWORK

This study addresses a significant public health issue that is closely tied to infection control in hospitals. Unvaccinated healthcare workers are more likely to get infected because of poor observance of standard precautions or in the event of occupational exposure to body fluids. Determinants of high or low vaccination rates could be utilized as baseline information to tailor strategies and strengthen current health policies.

I.4 DEFINITION OF TERMS

The World Health Organisation defines vaccination coverage in HCW as the proportion of HCWs in the study population that have taken a vaccine. This will be calculated per recommended vaccine.

Healthcare workers are defined as persons working in the healthcare milieu having potential exposure to patients and to infectious materials. They include; doctors, nurses, laboratory technicians, cleaners, midwives, care assistants, etc. who have contact with syringes, needles, and other sharp objects in the course of their work [5].

Persons are considered to be fully vaccinated when they have received 3 doses or more for Hepatitis B, 2 doses or more for COVID-19, 2 doses or more for tetanus, 2 doses or more for Tuberculosis, and 2 doses or more for oral Cholera vaccine.

CHAPTER II: LITERATURE REVIEW

LITERATURE REVIEW

BACKGROUND KNOWLEDGE

II.1 INFECTION PREVENTION

II.1.1 Definition

According to WHO, in 1948, infection prevention is the set of measures to avoid or reduce the number and severity of diseases, accidents, and handicaps. It can also be defined as all measures aimed at reducing the risk of cross-transmission of infectious agents between caregivers, patients, and the environment, or by exposure to a biological product of human origin (blood, secretions, excreta, etc.). Prevention must be applied to all care, in all places, for all patients, whatever their infectious status, and by all healthcare professionals. Since the transmission of micro-organisms is facilitated by exposure to and handling of any biological product of human origin, the "Standards Precautions", a synthesis of the two concepts, were introduced in 1996. Applicable to all patients by all carers (carer/caregiver protection), they were updated by the Centre for Disease Control (CDC) in 2007, incorporating respiratory hygiene [13,21,22].

II.1.2 Primary Prevention

All measures aim to avoid or reduce the occurrence or incidence of diseases, accidents, and disabilities. At this stage of prevention, individual risk behavior is taken into account, as are environmental and societal risks, as well as consolidating and structuring factors such as psychosocial skills. For example: vaccination, prevention campaigns in schools, training employees in environmental risks, etc. [13].

II.1.3 Secondary Prevention

It is an intervention designed to reduce the prevalence of a disease in a population. This stage of prevention covers actions designed to act at the very beginning of the appearance of the disorder or pathology to oppose its development or eliminate the risk factors. For example: reducing infection from the sea to children [13].

II.1.4 Tertiary prevention

This takes place after the onset of the disease and aims to reduce complications and the risk of relapse. The aim is to reduce the effects and after-effects of a disease or its treatment. For example: therapeutic education for asthma [13,21].

II.2 PRINCIPLES OF INFECTION PREVENTION AND CONTROL

II.2.1 Hand Washing

Hand hygiene plays a dual role: it protects both patients and healthcare workers from infection by, and acquisition of, micro-organisms that can harm them, and it leads to a significant reduction in the carriage of potential pathogens on the hands. This objective can be easily achieved by using liquid soap and water with an effective technique, or by using an alcohol-based hand gel or cream on visibly clean hands [3,21].

Types of hand washing

- Simple hand washing;
- Surgical hand washing;
- Friction with alcohol-based gel.

Five indications for hand hygiene

- Before contact with the patient;
- Before a clean or aseptic spot;
- After exposure to blood or body fluids;
- After touching a patient;
- After touching the patient's environment.

II.2.2 Personal Protective Equipment

Personal protective equipment (PPE) is defined as “any equipment intended to be worn or held by a person at work and which protects them against one or more risks to their health or safety”. When it comes to infection prevention and control, the primary goal of wearing PPE (gloves, gowns, masks, and eye protection) is to prevent the transmission of microorganisms to patients and staff. Unfortunately, the why and how of PPE causes great confusion among healthcare personnel which is often discovered by nurses specializing in infection prevention and control. PPE included:

- Gloves
- Surgical mask
- Glasses and visors
- Blouses [21]

II.2.3 Safe handling and disposal of sharps

Healthcare workers are exposed to blood-borne viruses every day through the handling of clinical waste, contact with blood and other high-risk bodily fluids, procedures such as cannulation and venipuncture, and surgery. Sharps or needle stick injuries (also known as inoculation injuries) are the most common occupational hazard faced by healthcare workers in hospital and community settings, as well as others. Good practice recommendations for the prevention of sharps injuries are described, including the use of safety devices following the European directive [13,23].

II.2.4 Respiratory Hygiene

The mucous membranes of the eyes, nose, and mouth are sensitive portals of entry for microorganisms and during certain patient care activities and procedures; they will be exposed to splashes or sprays of blood, bodily fluids and/or secretions or respiratory excretions. Respiratory and facial protection offers the user protection against potentially infectious microorganisms present in the air, which can present them in the form of:

- Aerosols
- Droplets
- Splash particles

Masks worn to protect the respiratory tract must comply with European standard EN 149:2001, which is the respiratory protection standard for disposable filtering masks which are worn as masks covering the nose, mouth and chin and which filter particles, including bacteria and viruses. Class 3 disposable filtering masks (FFP3 masks) offer healthcare professionals the highest level of respiratory protection, reducing exposure to infectious particles by at least a factor of 20 if the respirator is properly fitted, and must be worn during aerosol-generating procedures or when caring for patients with multidrug-resistant tuberculosis, pandemic or avian influenza, severe acute respiratory syndrome (SARS) or new coronaviruses [22].

II.2.5 Environmental Hygiene

Concerns about hospital cleanliness have often made headlines over the past decade, the public remains unconvinced about the cleanliness of hospitals, and healthcare-associated infections such as MRSA and *Clostridium difficile* are largely, but not exclusively, attributed to the filth of hospital wards. Cleaning is one of the most important tasks in any healthcare facility, the environment is a challenge for cleaning staff however, the responsibility does not rest solely

on all healthcare staff have a role to play in maintaining cleanliness of the environment and equipment.

This section does not cover different cleaning methods, although it does refer to new cleaning technologies. Rather, its intention is to provide an overview of the importance of environmental cleanliness, including cleaning of patient equipment, and to encourage healthcare personnel to consider their role in this area. It begins by defining the responsibilities of staff to ensure that patients are cared for in a clean environment, as stipulated in the Code of Practice on the Prevention and Treatment of Infections and Infectious Diseases, and examines factors that may hinder the effectiveness of infection prevention, examples of environmental contamination by specific pathogens, as well as the importance of cleaning surfaces frequently touched by hands. Reference is made to NHS cleaning standards and color coding, as well as cleaning of beds, chests of drawers, mattresses, etc. [3,5,21].

II.3 IMMUNIZATION AS INFECTION CONTROL MEASURE

II.3.1 Definition

Vaccination is a simple, safe, and effective way of protecting people from dangerous diseases before they come into contact with them. It uses the body's natural defences. Vaccines stimulate the immune system to create antibodies in the same way as if it were exposed to the disease. Most vaccines are administered by injection, but others are taken by mouth or nasal spray [3,13].

II.3.2 Indication

Immunization is a successful use of immunotherapy to treat many infectious diseases by stimulating the immune system to produce specific antibodies or specific lymphocytes to fight off pathogens and, more recently, protect against malignant tumours. This immunotherapy creates an immunological memory that can be long-lasting. The current immunizations protect against diphtheria, tetanus, pertussis, poliomyelitis, measles, mumps, rubella, pneumococcal pneumonia, smallpox, sepsis, meningitis, hepatitis B, varicella-zoster, tuberculosis, cholera, diarrhoea caused by rotavirus, salmonellosis, and dengue. However, the development of vaccine technology in recent years, the emergence of HIV, SARS, avian influenza, Ebola, and Zika emphasizes the need for global preparedness for a pandemic [3,24].

II.3.3 Mechanism of action

Live vaccines are most effective than killed vaccines because they retain more antigens of the microbes. However, toxoids, including those that cause tetanus and diphtheria, are the most effective bacterial vaccines because their effect is based on inactivated exotoxins that stimulate strong antibody production. Subunit vaccines, including hepatitis B, meningococcal, and *Hemophilus influenzae* B vaccines, are effective when conjugated to carrier proteins such as tetanus toxoid. Vaccinologists produce subunit vaccines either by recombinant DNA technology or by antigen purification from different bacterial strains[3,25].

Vaccines contain one or various immunogens (peptides), which antigen-presenting cells can engulf, process, and present along with MCH antigens to CD4+ T cells. These lymphocytes can synthesize cytokines that activate humoral and cellular responses, including antibody production, activation of CD8+ T cells, macrophage stimulation, and other functions. Memory cells can develop in this process. They can proliferate more quickly in further encounters with the antigen [3,26].

B cells can recognize vaccines made of carbohydrates and other compounds except for proteins. Subsequently, B lymphocytes can differentiate into plasma cells that produce specific antibodies to protect against infectious diseases caused by bacteria, including meningitis caused by *Neisseria meningitidis* and pneumonia caused by *Streptococcus pneumoniae*. This immune response against a non-peptidic antigen does not involve T-cell presentation, class switching, affinity maturation, or generation of memory T-cells [3,27].

Using adjuvants enhances antibody synthesis and T-cell responses. Certain compounds, including aluminum salts added to immunogens, stimulate immune responses. This effect can be mediated by two essential functions: cytokine induction that regulates T and B cell functions and increased antigen presentation in sites where lymphocytes can concentrate. Many bacterial substances can activate pattern recognition receptors that activate cytokine production by antigen-presenting cells [3,28,29].

Immunological studies for testing the humoral and cellular immunity after immunizing a host:

Quantitative Serum Immunoglobulins; IgG, IgM, IgA, IgE

IgG Sub-Classes; IgG1, IgG2, IgG3, IgG4

Antibody Activity

1. *IgG antibodies (post-immunization)* [30]: Tetanus toxoid, Diphtheria toxoid, Pneumococcal polysaccharide, Polio
2. *IgG antibodies (post-exposure)*; Rubella, Measles, and *Varicella-zoster*

Blood Lymphocyte Subpopulations: Total lymphocyte count, T lymphocytes (CD3, CD4, and CD8), B lymphocytes (CD19 and CD20), and CD4/CD8 ratio.

Microbiological Studies

These can be done the following samples; blood (bacterial culture, HIV by PCR, HTLV testing), urine (testing for cytomegalovirus, sepsis, and proteinuria), nasopharyngeal swab (testing for rhinovirus), stool (testing for viral, bacterial, or parasitic infection), sputum (bacterial culture and pneumocystis PCR), Cerebrospinal fluid (culture, chemistry, and histopathology)

II.3.4 Vaccine Administration

Most human vaccines are administered by injection, although this approach is risky in the developing world, where injections can transmit diseases such as HIV infections. Live vaccines can be given orally but not killed vaccines. Alternatively, the uses of the oral route and other mucosal surfaces have been explored as an immunization route. For example, polio vaccination underwent a successful implementation via the oral route[3,31].

II.3.5 Adverse Effects

Attenuated vaccines have several potential safety issues, including hypersensitivity to viral antigens (measles), hypersensitivity to egg antigens (mumps), and persistent infection (varicella-zoster), in an immune-deficient patient, it may cause severe disease (BCG).

Live attenuated vaccine safety issues include yeast contaminant (hepatitis B), contamination with animal viruses (polio)and endotoxin contamination (pertussis).

II.3.6 Vaccine Contraindications

All vaccines have as contraindications severe allergic reactions (e.g., anaphylactic reaction) after a previous dose or to a vaccine component. DTaP should contraindicate if the child develops encephalopathy within seven days of administering a prior dose of DTP or DTaP and after ruling out other causes of brain illness. Hepatitis B vaccine contraindicates in patients with hypersensitivity to yeast. Hepatitis B vaccine is contraindicated in infants aged less than six weeks[3].

MMR vaccine is avoided in those with a known severe immunodeficiency due to lymphoid malignancies, congenital cause, chemotherapy, family history of immunosuppression, and in patients with HIV/AIDS. Rotavirus vaccine must contraindicate in children with a history of intussusception, and it should use with precaution in altered immune-competence, other than severe combined immunodeficiency disorder. Both varicella and zoster vaccines contraindicate in immune-compromised host and pregnancy. Live-attenuated influenza virus vaccine should be avoided when in the previous 48 hours, a patient has taken influenza antiviral medication; dosing should proceed with caution in patients who developed Guillain-Barre syndrome within six weeks after a prior dose of influenza vaccine and in patients who have asthma [3].

II.3.7 Vaccine Monitoring

Most vaccines have adverse reactions, as is the case with any drug or medication. For example, BCG vaccination may provoke fever, vomiting, haematuria, lymphadenitis, and redness at the injection site. The Hepatitis B vaccine has few adverse reactions, and none of them are dangerous. These reactions include redness, warmth, swelling, and fever over 101 F (38.3 C). A rare and lethal adverse reaction secondary to vaccination is the Guillain-Barre syndrome [32,33].

II.3.8 Vaccine Toxicity

Anaphylactic reactions are examples of allergic reactions that can affect individuals that vaccinated. They can be treated with aqueous epinephrine 1 to 1000 dilutions intramuscularly (IM), 0.01 mL/kg/dose. The adult dose can range from 0.3 mL to 0.5 mL. Optional treatment is the use of an H1 antihistamine for skin reactions (hives or itching). It can be administered diphenhydramine (either orally or IM). Inject a dosage of 1 to 2 mg/kg every 4 to 6 hours, up to 50 mg) or hydroxyzine 0.5 to 1 mg/kg every 4 to 6 hours up to 100 mg. The dosage of epinephrine can be repeated every 5 to 15 minutes for up to 3 doses, depending on the clinical picture. Record the patient's reaction, the medications, and the health care provided to the patient, and the name of the personnel who administer the drug [3].

CURRENT STATE OF KNOWLEDGE ON VACCINATION FOR HCWs

II.4 VACCINES RECOMMENDED FOR HCWS

According to the International Labour Office, each health facility should have a policy for the necessary vaccinations of HCWs according to the national immunization policy and the specific occupational health hazards of its country. Immunization against VPDs should be provided at no cost to the HCWs and it is ensured that all required doses of immunizations have been received by all workers at risk, including cleaners and waste handlers [34].

The International Labour Office also recommends the following measures to be taken at the hospital level to increase vaccination coverage among HCWs:

1. Identify high-risk workers and develop a risk-based immunization schedule to be implemented at all levels of health facilities and covering all categories of workers.
2. Provide and promote free on-site vaccination.
3. Encourage participation by utilizing signed consent or declination forms; educate health workers about the occupational risks associated with vaccine-preventable diseases, the efficacy of vaccination, and other preventive methods. Use reminders to ensure completion of the full doses of the vaccine and maintain the immunization records of workers at facilities as well as at subnational and national levels.
4. Provide paid sick leave, as needed, for workers experiencing adverse events following immunization.
5. Integrate immunization into pre-employment orientation.
6. Demonstrate management commitment by providing communication messages, resources, and incentives, and monitoring vaccine coverage regularly [34].

II.4.1 List of recommended vaccines for healthcare workers

1. **COVID-19:** If not up to date, give COVID-19 vaccine according to current CDC recommendations.
2. **Hepatitis B:** If no previous dose, give either a 2-dose series of Heplisav-B or a 3-dose series of Engerix-B, PreHevbrio, or Recombivax HB. A 3-dose series of Twinrix vaccine, which prevents hepatitis A and B, is an option.
3. **Influenza:** Take 1 dose of influenza vaccine annually.
4. **MMR:** For healthcare personnel born in 1957 or later without serologic evidence of immunity or prior vaccination, give 2 doses of MMR, 4 weeks apart.

5. **Varicella (chickenpox):** For HCWs, who have no serologic proof of immunity, prior vaccination, or diagnosis or verification of a history of varicella or herpes zoster (shingles) by a healthcare provider, give 2 doses of varicella vaccine, 4 weeks apart.
6. **Tetanus, Diphtheria, Pertussis:** Give 1 dose of Tdap as soon as feasible to all HCP who have not received Tdap previously and to pregnant HCP with each pregnancy (see below). Give Td or Tdap boosters every 10 years thereafter.
7. **Meningococcal:** Give to microbiologists who are routinely exposed to isolates of *Neisseria meningitides*. As long as risk continues: boost after 1 year, then every 2–3 years thereafter; boost with MenACWY every 5 years [14,33,34].

II.4.2 List of Mandatory vaccines for healthcare workers

The following vaccines are mandatory for all medical and paramedical students, medical doctors, and paramedical personnel including cleaners and waste handlers; **Diphtheria, Tetanus, Poliomyelitis, Hepatitis B** [14].

II.4.3 List of Optional vaccines for healthcare workers

These include vaccines against the Human Papilloma Virus, Herpes Simplex virus, and Varicella-zoster virus [1,14].

II.5 VACCINATION COVERAGE AMONG HCWS

Some specifications about TB vaccination in HCWs; it is particularly recommended for some HCWs. You may need the BCG vaccine if you are at risk of getting TB because of your work, for example, if you are a health worker who works with people with TB, you work in a laboratory where you may come into contact with TB bacteria, you work with animals that could be infected with TB (such as people who work at a vet or abattoir), you work with people who may be more at risk of TB such as some homeless people, asylum seekers, and refugees, people who misuse drugs, and people in prison

The BCG vaccine is recommended if you're staying for more than 3 months in a country where there is a higher risk of getting TB and either: you are aged 16 or under and you'll be staying with friends, family, or local people or you are over 16 years of age and you're a health worker who is likely to be in contact with people with TB [35].

Some specifications on Oral Cholera Vaccine in HCWs (OCV); in case of an outbreak and HCWs working in endemic areas [36].

The other vaccines are recommended routinely for all HCWs.

II.6 VACCINE HESITANCY: DEFINITION, MODELS AND DETERMINANTS

Vaccine Hesitancy

“Vaccine hesitancy refers to the delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context-specific, varying across time, place, and vaccines. It is influenced by factors such as complacency, convenience, and confidence.”[37]

Vaccine Hesitancy Models

Acceptance of vaccination is an outcome behaviour resulting from a complex decision-making process that can be potentially influenced by a wide range of factors. In developing the definition, the SAGE working group in 2012 reviewed several conceptual models for grouping vaccine hesitancy determinants. In the review, model complexity, global applicability, breadth of factors considered, and potential usefulness in informing the development of vaccine hesitancy indicators and survey questions for use at the global and country levels were all considered [37,38].

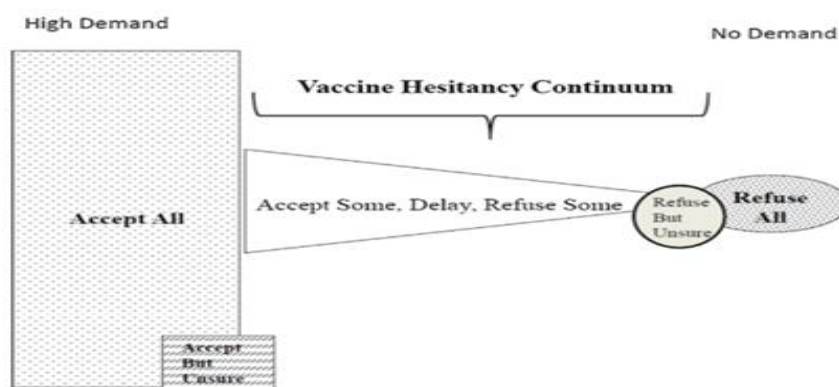


Figure 1: The continuum of vaccine hesitancy

The WG also assessed whether the model could facilitate understanding of the concept of vaccine hesitancy for those unfamiliar with the term. A review of these models confirmed the complexity of vaccine hesitancy and its determinants. The “3 Cs” model, first proposed to the WHO EURO Vaccine Communications Working Group in 2011, highlights three categories; complacency, convenience and confidence (Fig. 2). As this model was viewed as being the most readily understandable, the concepts were incorporated in the definition. In the “3 Cs” model, confidence is defined as trust in (i) the effectiveness and safety of vaccines; (ii) the system that delivers them, including the reliability and competence of the health services and health professionals, and (iii) the motivations of policy-makers who decide on the needed

vaccines. Vaccination complacency exists where perceived risks of vaccine-preventable diseases are low and vaccination is not deemed a necessary preventive action. Complacency about a particular vaccine or about vaccination in general is influenced by many factors, including other life/health responsibilities that may be seen to be more important then. Immunization program success may, paradoxically, result in complacency and ultimately, hesitancy, as individuals weigh the risks of vaccination with a particular vaccine against the risks of the disease the vaccine prevents that disease is no longer common. Self-efficacy (the self-perceived or real ability of an individual to take action to be vaccinated) also influences the degree to which complacency determines hesitancy. Vaccination convenience is a significant factor when physical availability, affordability and willingness-to-pay, geographical accessibility, ability to understand (language and health literacy), and appeal of immunization services affect uptake. The quality of the service (real and/or perceived) and the degree to which vaccination services are delivered at a time and place and in a cultural context that is convenient and comfortable also affect the decision to be vaccinated and could lead to vaccine hesitancy [37,38].

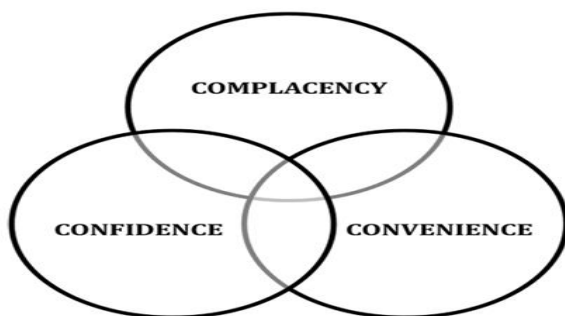


Figure 2: Three C model of vaccine hesitancy

Vaccine Hesitancy Determinants Matrix

After a review of models and much discussion about factors that can influence hesitancy, the WG developed the Vaccine Hesitancy Determinants Matrix with factors grouped in three categories: contextual, individual, and group and vaccine/vaccination-specific influences (Table 1). The Matrix includes determinants identified from research studies, experiences of WG members in the field, and discussions with experts working in the area. Neither the commissioned systematic review of determinants, nor the findings from the WG's Immunization Managers Survey on hesitancy uncovered new determinants that had not been included in the Matrix. Of note, unlike with the social determinants of health, vaccine hesitancy determinants like education and socio-economic status do not influence hesitancy in only one

Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in Yaoundé District Hospitals

direction. As shown in the commissioned systematic review, higher education may be associated with both lower and higher levels of vaccine acceptance. In contrast, as a social determinant of health, education drives in one direction – more education leads to better health outcomes [37,38] .

Table I: Vaccine hesitancy determinants matrix

Contextual influences Influences arising due to historic, socio-cultural, environmental, health system/institutional, economic or political factors	<ul style="list-style-type: none"> a. Communication and media environment b. Influential leaders, immunization programme gatekeepers and anti- or pro-vaccination lobbies c. Historical influences d. Religion/culture/gender/socio-economic e. Politics/policies f. Geographic barriers g. Perception of the pharmaceutical industry
Individual and group influences Influences arising from personal perception of the vaccine or influences of the social/peer environment	<ul style="list-style-type: none"> a. Personal, family and/or community members' experience with vaccination, including pain b. Beliefs, attitudes about health and prevention c. Knowledge/awareness d. Health system and providers – trust and personal experience e. Risk/benefit (perceived, heuristic) f. Immunization as a social norm vs. not needed/harmful
Vaccine/vaccination – specific issues Directly related to vaccine or vaccination	<ul style="list-style-type: none"> a. Risk/benefit (epidemiological and scientific evidence) b. Introduction of a new vaccine or new formulation or a new recommendation for an existing vaccine c. Mode of administration d. Design of vaccination programme/Mode of delivery (e.g., routine programme or mass vaccination campaign) e. Reliability and/or source of supply of vaccine and/or vaccination equipment f. Vaccination schedule g. Costs h. The strength of the recommendation and/or knowledge base and/or attitude of healthcare professionals

Source [37]

Table II: Cost of vaccines recommended for HCWs in Cameroon

Vaccine	Cost
Hepatitis B	8 000-11 000frs for 3 doses
COVID-19	Free
TUBERCULOSIS	8 000-10 000frs (2 nd dose)
TETANUS	2 000-10 000frs
CHOLERA	Free

Source [38]

CHAPTER III: METHODOLOGY

METHODOLOGY

III.1 STUDY DESIGN

This study was a cross-sectional and analytic study.

III.2 STUDY AREA AND METHODS

This study was hospital-based; and carried out in all the seven district hospitals in the city of Yaoundé. These hospitals included: Biyem-Assi District Hospital (DH), Cite-Vert DH, Djoungolo-Olembe DH, Efoulan DH, Mvog-Ada DH, Nkolndongo DH, and Odza DH. The study was conducted in the following clinical units in each District hospital; surgery, internal medicine, obstetrics & gynaecology, laboratory, paediatrics, emergency, outpatient department, and hygiene department.

The Cameroonian health system is organized around health districts. The District Hospital is the first level of reference in the health pyramid. It is responsible for providing primary health care [39]. The Yaoundé DHs; Biyem-Assi (created in 1989), Cite-Verte (created in 1986), Djoungolo-Olembe (created in 1992), Efoulan (created in 1992), Mvog-Ada (created in 2018), Nkolndongo (created in 2019) and Odza (created in 2021) cover a population of approximately 4 million residents, cumulate nearly 470 health personnel, 420 beds, provide 154 583 consultations and 19 592 admissions per annum [40,41].

STUDY DURATION AND PERIOD

The study was conducted from **November 2023 to July 2024**.

III.3 STUDY POPULATION AND SAMPLING

III.3.1 Target population

The target population was all healthcare workers in Cameroon.

III.3.2 Study population

The study population was all healthcare workers in all district hospitals in Yaoundé.

III.3.3 Inclusion criteria

All HCWs in the seven District Hospitals in Yaoundé, involved in healthcare activities who gave their written informed consent to participate in this study were included.

III.3.4 Non-inclusion criteria

All healthcare workers were absent during the study period, and those who refused to give informed consent.

III.3.5 Exclusion Criteria

All healthcare workers who returned incomplete questionnaires or withdrew their informed consent were excluded from the study.

III.3.6 Sample size

An exhaustive sampling method was used, in each unit of each District hospital, and all consenting HCWs were enrolled.

III.4 STUDY PROCEDURES

After the data collection questionnaire was pre-tested and validated, it was administered to HCWs who consented in the seven District hospitals in Yaoundé.

The same procedure was used to collect data for the three study objectives;

- The study's objectives were fully explained to study participants with the aid of the study information notice;
- The study participant read and signed the informed consent form;
- Study participants were given 10-15 minutes to complete the questionnaire.

III.5 DATA COLLECTION AND ANALYSIS

III.5.1 Data Collection

The questionnaire was pre-tested by random HCWs to ensure that all questions were valid and reliable and that any misunderstandings were addressed before final administration. the data collection tool consisted of 28 questions and was structured in four sections. It captured data related to socio-demographic characteristics, knowledge on vaccination, working environment, vaccination coverage, and compliance (see appendices 14 and 15).

III.5.2 Data Processing and Analysis

Data were cross-checked, entered, recoded as necessary, and analysed using R Statistics Version 4.3.3. The mean and standard deviation were used to describe continuous variables. Categorical variables were described using frequency (n) and percentage (%). Proportions were compared using the Chi-square test. Simple and multiple binary logistic regressions were used to assess the strength of the association between variables and adjust for potential confounders. The predictors that best fit the model were chosen step by step using the Akaike Information Criterion (AIC). The model with the lowest index was selected. A p-value <0.05

was considered statistically significant. Confidence intervals were estimated at a 95% level of confidence.

III.5.3 Variables

The dependent variable assessed the vaccination status of the HCW. Independent variables included sociodemographic characteristics (age, sex, unit, years of experience, and professional status), HCWs' practices related to vaccination, and compliance with vaccination. In the log-linear regression analysis, a participant was fully vaccinated upon receiving three doses of the hepatitis B vaccine and two doses for the other vaccines; COVID-19, Tuberculosis, Tetanus, and Cholera.

III.6 ETHICAL CONSIDERATIONS

III.6.1 Ethical and Administrative Approval

Ethical clearance for the study was obtained from the Institutional Review Board of the Faculty of Medicine and Biomedical Science of the University of Yaoundé I **No 1115/UY1/FMSB/VDRC/DAASR/CSD**. This was followed by ethical clearance from the Institutional Review Board of the Regional Delegation of Public Health for Centre Region **No 0244-3/CRERSHC/2024** (Appendix 1 and 2).

Individual District Hospital authorizations were obtained before data was collected from healthcare workers (Appendix 3-9).

III.6.2 Study information Notice and Informed consent

The study information notice was provided to the study participants: it summarized in simple, non-scientific terms the study goal and objectives, the samples/examinations to be carried out, any risks that could arise in the course of the work, the interest of the work for the participant's use;

The signed informed consent of the participant was collected, in which he or in which he/she certifies that he/she has received information about the research, and voluntarily agrees to participate. It specifies the non-binding nature of the study and its non-detrimental withdrawal. Contact details for the researcher and the supervisors were given in case of any complaints.

CHAPTER IV: RESULTS

RESULTS

IV.1 Study Participants

Out of 450 healthcare workers approached in the seven District Hospitals for this study, 406 were included, giving us a study participation rate of **90.2%**. The study participants' flow chart is shown below (Fig. 3).

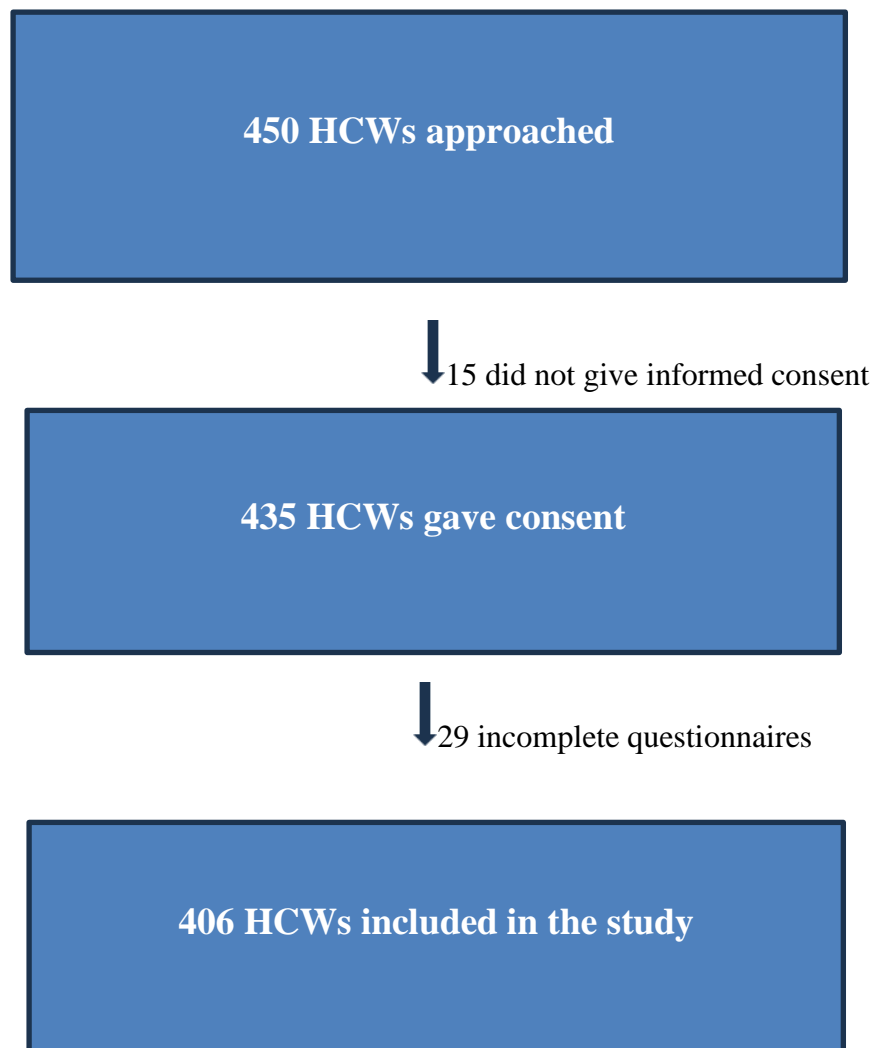


Figure 3: Study participants' flow diagram

IV.1.2 Study Participants per District Hospital

The 406 HCWs included in the study were distributed in the seven District hospitals in Yaoundé as follows (Fig. 4).

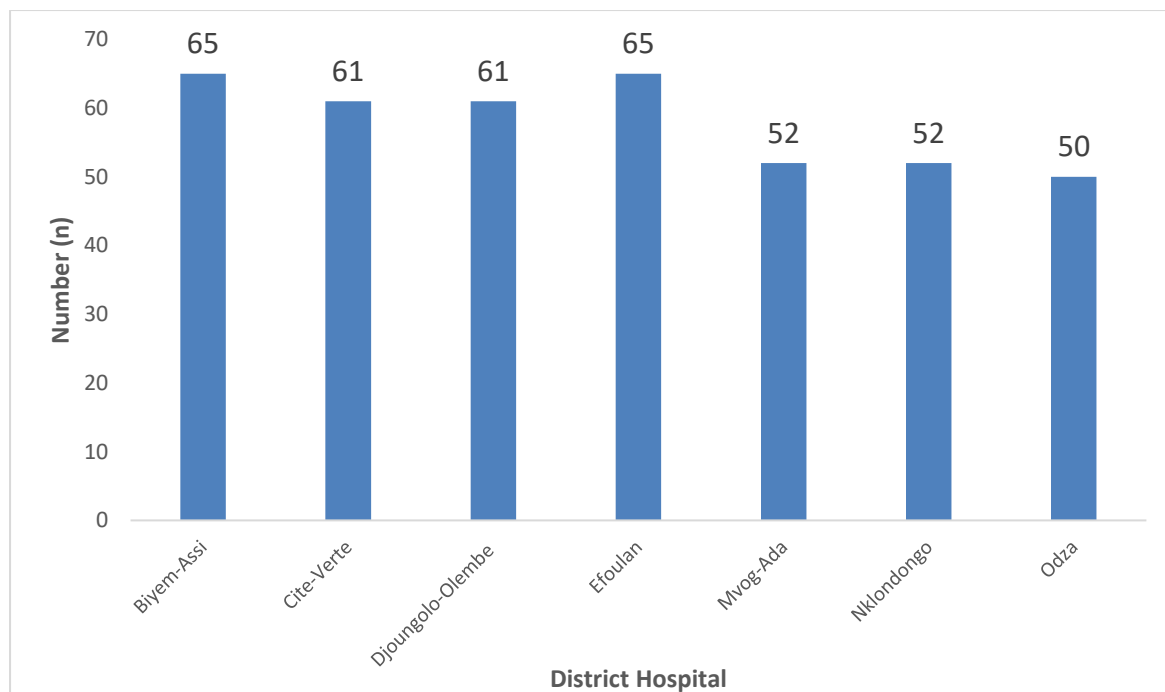


Figure 4: Distribution of study participants per District Hospital

IV.1.3 Socio-Professional Characteristics of the study participants

Most of our study participants were female (75.6%), and participants aged between 30-45 years were the most represented (65.5%). The study participants were mostly nurses (61.3%) and doctors (17.0%) (Table II).

Table III : Socio-professional characteristics of HCWs in Yaoundé District Hospitals, June 2024 (n=406)

Variable	Count (n)	Frequency (%)
Age Group		
19-30	55	13.5
30-45	266	65.5
45-55	74	18.2
55-66	11	2.7
Sex		
Female	307	75.6
Male	99	24.4
Level of Education		
Primary	3	0.7
Secondary	84	20.7
University	319	78.6
Grade		
Medical student	4	1.0
Nurse	249	61.3
Doctor	69	17.0
Administrative Staff	4	1.0
Hygiene Staff	14	3.4
Laboratory technician	54	13.3
Other technicians	12	3.0
Professional Experience in Years		
1-5	116	28.6
5-15	224	55.2
15-34	66	16.3
Hospital Service		
Dentistry	18	4.4
Laboratory	48	11.8
Internal Medicine	63	15.5
Paediatrics	40	9.9
Maternity and Gynaecology	54	13.3
Surgery	46	9.9
Outpatient (Vaccination)	30	7.4
Hygiene	15	3.7
Others (OPD consultation, emergency, etc)	92	22.7

IV.2 Vaccination Coverage

IV.2.1 Knowledge on mandatory, recommended, and optional vaccines for HCWs

Vaccines against Hepatitis B and tuberculosis were the most reported as mandatory and recommended vaccines for HCWs by HCWs, while vaccines against Hepatitis B and COVID-19 were top of the list for optional vaccines for HCWs (Fig. 5, 6 and 7).

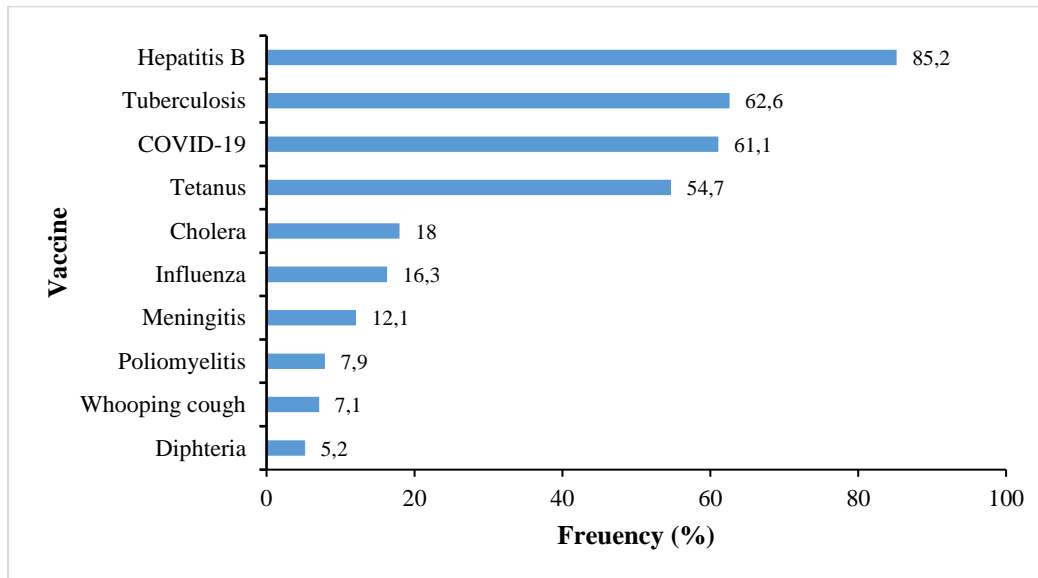


Figure 5: Mandatory vaccines for HCWs in Yaoundé DHs

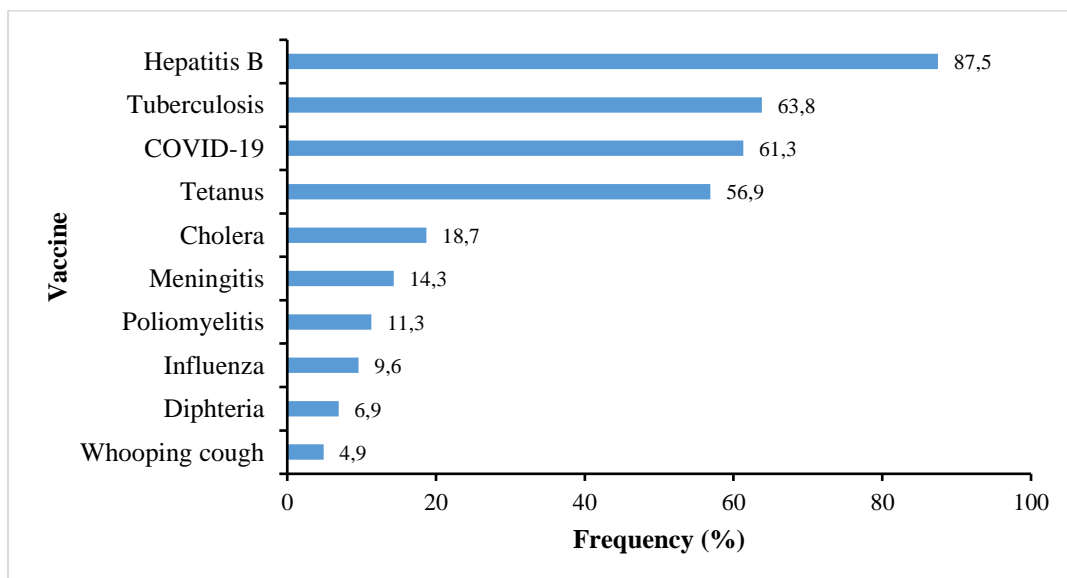


Figure 6: Recommended vaccines for HCWs in Yaoundé DHs

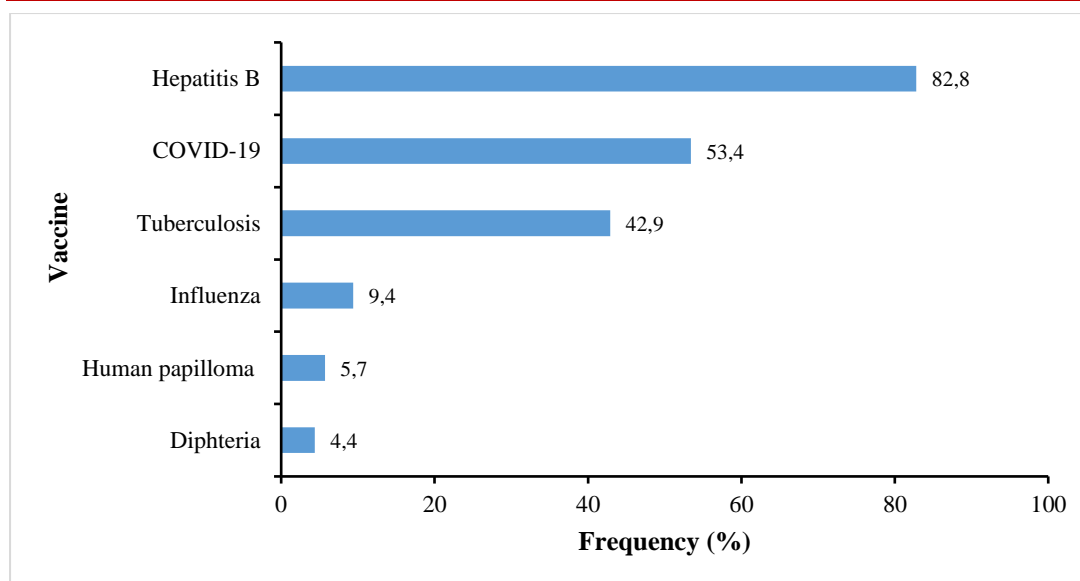


Figure 7: Optional vaccines for HCWs in Yaoundé DHs

IV.2.2 Source of information: Healthcare workers have as their main sources of information on vaccination; colleagues, information from their training, medical conferences, scientific journals, radio, and television (Fig. 8).

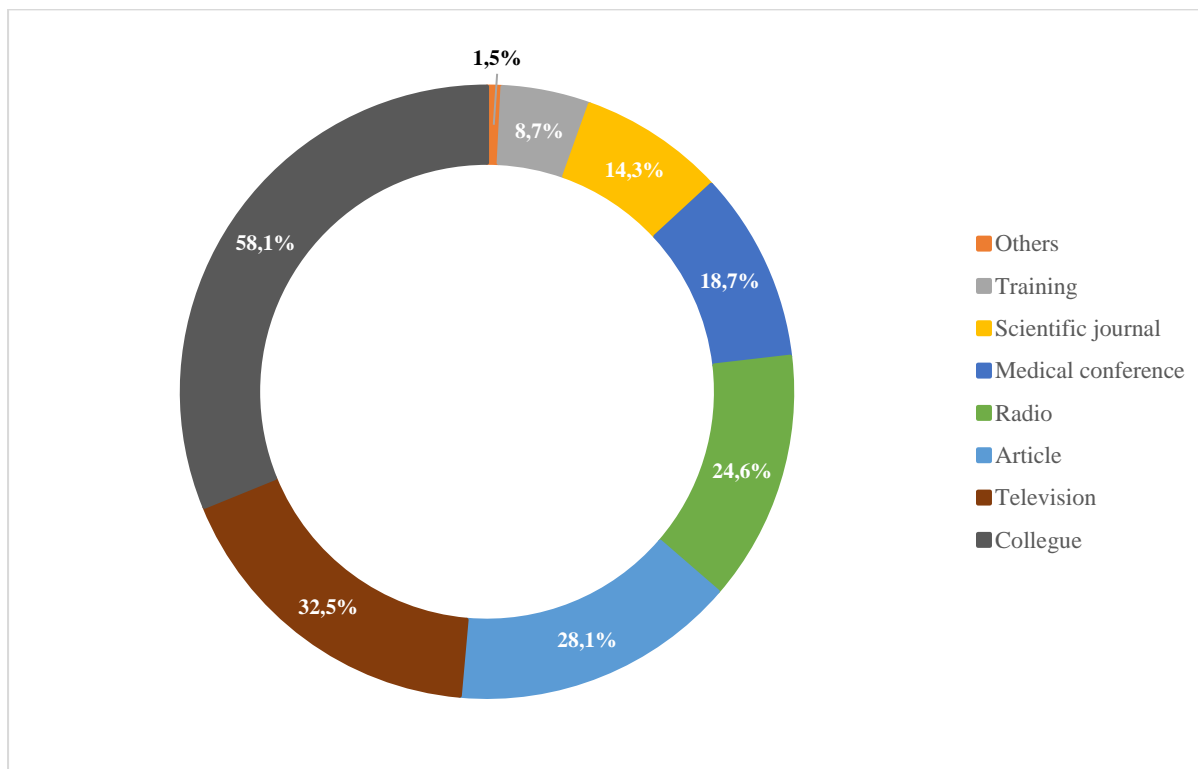


Figure 8: HCWs Sources of information on vaccination of HCWs in Yaoundé DHs

IV.2.3 Risk perception of the working environment

Most (62.8%) healthcare workers perceive that their work environments represent a high risk of infection (Fig. 9).

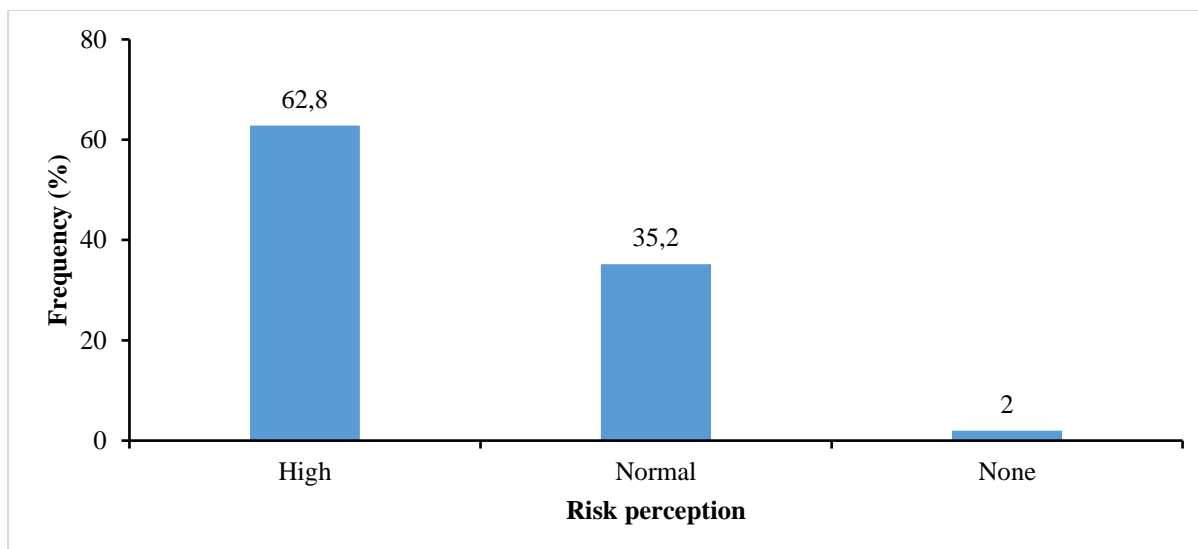


Figure 9: Risk perception of the working environment of HCWs in Yaoundé DHs

IV.2.4 Vaccination Coverage per Vaccine

Healthcare workers in District Hospitals in Yaoundé are most vaccinated against tetanus, COVID-19, and Hepatitis B (Table III).

Table IV: Vaccination coverage among HCWs in Yaoundé District Hospitals, June 2024 (n=406)

Vaccine	Complete	Incomplete	Unvaccinated
Hepatitis B	147 (36.2%)	84 (20.7%)	175 (43.1%)
COVID-19	172 (42.4%)	1 (0.2%)	233 (57.4 %)
TB	64 (15.8%)	340 (83.7%)	2 (0.5%)
Tetanus	217 (53.4%)	119 (29.3%)	70 (17.2%)
Cholera	19 (4.7%)	61 (15.0%)	326 (80.3%)

IV.3 Factors associated with compliance with vaccination

IV.3.1 Factors associated with Hepatitis B vaccination

The factors associated with compliance of HCWs for the Hepatitis B vaccine below are; professional work experience >5 years, being a nurse, and cost (Table IV).

Table V: Multivariate analysis of factors associated with compliance to Hepatitis B vaccination among HCWs in Yaoundé District Hospitals, June 2024 (n=406)

Determinants	aOR	95% CI limits		P value
		Lower	Upper	
Age group				
30-45	0.55	0.21	1.41	0.220
45-55	0.43	0.13	1.43	0.173
55-66	0.08	0.01	0.50	0.009
Sex				
Female	0.83	0.46	1.46	0.517
Professional work experience in years				
5-15	0.46	0.23	0.91	0.028*
15-34	0.48	0.17	1.34	0.016*
Service				
Dentistry	2.46	0.63	10.3	0.204
Laboratory	2.89	0.47	18.4	0.250
Internal Medicine	1.58	0.59	4.23	0.360
Gynecology	2.14	0.79	5.90	0.137
Pediatrics	2.22	0.78	6.46	0.137
Surgery	1.77	0.62	5.11	0.289
Other Services	3.45	1.31	9.22	0.013
Grade				
Medical Students	3.55	0.35	81.0	0.316
Nurses	8.38	4.27	17.2	0.001*
Laboratory Technician	3.05	0.57	16.8	0.186
Other staff	3.99	0.43	89.0	0.264
Vaccine Cost	0.42	0.23	0.74	0.004*

aOR = Adjusted Odds Ratio, CI= Confidence Interval, *= *p-value* <0.05

IV.3.2 Factors associated with COVID-19 vaccination

The factors associated with the compliance of HCWs to the COVID-19 vaccine are; professional work experience of more than 5 years, being a nurse, and cost (Table V).

Table VI: Multivariate analysis of factors associated with compliance to COVID-19 vaccination among HCWs in Yaoundé District Hospitals, June 2024 (n=406)

Determinants	aOR	95% CI limits		P value
		Lower	Upper	
Age group				
30-45	0.57	0.23	1.40	0.225
45-55	0.40	0.12	1.24	0.113
55--66	0.54	0.10	3.11	0.490
Sex				
Female	1.40	0.82	2.40	0.215
Professional work experience in years				
5-15	0.41	0.20	0.79	0.010*
15-34	0.35	0.13	0.95	0.040*
Service				
Dentistry	2.30	0.59	9.48	0.234
Laboratory	0.59	0.06	3.92	0.604
Internal Medicine	0.82	0.30	2.17	0.693
Gynecology	1.63	0.59	4.48	0.343
Pediatrics	1.31	0.46	3.70	0.609
Surgery	0.76	0.27	2.14	0.608
Other Services	1.36	0.52	3.49	0.519
Grade				
Medical Students	2.06	0.21	45.9	0.561
Nurses	3.96	2.07	7.81	0.001*
Laboratory Technician	8.00	1.38	69.8	0.032
Other staff	3.99	0.43	89.0	0.264
Vaccine Cost	2.35	1.41	3.96	0.001*

aOR = Adjusted Odds Ratio, CI= Confidence Interval, *= *p-value* <0.05

IV.3.3 Factors associated with TB vaccination

The factors associated with compliance of HCWs to the TB vaccine below are; age greater than 55 years, professional work experience of more than 15 years, and working in the internal medicine ward (Table VI).

Table VII: Multivariate analysis of factors associated with compliance to TB vaccination among HCWs in Yaoundé District Hospitals, June 2024 (n=406)

Determinants	aOR	95% CI limits		P value
		Lower	Upper	
Age group				
30-45	0.17	0.01	1.13	0.118
45-55	0.21	0.01	1.70	0.199
55-66	0.06	0.00	0.68	0.038*
Sex				
Female	0.85	0.40	1.73	0.667
Professional work experience in years				
5-15	0.49	0.16	1.27	0.172
15-34	0.21	0.05	0.73	0.018*
Service				
Dentistry	5.63	1.06	45.1	0.061
Laboratory	0.57	0.02	7.87	0.707
Internal Medicine	5.44	1.59	19.9	0.008*
Gynecology	4.49	1.35	16.0	0.016*
Pediatrics	3.45	1.02	12.5	0.050
Surgery	2.68	0.80	9.38	0.114
Other Services	7.75	2.37	26.9	0.001*
Grade				
Doctors	1.52	0.06	19.0	0.756
Nurses	4.44	0.18	52.8	0.258
Laboratory Technician	13.2	0.26	782	0.184
Other staff	1.74	0.06	31.7	0.709
Vaccine Cost	1.63	0.82	3.19	0.159

aOR = Adjusted Odds Ratio, CI= Confidence Interval, *= *p-value* <0.05

IV.3.4 Factors associated with Tetanus vaccination

The factors associated with compliance of HCWs to the Tetanus vaccine are; age 45-55 years, female gender, and professional work experience of more than 5 years (Table VII).

Table VIII: Multivariate analysis of factors associated with compliance to Tetanus vaccination among HCWs in Yaoundé District Hospitals, June 2024 (n=406)

Determinants	aOR	95% CI limits		P value
		Lower	Upper	
Age group				
30-45	0.23	0.07	0.67	0.011
45-55	0.07	0.02	0.28	<0.001*
55--66	0.04	0.00	0.41	0.015
Sex				
Female	0.53	0.29	0.93	0.030*
Professional work experience in years				
5-15	0.19	0.09	0.37	<0.001*
15-34	0.18	0.06	0.51	0.002*
Service				
Dentistry	2.29	0.53	10.4	0.270
Laboratory	1.85	0.28	15.0	0.540
Internal Medicine	1.21	0.40	3.82	0.739
Gynecology	1.27	0.42	4.00	0.670
Pediatrics	1.50	0.47	4.96	0.497
Surgery	0.74	0.23	2.48	0.626
Other Services	1.33	0.46	4.04	0.602
Grade				
Doctors	0.82	0.15	5.44	0.826
Nurses	1.59	0.32	9.85	0.588
Other technicians	1.52	0.19	13.7	0.694
Other staff	2.03	0.10	37.3	0.629
Vaccine Cost	1.51	0.85	2.73	0.164

aOR = Adjusted Odds Ratio, CI= Confidence Interval, *= *p-value* <0.05

IV.3.5 Factors associated with Cholera vaccination

The factors associated with compliance of HCWs to the Cholera vaccine are; professional work experience of 5-15 years, being a nurse, working in the internal medicine ward, and cost (Table VIII).

Table IX: Multivariate analysis of factors associated with compliance to Cholera vaccination among HCWs in Yaoundé District Hospitals, June 2024 (n=406)

Determinants	aOR	95% CI limits		P value
		Lower	Upper	
Age group				
30-45	0.74	0.11	5.04	0.762
45-55	0.20	0.02	2.13	0.181
Sex				
Female	1.85	0.50	6.86	0.360
Professional work experience in years				
5-15	2.77	0.58	13.2	0.028*
15-34	1.52	0.21	10.8	0.678
Service				
Dentistry	2.97	0.25	34.9	0.386
Laboratory	1.89	0.01	495	0.823
Internal Medicine	11.2	1.04	120	0.046*
Gynecology	2.40	0.42	13.6	0.321
Surgery	2.85	0.45	18.0	0.267
Other Services	4.06	0.77	21.3	0.098
Grade				
Doctors	2.49	0.15	40.5	0.522
Nurses	1.54	0.14	17.5	0.001*
Laboratory Technician	4.81	0.01	1.72	0.600
Vaccine Cost	3.23	1.08	9.65	0.036*

aOR = Adjusted Odds Ratio, CI= Confidence Interval, *= *p-value* <0.05

IV.4 Constraints to vaccination among HCWs

IV.4.1 Main reasons for non-vaccination per vaccine

The main reasons given by HCWs for not being vaccinated against **Hepatitis B** were; high cost (63.2%), fear of side effects (18.8%), and doubts about the real need for the vaccine (11.7%) (Fig. 10).

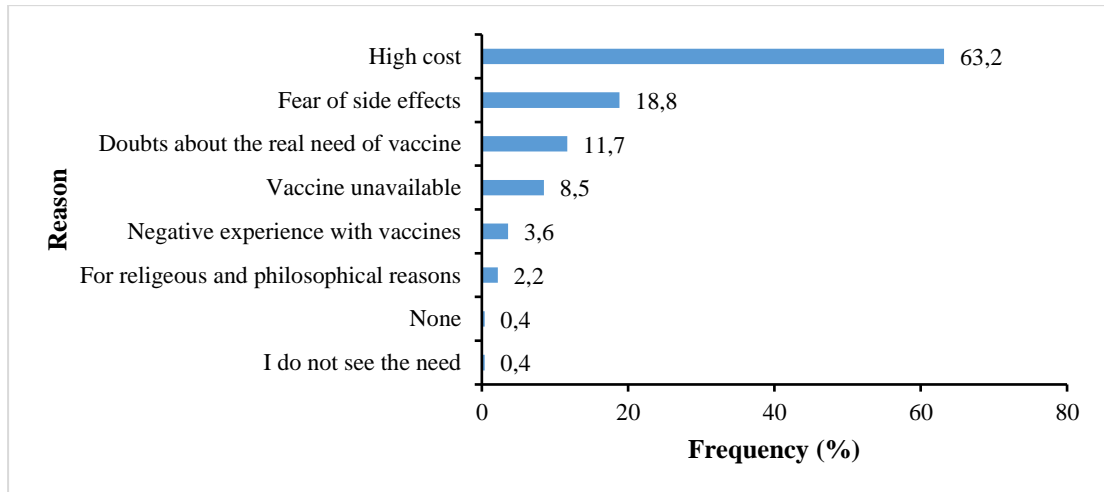


Figure 10: Reasons for Hepatitis B non-vaccination in HCWs in Yaoundé DHs

The main reasons given by HCWs for not being vaccinated against **COVID-19** were; fear of side effects (63.4%), doubts about the real need for the vaccine (11.7%), and religious reasons (8.4 %) (Fig. 11).

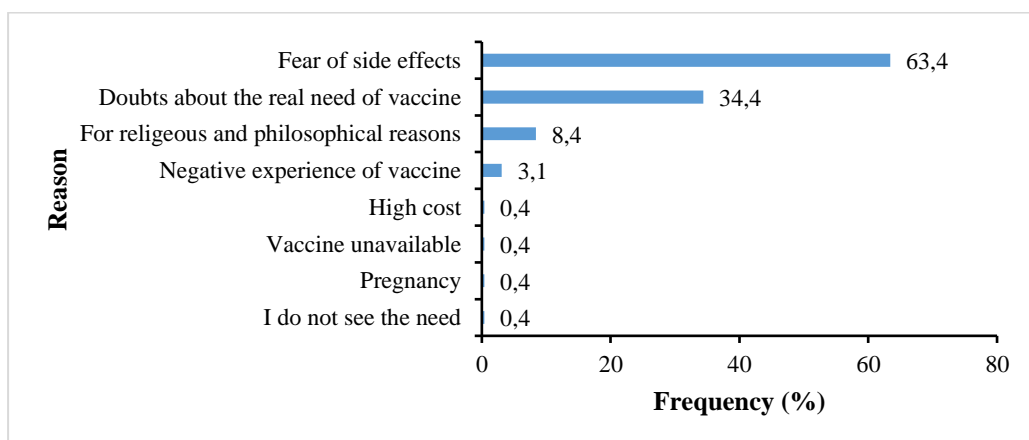


Figure 11: Reasons for COVID-19 non-vaccination in HCWs in Yaoundé DHs

Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in Yaoundé District Hospitals

The main reasons given by HCWs for not being vaccinated against **TB** were; doubts about the real need for the vaccine (79.8%), fear of side effects (10.5%), and vaccine unavailability (7.1 %) (Fig. 12).

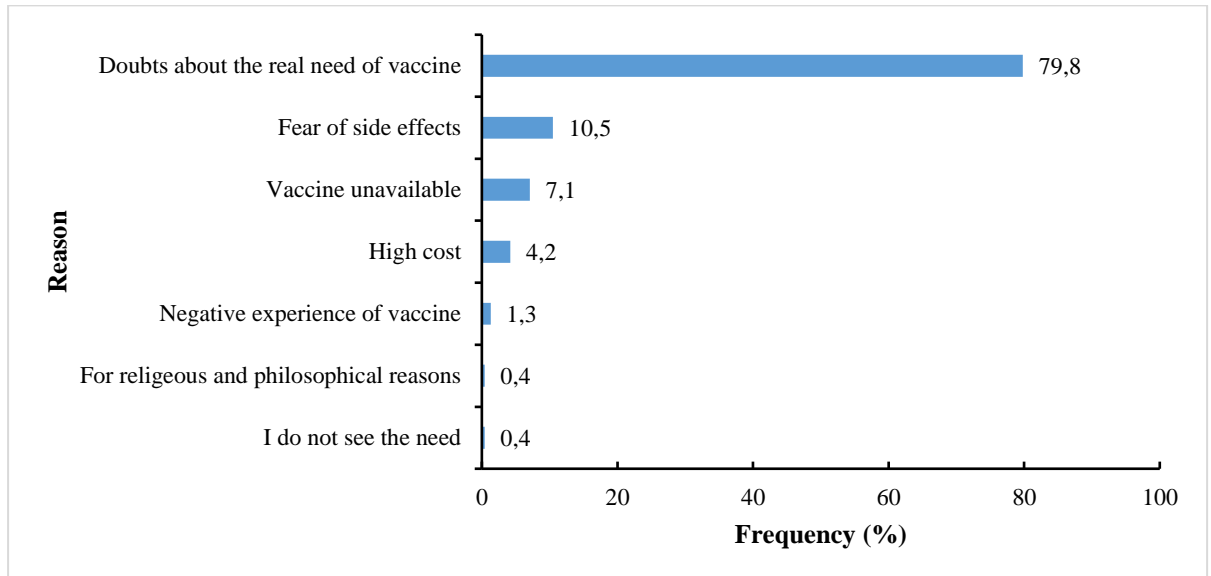


Figure 12: Reasons for TB non-vaccination in HCWs in Yaoundé DHs

The main reasons given by HCWs for not being vaccinated against **Tetanus** were; high cost (34.6%), fear of side effects (33.3%), and doubts about the real need for the vaccine (23.1%), (Fig. 13).

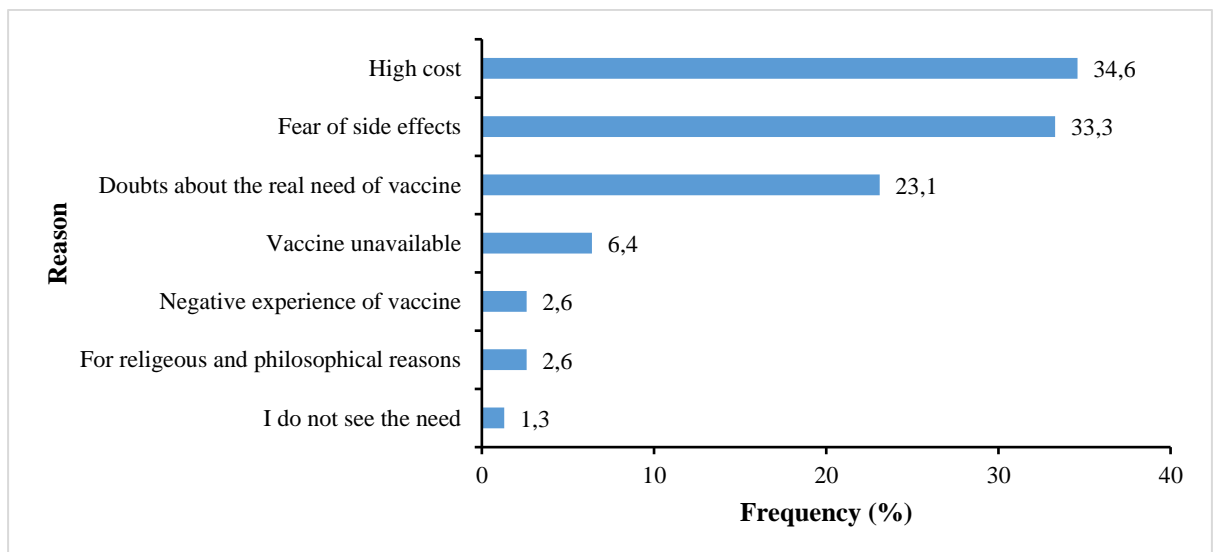


Figure 13: Reasons for Tetanus non-vaccination in HCWs in Yaoundé DHs

Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in Yaoundé District Hospitals

The main reasons given by HCWs for not being vaccinated against **Cholera** were; vaccine unavailability (72.5%), doubts about the real need for the vaccine (24.4%), and fear of side effects (8.2%) (Fig. 14).

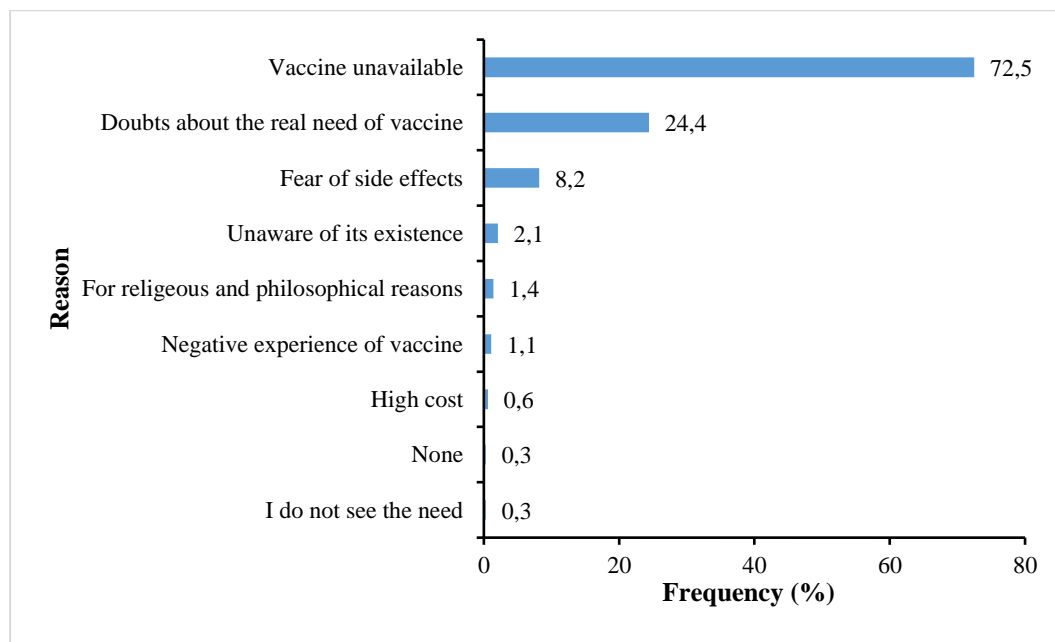


Figure 14: Reasons for Cholera non-vaccination in HCWs in Yaoundé DHs

IV.4.2 Main Adverse effects reported per vaccine

Fever and headache were the most reported side effects of Hepatitis B and COVID-19 vaccines. In contrast, a large sore at the vaccination site and fever were the most reported adverse effects of the TB and tetanus vaccines. Diarrhoea, fever, and headache were the most reported adverse effects for the Cholera vaccine. (Fig. 15)

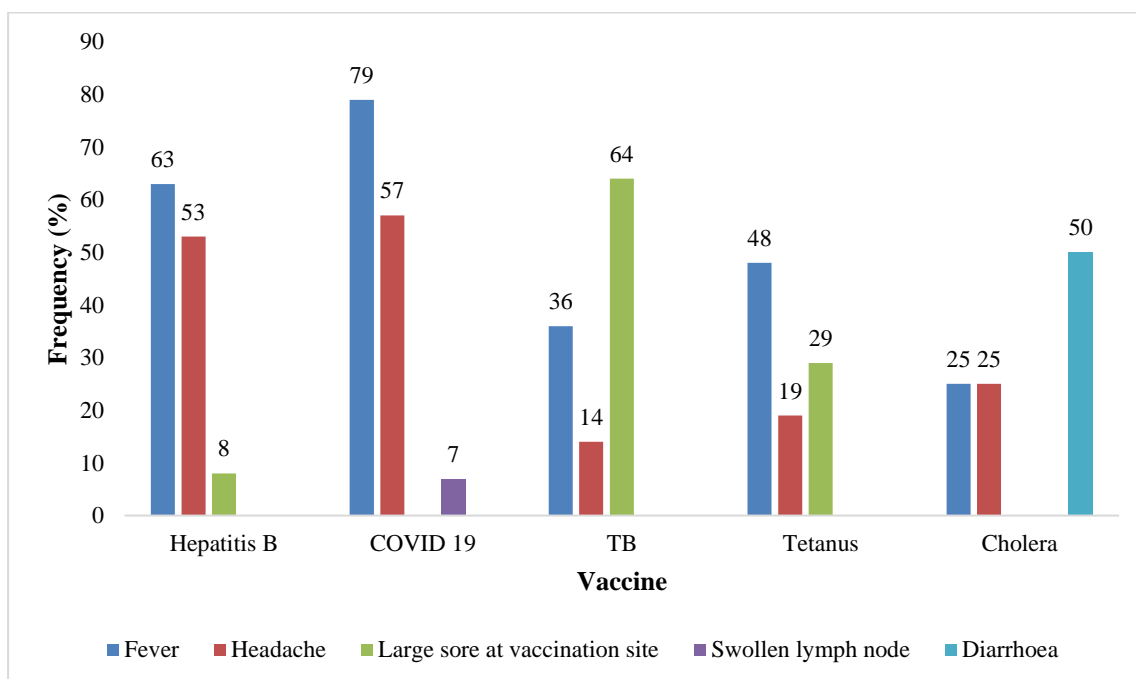


Figure 15: Main adverse effects reported per Vaccine in in HCWs in Yaoundé DHs

CHAPTER V: DISCUSSION

DISCUSSION

Given the burden of infection control in Cameroonian health facilities and the high occurrence of accidental exposure such as needle stick injuries, there is a need to assess the determinants of compliance to vaccination among HCWs to enhance better practice and develop more specific health policies. This study had as its main aim to identify determinants of compliance to vaccination among healthcare workers in Yaoundé. More specifically; to determine the vaccination coverage rates of Hepatitis B, COVID-19, BCG, tetanus and cholera vaccines, identify the socio-professional determinants associated with compliance to vaccination and to identify major reasons for non-vaccination for each vaccine and major side effects. The main limitation of our study was the study design, which could not permit us to infer causality. We solely presented the results of what already existed and were not able to directly give the reasons or causes of compliance of HCWs to vaccination as a means of infection control. Secondly, our study was carried out in district hospitals in the city of Yaoundé. Healthcare workers in Yaoundé tend to have access to more vaccination centres than those in rural areas or cities further away from Yaoundé.

Study population profile

Our study population was mostly aged between 30 and 45 years (65.5 %), three-quarters of the study population were females (75.6 %) and more than half of the study population were nurses. The majority of our study population had a university education (78.6 %), and more than half of our study population were nurses (61.3 %) followed by medical doctors (17 %). A little more than half (55.2 %) of our study population had between 5 to 15 years of professional work experience. The HCWs included in this study were mostly from the internal medicine (15.5 %) service and outpatient departments (22.7 %). Our study's population profile is similar to that of studies done on HCWs in Yaoundé and Bertoua [42–44]

V.1 Vaccination coverage

Hepatitis B

Our study reported a 36.2 % hepatitis B vaccination coverage among HCWs in Yaoundé, this implies that more than half of HCWs are exposed to hepatitis B infection and are not protected in case of an accidental exposure to body fluids or a needlestick injury. This result is similar to 34 % VC for Hepatitis B reported by another study done in Yaoundé [44]. Our results are above the vaccination coverage of 11.4 % reported in a nationwide study done in Cameroon in 2018 [11], this could be explained by the fact that our study was done in the capital city where most HCWs have more access to the vaccine and can afford it and the fact that it was done 4-6 years later. Other countries in Africa like South Africa report a 49.0 % hepatitis B vaccination coverage rate among healthcare workers [45]. A systematic review done on hepatitis B vaccination coverage in Africa reports the hepatitis B vaccination coverage to be 24.7 % in Africa, and 13.4 % in central Africa [46] , these numbers are lower than ours probably because the systematic review covered many more cities and countries than our study. This implies that hepatitis B vaccination coverage among HCWs in Africa is less than 50 % indicating that more still needs to be done in Cameroon and Africa to make vaccines available and raise awareness to HCWs on the importance of being immunized against hepatitis B. A study done in China reports a hepatitis B VC of 60 % among HCWs [47], while another study done in Bangladesh reports 66.6% hepatitis B VC [48]. Hepatitis B VC among HCWs in Europe particularly Italy is reported to be 77.3 % by a study done in 2019 [49]. These results demonstrate that VC among HCWs in Bangladesh, China, and Europe are significantly higher than those reported in our study and Africa but they are not yet at 100 % VC.

COVID-19

Our study reports a COVID-19 VC OF 42.4 % among HCWs in Yaoundé, this is close to that reported in a similar study done in fewer hospitals in the same city of Yaoundé in 2022 which reported a COVID-19 VC Of 44.8 % [43]. The Expanded Program of Immunization (EPI) in Cameroon reported a national COVID-19 VC coverage among HCWs nationwide to be 49.9 % in January 2024[50]. All three COVID-19 VCs are close to each other and concur that it is less than 50 %, less than half of HCWs are fully immunized against SARS-COV-2. More still needs to be done to increase VC in HCWs in Cameroon, in case there is another outbreak of COVID-19. Other countries in Africa report COVID-19 VC among HCWs of 37.4 % in Somalia [51] , 65 % in Guinea [52] and 70.5 % in Tanzania in 2022 [53]. The COVID-19 VC is lower in Somalia than in Cameroon probably due to the lower economic status of the country

which may impact vaccine accessibility and information provided on the vaccine by health authorities to HCWs. The COVID-19 VCs in Guinea and Tanzania were higher than those in Cameroon, this could be explained by the fact that they are more developed than Cameroon and there could have been more access to the vaccines, also there may not have been as much negative propaganda on the vaccine as much as there was in Cameroon. In general COVID-19 VC among HCWs in Africa is lower than in other continents [54].

In Europe, the COVID-19 VC rate among HCWs is reported to be 95 % in 2024 [55], with Finland having the highest coverage rate at 97.1 % in 2024 [56]. This shows that the COVID-19 VC in Europe is almost at 100 % and twice that of Cameroon. This could be explained by the fact that the impact of COVID-19 in Europe was more than in Cameroon and Africa, with many more HCWs dying there, in addition to this there was less reported vaccine hesitancy in Europe compared to Africa and Cameroon in particular.

TB

The TB CV among HCWs in Yaoundé in our study was at 15.8 %, this vaccination specifically refers to the TB vaccine received as an adult, a minimum of 10 years after the first. It should be noted that taking this vaccine as an adult is largely disputed in the scientific communities, some schools of thought say that the BCG vaccine received at birth provides sufficient immunity for a lifetime. The WHO recommendations states that the 2nd and 3rd vaccines should be taken by HCWs working in TB wards or in very high TB endemic areas. One of the limitations of our study is that it calculated the TB VC in all HCWs approached in the study hospitals and not just in those working in TB units or internal medicine units which could explain the low TB VC rate found in the study. We could not find other studies in the literature done in Cameroon that reported TB VC among HCWs. A study in Ethiopia reported 65.5 % TB vaccination coverage among HCWs [57], this is significantly higher than ours, this may be because this study was carried out among HCWs in the medical and TB wards, it was much more specific than our study. On the other hand, TB VC among HCWs was reported to be 24.5 % in one study done in Italy in 2019 [49] and another study reported it to be at 32 % in 2021 in the same country [58], these TB VC rates are not as high as those found in Ethiopia but are higher than those we found. This could be explained by the fact that the study was targeted at HCWs working with TB patients or those who felt here were exposed to TB. A multi-country study done in Australia, Brazil, and Spain reported that 49.3% of TB VC received one dose of TB [59], this study was also carried out specifically in HCWs working in medical and TB units in hospitals explaining the higher VC than that reported in our study. As mentioned above,

there is a lot of controversy around the second vaccine of TB as the first vaccine is said to provide full immunization for TB, and the second and third TB vaccines are recommended only for HCWs working in TB units and traveling to high Tb endemic areas [60]

Tetanus

Our study reported a 53.4 % VC rate for the tetanus vaccine received as adults, this was the highest VC rate reported in our study out of all the recommended vaccines studied. Very few studies have been carried out on this in Cameroon, and the few found reported on tetanus VC among pregnant women in Cameroon [61] and the study in the western region reported 65 % of 5 doses of VC in pregnant women [62]. Studies carried out in Ethiopia reported on age-specific tetanus vaccination coverage [63], another study in the same country reported 41.9 % tetanus VC [64]. Other similar studies done in Somalia report 44 % 2 doses and 10 % 3 doses vaccination coverage for tetanus vaccine among HCWs [65]. The tetanus vaccination coverage rates in Ethiopia and Somalia are lower than those reported in our study, this may be explained by the fact that vaccine accessibility in these countries and the fact that HCWs there may not see the need for the vaccine less than those in Cameroon. Studies done in Europe, particularly in Italy report a tetanus vaccination coverage among HCWs of 76.8 % in one study [49], and 75.5 % in another study [66]. Studies done in Turkey report a tetanus vaccination coverage rate of 78.5 % among HCWs [67,68] and also report the fact that healthcare workers influence tetanus coverage in children and patients but are not as willing to take the vaccine themselves [69]. Tetanus vaccination coverage rates in HCWs in Europe are higher than those reported in our study, this could be explained by the fact that they are more accessible and affordable to HCWs there, and more communication is done on the importance of this vaccine and other recommended vaccines for HCWs.

Cholera

Our study reports a cholera VC in HCWs of 4.7 %. This is extremely low, and it was the lowest VC rate reported in our study among all the recommended vaccines studied. The particularity of the oral cholera vaccine is that it is given only during cholera outbreaks and to those in hotspot areas and surrounding areas and this is applied in Cameroon [36]. Our study was done in all the district hospitals in Cameroon and not only in District hospitals that had hospitalized patients with cholera before, this could explain the extremely low cholera VC rate we found. Another reason is that Cholera is mostly known to be more prevalent in overpopulated areas and due to poor sanitation conditions, many HCWs reported not even knowing it existed and

others reported not seeing the use of the vaccine. Two studies done in Cameroon have shown that Cholera vaccination campaigns done post-cholera outbreaks report a 67 % refusal of the oral vaccine in adults above 20 years[70], the other study reported that the VC of OCV among HCWs during Cholera vaccine campaigns was low [71]. This explains our results, HCWs may not see the need to take this vaccine, also this vaccine is only accessible during campaigns post-cholera outbreaks and only in the areas where there was the outbreak. In Ethiopia, more than 80% of the population has received 2 doses of the Cholera oral vaccine [72] and in Sierra Leone, 56 % of their rural population and 57 % of their urban population have received the two doses of the oral cholera vaccine[73]. The Cholera VC rates in these two countries are significantly higher than ours because there have been more cholera outbreaks and more post-outbreak campaigns than in Cameroon and this vaccine is more accessible in those countries.

V.2 Factors associated with compliance with vaccination

Hepatitis B

Our study found that the determinants that were significantly associated with compliance with Hepatitis B vaccination were; having a professional working experience of more than 5 years, being a nurse, and the cost of the vaccine. These results could be explained by the fact that HCWs with more professional experience are more experienced therefore more protected from some level of vaccination hesitancy. The majority of our study participants were nurses (65.5%), which could explain the fact that nurses were more compliant to hepatitis B vaccination than other healthcare professional groups, nurses also tend to be the healthcare professional grade more exposed to accidental exposures to blood and body fluids like needlestick injuries. Lastly, the cost of the vaccine or source of vaccine funding was a determinant of compliance, the hepatitis B vaccine is costly and this was the most reported reason for non-vaccination with the hepatitis B vaccine by HCWs. This contradictory result could be explained by the structure of the data collecting tool; all the HCWs who have received the hepatitis B vaccine paid for it, and those who didn't receive this vaccine skipped the question on cost and immediately answered the question on reasons for non-vaccination. Other studies reported, access to the hepatitis B vaccine [74] as determinant to compliance, the high cost of the hepatitis B vaccine is a determinant of non-compliance [75,76], the HCW's professional grade and years of increased professional working experience as a determinant of compliance [77,78]. Finally, a study reported that the vaccination rate for hepatitis B was lower in medical students, implying that being a medical student was a determinant of non-compliance to hepatitis B vaccination in HCWs [79]. Our results are similar to the studies who reported professional-grade and increased working experience as the determinants of compliance to hepatitis B vaccination by HCWs.

COVID-19

Our results found that professional working experience of more than 5 years, being a nurse, and the cost/ source of vaccination funding were significantly associated with compliance with the COVID-19 vaccine in HCWs in Yaoundé. Because the COVID-19 vaccine was free for HCWs and even for the rest general population, it increased compliance with vaccination as cost or funding was not an issue. Healthcare workers with more than 5 years of medical professional working experience were protected from vaccination hesitancy to the COVID-19 vaccine, this could be explained by the fact that having more experience made them less hesitant about the vaccine. Being a nurse was found to be a determinant of compliance with

the COVID-19 vaccine in HCWs, this could be explained by the fact that a higher level of education reduces vaccine hesitancy in addition to the fact that the majority of our study participants were nurses. Our findings were similar to those that reported the level of education and working experience as determinants of compliance with COVID-19 vaccination in HCWs [80]. Other determinants of compliance to COVID-19 vaccination in HCWs found in the literature were; HCWs trust the manufacturing company, easy access to the vaccine [81], clear information about the vaccine [82], if the vaccine provided was recommended [83], and being a front line COVID-19 HCWs [84].

Tuberculosis

The determinants associated with compliance to vaccination for the tuberculosis vaccine in HCWs found in our study were; being more than 55 years of age, having a professional working experience of more than 15 years, working in the internal medicine ward and other services like outpatient and vaccination department. Healthcare workers working in internal medicine wards and outpatient departments are those who are involved in the management of TB patients, hence they feel more exposed to TB and are more compliant with the vaccine. This is per the guidelines and directives given for this vaccine, the doses given in adulthood are mostly for HCWs working in TB units or traveling to areas with very high TB prevalence. Being above 55 years of age and having more than 15 years of professional working experience in the medical field was also a determinant of compliance of HCWs to the TB vaccine, this could be explained by the fact that being older and having more work experience increases your chances of being exposed to TB patients hence taking the vaccine and also decreases vaccine hesitancy in general. Our results were similar to those reported in a study that found exposure to TB patients as the main determinant of compliance of HCWs to vaccination, all the determinants found in our study were linked to exposure to TB patients [85]. We did not find other studies that worked on TB vaccination among HCWs, to enhance further discussion, comparison, and appraisal of ours.

Tetanus

The determinants associated with compliance to vaccination for the tetanus vaccine in HCWs found in our study were; the age group of 45-55 years of age, being a female, and having a professional working experience of more than 5 years. Our findings could be explained by the fact that females take the tetanus vaccine during pregnancy therefore female HCWs were more compliant with the tetanus vaccine. Being more experienced in the medical profession is a

determinant of compliance with all the vaccines studied in our study by HCWs, this could be explained by the fact that being more experienced decreases vaccine hesitancy in HCWs. Lastly, the age group of 45-55 years was shown to be a determinant of compliance to vaccination by HCWs in our study, this could be explained by the fact that this age group comes with some level of maturity and less vaccine hesitancy. Our findings were similar to those of a study that reported professional experience of more than 5 years being a determinant to compliance to tetanus vaccination in HCWs [65]. There were not many studies published on tetanus vaccination in HCWs to allow for more comparison, appraisal, and discussion.

Cholera

The determinants associated with compliance to vaccination for the cholera vaccine in HCWs found in our study were; having a professional working experience of 5-15 years, being a nurse, working in the internal medicine ward, and the cost of the vaccine. This could be explained by the fact that cholera patients are hospitalized in internal medicine wards, therefore HCWs working in these wards would be more compliant to taking the vaccine and will also be the first people to whom the vaccine is proposed during post-cholera outbreak campaigns. Most HCWs received the oral cholera vaccine during campaigns and this vaccine is free during campaigns, this explains the fact that the cost that is the fact that the vaccine is free was a determinant of compliance. Our findings are similar to this study's reported exposure to patients with cholera as a determinant of compliance to the cholera vaccine by HCWs, we equally found that HCWs who were exposed to Cholera patients were the ones who were more compliant to take the vaccine [86]. Unfortunately, we found just one study that reported on cholera vaccination among HCWs.

V.3 Constraints to Vaccination among HCWs

Hepatitis B

The main reasons for non-vaccination for the Hepatitis B vaccine among HCWs found in our study were; high cost, fear of side effects, and concerns about the efficacy of the vaccine. This was similar to another study done among HCWs in Yaoundé that reported the main reasons for non-vaccination of hepatitis B among HCWs; high cost, no time to go take the vaccine, and fear of side effects [44]. This result is similar to ours and implies that healthcare institutions and the state need to work on providing more subsidies for the hepatitis B vaccine. A study done in Nigeria reported a lack of opportunity and high cost as the main reasons for non-vaccination of hepatitis B vaccine among HCWs [75]. A systematic review done in many African countries including Cameroon reported the high cost of hepatitis B vaccine as the main reason for non-vaccination, this high cost was reported more in countries in West Africa than those in East Africa [76]. These results from Nigeria and Africa are similar to our results reinforcing the need for Africa particularly West Africa Health authorities to work on subsidizing the cost of Hepatitis B for HCWs.

COVID-19

The main reasons for COVID-19 non-vaccination among HCWs found in our study were concerns about the efficacy of the vaccine, fear of side effects, and religious and personal reasons. This is similar to the results found in a similar study done in Yaoundé that reports the same reasons for non-vaccination of the COVID-19 vaccine in HCWs [43]. Another study done in Africa reported, doubts about the efficacy of the vaccine, immunity may not be long lasting, HCWs preferred naturally acquired immunity to vaccine acquired immunity [87] as main reasons for non-vaccination among HCWs. A study done in Italy reported, that the main reasons for the non-vaccination of HCWs; are concerns about the safety and the efficacy of the vaccine, feeling personal rights are being infringed upon[88]. Another study reported distrust of the healthcare institutions providing the vaccine [89], vaccine safety and efficacy[90] as reasons for non-vaccination. Another study reported reasons for vaccination; to protect self, family, friends, and patients, on the other hand, reasons for non-vaccination concerns about safety and side effects [91], and reasons for non-vaccination were; vaccine novelty, insufficient time for decision-making [92]. All the above results are similar to ours and communicate a general fear and vaccine hesitancy by HCWs worldwide for the COVID-19 vaccine. This is explained by the determinants of the vaccination matrix [37] and the fact that COVID-19 was a relatively new disease for everyone and the rapidity at which the vaccine was provided was

a scare to many. More needs to be done to communicate on the efficacy and importance of the vaccine particularly to HCWs in Cameroon.

TB

The main reasons for TB non-vaccination among HCWs found in our study were; doubts about the need for the vaccine, and fear of side effects. The main reasons for non-vaccination of HCWs reported in two studies done in Africa was the fact that the HCWs were not working in areas of high prevalence of TB and did not see the need to be vaccinated [93,94]. This is similar to our result, the first reason was doubt of the need, many HCWs do not see the need to receive a second or third TB vaccine because they think they are fully immunized already and are not exposed to TB anymore. Unfortunately, our study could not separate TB VC in HCWs working in TB wards only from all the other HCWs, doing this may have reported a higher TB vaccination coverage rate.

Tetanus

The main reasons for non-vaccination for tetanus among HCWs found in our study were; high cost, fear of side effects, and doubts on the need for the vaccine. A study reported unawareness of the tetanus vaccine for HCWs as the main reason for non-vaccination [95], while another study reported little knowledge of the recommendations on tetanus vaccination in HCWs as the main reason for non-vaccination [96]. These results are similar to those found in our study and imply that there is a need for health authorities to further subsidize the cost of the tetanus vaccine as well as communicate more on the need and recommendations of this vaccine for healthcare workers.

Cholera

The main reasons for non-vaccination for the Cholera vaccine were; vaccine unavailability, doubts about the need for the vaccine, and the fear of side effects. A study reported the absence of campaigns as the main reason for non-vaccination [97] while another study reported a lack of time to go take the vaccine and fear of side effects [98]. These findings are similar to ours, the main challenge with the Cholera vaccine is that it is not readily available to be taken if a healthcare worker at any moment desires to take it. In many countries, Cameroon included this vaccine, which is only available post a cholera outbreak and only in the areas of the outbreaks or cholera hotspots. It is challenging to adequately appraise the VC of this vaccine due to its unavailability.

Main adverse effects per vaccine

Hepatitis B

The main side effects reported by HCWs who had received the Hepatitis B vaccine in our study were; fever, headache, and large sore at the injection site, mild paralysis of the arm where the vaccine was received. This is similar to the side effects of this vaccine reported in the literature which also states that this vaccine is safe and efficacious in humans. These side effects are said to be transitory and to disappear 24-72 hours after taking the vaccine or after taking acetaminophen tablets [99].

COVID 19

The main side effects reported by HCWs who had received the COVID-19 vaccine in our study were; fever, headache, flu-like symptoms, and appearance of lymph nodes. Three studies reported; soreness at the site of injection, myalgia, headache, fever, and muscle pain as the main side effects observed in people who had taken the COVID-19 vaccine. All of the above were reported to disappear within 24 hours or after taking acetaminophen [100–102].

Tuberculosis

Our study reports fever, headache, and large swelling and soreness at the injection site as the main side effects of the tetanus vaccine. This is similar to the results found in another study that reported; local injection site redness and swelling, headache, myalgia, and pain as the main side effects of the tuberculosis vaccine. This study also reported that the side effects in adults may be more severe than those in children taking the BCG vaccine. [103].

Tetanus

Fever, headache, and large swelling and soreness at site of injection were found to be the main side effects of the tetanus vaccine in our study. This is similar to the results found in another study that reported, pain at the site of injection, cellulitis, and paralytic syndrome as the main side effects of the tetanus vaccine. These side effects were equally reported to be transient and alleviated by acetaminophen [104]

Cholera

Among the very few HCWs who had received two doses of the oral cholera vaccine in our study, they reported the main side effects to be diarrhoea, fever, and headaches. Other studies done on this vaccine report that the oral Cholera vaccine has a good tolerability, and has as

main reported side effects; fatigue, headache, and abdominal pain[105]. These results are similar to those found in our study.

We have deliberately and detailly reported the main side effects reported by HCWs in Yaoundé for each vaccine studied in our study to show that all the side effects reported by the HCWs who have already received these vaccines are mild and are similar to those reported by other people who have received these same vaccines in other countries. This is done to show that the fear of side effects which is one of the most common reasons for non-vaccination among HCWs for each vaccine should not be. Vaccines are thoroughly tested with all the scientific procedures before being put on the market, hence their mild side effects should not be feared by HCWs. Health authorities in our country need to work more on mass communication on these vaccines to reduce the fear of side effects by HCWs and increase vaccine acceptance [37,38].

Vaccination is an important prophylactic action to reduce the number of susceptible HCWs and to protect susceptible patients and colleagues indirectly [106]. An additional benefit is a reduction in work time lost due to illness. Despite the persistence of outbreaks of vaccine-preventable diseases in healthcare facilities, HCWs vaccination rates remain suboptimal globally. Higher vaccination coverage among HCWs than the actual would be useful both to reinforce occupational safety in healthcare facilities and to prevent nosocomial outbreaks [107–109]. Despite the several recommendations and campaigns to promote vaccinations, achieving high immunization rates among HCWs is still a challenge [110].

CONCLUSION

CONCLUSION

The objectives of our study were to identify determinants of vaccination compliance among HCWs in Yaoundé, determine vaccination coverage rates and reasons for non-vaccination.

At the end of our study, we noted that our study population was mostly aged between 30 and 45 years, three quarters of them were females and more than half of the study population were nurses. The vaccine against tetanus and COVID-19 had the highest vaccination coverage, while the vaccine against Cholera had the lowest vaccination coverage among HCWs in Yaoundé. Factors associated with compliance to vaccination among HCWs included; professional work experience of more than 5 years, vaccine gratuity, service where HCWs work, and being a nurse. The most reported reasons for non-vaccination were; the high cost of vaccines, fear of side effects of vaccines, vaccine unavailability (TB, Cholera), doubts about the efficacy of the vaccines, and religious and personal reasons (COVID-19). The main reported side effects of the vaccines were fever, headache, swollen lymph nodes (COVID-19), large sore at the injection site that took a long time to heal (Tetanus and TB), and diarrhoea (Cholera).

Vaccination coverage among HCWs was suboptimal, indicating a high vulnerability of HCWs to blood-borne preventable infections. There is a need to strengthen District Hospitals for upscaling the implementation of standard guidelines for infection prevention particularly that of vaccination. Health institutions and the state could fully support the cost of vaccines.

RECOMMENDATIONS

RECOMMENDATIONS

At the end of our study, we suggest the following recommendations;

To the Ministry of Public Health

- Subsidize the cost of all vaccines recommended for healthcare workers, in cooperation with its international technical and financial partners.
- Increase the vaccine accessibility for medical professionals.
- Create more detailed and adequate regulations requiring vaccinations for healthcare personnel before they are hired by any healthcare facility and from the point of training (in medical, nursing, and other training facilities).
- Make the available regulations in all health Facilities in the nation.

To District Hospitals

- Make sure that every healthcare professional employed in their facilities has obtained all required vaccinations both before and throughout their employment via the implementation of Infection control committees.
- Provide HCWs with easy access to information platforms (such as booklets, posters, and recorded films) that contain vaccination recommendations. At their monthly coordination meetings, provide a notification about this.

To Healthcare workers

- Familiarise themselves more with mandatory, recommended, and optional vaccines for them and make the effort to receive them as a measure of infection prevention.

To all Faculties of Science, Medicine and all HCW teaching institutions

- Introduce from first year of training the need and importance of recommended vaccines for HCWs.
- Ensure that students in their first years of training receive these vaccines before being exposed to clinical rotations.

To the Scientific Community

- Conduct qualitative and/or longitudinal prospective studies to determine more specifically the factors influencing HCWs' vaccination rates, then modify strategies and plans to improve them.

- Conduct more research on the sources of information used for HCWs on vaccines recommended for them.
- Conduct more research to provide a better understanding of risk perception in their working environment.

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APPENDICES

Appendix 1: Ethical clearance from faculty

UNIVERSITÉ DE YAOUNDÉ I FACULTÉ DE MÉDECINE ET DES SCIENCES BIOMÉDICALES COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE Tel/ fax : 22 31-05-86 22 311224 Email: decanatfmsb@hotmail.com		THE UNIVERSITY OF YAOUNDE I FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES INSTITUTIONAL ETHICAL REVIEW BOARD
Ref. : N° <u>MMS</u> /UY1/FMSB/VERC/DAASR/CSD		

CLAIRANCE ÉTHIQUE

19 JUL 2024

Le COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE (CIER) de la FMSB a examiné

La demande de la clairance éthique soumise par :

M.Mme : NOUKO ARIANE

Matricule: 20S1131

Travaillant sous la direction de : • Pr TAKOUGANG Innocent
• Pr NGUEFACK Félicitée Epse DONGMO

Concernant le projet de recherche intitulé : Determinants of compliance to vaccination as means of infection prevention among healthcare workers in the health districts of Yaoundé

Les principales observations sont les suivantes

Evaluation scientifique	
Evaluation de la convenance institutionnelle/valeur sociale	
Equilibre des risques et des bénéfices	
Respect du consentement libre et éclairé	
Respect de la vie privée et des renseignements personnels (confidentialité) :	
Respect de la justice dans le choix des sujets	
Respect des personnes vulnérables :	
Réduction des inconvénients/optimalisation des avantages	
Gestion des compensations financières des sujets	
Gestion des conflits d'intérêt impliquant le chercheur	

Pour toutes ces raisons, le CIER émet un avis favorable sous réserve des modifications recommandées dans la grille d'évaluation scientifique.

L'équipe de recherche est responsable du respect du protocole approuvé et ne devra pas y apporter d'amendement sans avis favorable du CIER. Elle devra collaborer avec le CIER lorsque nécessaire, pour le suivi de la mise en œuvre dudit protocole.

La clairance éthique peut être retirée en cas de non - respect de la réglementation ou des recommandations sus évoquées.

En foi de quoi la présente clairance éthique est délivrée pour servir et valoir ce que de droit

LE PRÉSIDENT DU COMITE ETHIQUE




Appendix 2: Regional ethical clearance

REPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie

MINISTRE DE LA SANTE PUBLIQUE

SECRETARIAT GENERAL

COMITE REGIONAL D'ETHIQUE DE LA
RECHERCHE POUR LA SANTE HUMAINE DU CENTRE

Tél : 222 21 20 87/ 677 94 48 89/ 677 75 73 30

CE N° **0244-3** / CRERSHC/2024



REPUBLIC OF CAMEROON
Peace – Work – Fatherland

MINISTRY OF PUBLIC HEALTH

SECRETARIAT GENERAL

CENTRE REGIONAL ETHICS COMMITTEE
FOR HUMAN HEALTH RESEARCH

Yaoundé, the **06 MAI 2024**

ETHICAL CLEARANCE

The Centre Regional Ethics Committee for Human Health Research (CRERSH-Ce) has received the request for an ethical approval for the project entitled: **"Determinants of compliance to Vaccination as a Means of Infection prevention among healthcare workers in the health Districts of Yaoundé"**, submitted by Madam/Miss **NOUKO Ariane**.

After evaluation, it appears that the subject is worthy of interest, the objectives are well defined, and the research procedure does not include invasive methods harmful to the participants. In addition, the informed consent form intended for participants is acceptable.

For these reasons, the CRERSH-Ce issued a six (06) months approval for the implementation of the current version of the protocol.

The Principal Investigator is responsible for scrupulous compliance with the protocol and must not make any amendments, however minor, without the favourable approval of the CRERSH-Ce. In addition, the Principal Investigator is required to:

- Collaborate on any descent from the CRERSH-Ce for monitoring the implementation of the approved protocol.
- And submit the final report of the study to the CRERSH-Ce and to the competent authorities concerned by the study.

This clearance may be withdrawn in the event of non-compliance with the regulations in force and the directives mentioned above.

In witness whereof the present Ethical Clearance is issued with the privileges thereunto pertaining. /-

Copy: CNERSH.



THE CHAIRPERSON,

Dr. Jean Baptiste Njamnshi
Pharmatien



Appendix 3: Authorisation BIYEM ASSI DH

REPUBLIQUE DU CAMEROUN

Paix – Travail – Patrie

MINISTRE DE LA SANTE PUBLIQUE

DELEGATION REGIONALE DU CENTRE

DISTRICT DE SANTE DE BIYEM-ASSI

HOPITAL DE DISTRICT DE BIYEM-ASSI

BP : 31 350 Ydé . Tél./Fax 22.31.64.05



REPUBLIC OF CAMEROON

Peace-Work-Fatherland

MINISTRY OF PUBLIC HEALTH

CENTER REGIONAL DELEGATION

BIYEM-ASSI HEALTH DISTRICT

BIYEM-ASSI DISTRICT HOSPITAL

E-mail:hopital_biyemassi@yahoo.fr

N° 529 /AR/MINSANTE/DRSPC/DSBA/HDBA.

AUTORISATION DE RECHERCHE

Le Directeur de l'Hôpital de District de Biyem-Assi à Yaoundé soussigné, donne autorisation de recherche à madame NOUKO Ariane, Médecin Résident en Santé Publique, à la Faculté de Médecine et des Sciences Biomédicales à l'Université de Yaoundé I, dont l'étude porte sur « *Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in the Health Districts of Yaoundé* ».

En foi de quoi la présente autorisation est établie et lui est délivrée pour servir et valoir ce que de droit.

Yaoundé, le 24 MAI 2024

Le Directeur

Dr. Daniel Okou
Médecin - Cardiologue

Appendix 4: Authorisation CITE VERTE DH

REPUBLIQUE DU CAMEROUN

Paix-Travail-Patrie

MINISTÈRE DE LA SANTÉ PUBLIQUE

DELEGATION REGIONALE DU CENTRE

DISTRICT DE SANTÉ DE LA CITE VERTE

HOPITAL DE DISTRICT DE LA CITE VERTE

B.P : 3604 Messa-Yaoundé



REPUBLIC OF CAMEROON

Peace-Work-Fatherland

MINISTRY OF PUBLIC HEALTH

REGIONAL CENTER DELEGATION

CITE VERTE HEALTH DISTRICT

CITE VERTE DISTRICT HOSPITAL

N° 086 /L/Minsanté/DRC/DSCV/HDCV

Yaoundé le, 22 mai 2024

LE DIRECTEUR

A

Madame NOUKO Ariane

Objet : *Autorisation de recherche*

Madame,

J'accuse réception de votre lettre dont les références sont ci-dessus reprises en marge.

Y faisant suite, j'ai l'honneur de vous signifier que je marque mon accord pour la collecte de données relatives à l'étude sur « **Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in the Health Districts of Yaoundé** ».

Veillez accepter Madame, les assurances de ma franche collaboration.



LE DIRECTEUR

[Signature]
Dr. BEKOULE Patrick S.
CHIRURGIEN
Directeur Hôpital District CITE VERTE
Tél: 677 67 57 94

Appendix 5: Authorisation DJOUNGOLO-OLEMBE DH

REPUBLIQUE DU CAMEROUN
Paix - Travail - Patrie
MINISTÈRE DE LA SANTÉ PUBLIQUE
DELEGATION REGIONALE DU CENTRE
DISTRICT DE SANTÉ DE DJOUNGOLO
HOPITAL DE DISTRICT DE DJOUNGOLO
BP 4618 YAOUNDE



REPUBLIC OF CAMEROON
Peace-Work-Fatherland
MINISTRY OF PUBLIC HEALTH
CENTRE REGIONAL DELEGATION
HEALTH DISTRICT OF DJOUNGOLO
DJOUNGOLO DISTRICT HOSPITAL

N° 335.../AR/MINSANTE/SG/DRSP-C/DSD/HDD

Yaoundé, le 24 MAI 2024

AUTORISATION DE RECHERCHE

Je soussigné, Dr MINYEM Fils Emmanuel, Directeur de l'Hôpital de District de Djoungolo, autorise madame **NOUKO Ariane**, Etudiante en 4^{ème} année du cycle de Spécialisation en Santé Publique à la Faculté de Médecine et de Sciences Biomédicales de l'Université de Yaoundé I, à mener une recherche sur le thème : « **Determinants of Compliance to Vaccination as a means of Infection prevention Among Healthcare Workers in the Health Districts of Yaounde** » à l'Hôpital de District de Djoungolo.

Cette recherche s'effectuera au mois de Juin 2024.

Le Directeur

Dr. Minyem Fils Emmanuel
Médecin (MD)

Appendix 6: Authorisation EFOULAN DH

REPUBLIQUE DU CAMEROUN
Paix - Travail - Patrie
MINISTERE DE LA SANTE PUBLIQUE
DELEGATION REGIONALE DU CENTRE
DISTRICT DE SANTE D'EFOULAN
HOPITAL DE DISTRICT D'EFOULAN
N° 322/ACD/MSP/DRC/DSE/HDE



REPUBLIC OF CAMEROON
Peace-Work-Fatherland
MINISTRY OF PUBLIC HEALTH
CENTER REGIONAL DELEGATION
EFOULAN HEALTH DISTRICT
EFOULAN DISTRICT HOSPITAL
Yaoundé, le 05 JUIN 2024

AUTORISATION DE COLLECTE DE DONNEES

Je soussigné, Dr Paul ELOUNDOU ONOMO, Directeur de l'Hôpital de District d'Efoulan,

Certifie qu'une autorisation administrative de collecte de données à l'Hôpital de District d'Efoulan pour les travaux de recherche dont le thème s'intitule « **Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in the Health Districts of Yaoundé** », dirigé par le Professeur Titulaire Innocent TAKOUGANG, est accordée à Madame NOUKO Ariane, étudiante en 4^{ème} année du Cycle de Spécialisation en Santé Publique à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé I.

L'éthique et la confidentialité sont à respecter ;

En foi de quoi cette autorisation de collecte de données est établie et délivrée à l'intéressé pour servir et valoir ce que de droit.

AMPLIATIONS
- INTERESSE (E)
- CHRONO/ARCHIVES. /-

LE DIRECTEUR
Le Directeur
Docteur
Paul Eloundou Onomo
Médecin RH

Appendix 7: Authorisation MVOG-ADA DH

Dr. NOUKO Ariane
Médecin Résident en Santé Publique
SP4, FMSB/UYI
Tel: +237 672 22 71 04
e-mail: arianenouko@gmail.com

Yaoundé le 08 Mai 2024

A. Clond
Dr. Nkodo A. Pierre
Chirurgien
ORL: 7703

A
Monsieur Le Directeur de l'hôpital de District de
Mvog Ada

Objet : Demande d'autorisation de recherche

Monsieur Le Directeur,

J'ai l'honneur de venir auprès de votre haute bienveillance solliciter une autorisation pour effectuer une recherche dans votre formation sanitaire.

En effet, je suis étudiant en quatrième année du Cycle de Spécialisation en Santé Publique à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé 1, et j'effectue un travail de mémoire de fin de Cycle de Spécialisation dont le thème est intitulé :

«Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in the Health Districts of Yaoundé».

L'objectif principal de cette étude est d'analyser les déterminants de l'observance de la vaccination comme moyen de prévention des infections parmi le personnel de santé dans les districts sanitaires de Yaoundé.

Par conséquent, je souhaiterais administrer un questionnaire à tous le personnel au sein de votre formation hospitalière pendant la période allant de Mai à Juillet 2024, soit une durée de 3 mois.

Dans l'attente d'une suite favorable, veuillez croire **Monsieur Le Directeur**, en l'expression de mon profond respect

Pièces jointes :

- Une Copie du protocole de recherche
- Une Copie de la Clairance éthique

[Signature]
NOUKO Ariane

Appendix 8: Authorisation NKOLDONGO DH

Dr. NOUKO Ariane
Médecin Résident en Santé Publique
SP4, FMSB/UYI
Tel: +237 672 22 71 04
e-mail: arianenouko@gmail.com

Yaoundé le 08 Mai 2024



A
Monsieur Le Directeur de l'hôpital de District de
NKOLDONGO

Objet : Demande d'autorisation de recherche

Monsieur Le Directeur,

J'ai l'honneur de venir auprès de votre haute bienveillance solliciter une autorisation pour effectuer une recherche dans votre formation sanitaire.

En effet, je suis étudiant en quatrième année du Cycle de Spécialisation en Santé Publique à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé I, et j'effectue un travail de mémoire de fin de Cycle de Spécialisation dont le thème est intitulé :

«Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in the Health Districts of Yaoundé».

L'objectif principal de cette étude est d'analyser les déterminants de l'observance de la vaccination comme moyen de prévention des infections parmi le personnel de santé dans les districts sanitaires de Yaoundé.

Par conséquent, je souhaiterais administrer un questionnaire à tous le personnel au sein de votre formation hospitalière pendant la période allant de Mai à Juillet 2024, soit une durée de 3 mois.

Dans l'attente d'une suite favorable, veuillez croire **Monsieur Le Directeur**, en l'expression de mon profond respect

Pièces jointes :

- Une Copie du protocole de recherche
- Une Copie de la Clairance éthique


NOUKO Ariane

Appendix 9: Authorisation ODZA DH

RÉPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie
MINISTÈRE DE LA SANTÉ PUBLIQUE
SECRÉTARIAT GÉNÉRAL
DÉLÉGATION RÉGIONALE DU CENTRE
DISTRICT DE SANTÉ D'ODZA
HOPITAL DE DISTRICT D'ODZA
YAOUNDE IV
TÉL : 222 30 50 10



REPUBLIC OF CAMEROON
Peace-Work-Fatherland
MINISTRY OF PUBLIC HEALTH
SECRETARIAT GENERAL
CENTER REGIONAL DELEGATION
ODZA HEALTH DISTRICT
ODZA YAOUNDE IV DISTRICT
HOSPITAL
PHONE: 222 30 50 10

N° 1924 AR/MSP/DRSPC/DSOD/HDO

Yaoundé le, 7 MAI 2024

Madame le Directeur de l'Hôpital de District d'Odza

A

Dr. NOUKO Ariane Medecin Résident en Sante Publique
SP4, FMSB/UII

OBJET : AUTORISATION DE RECHERCHE

Je soussignée, Dr NKONGO Victorine Directeur de l'Hôpital de District d'Odza ; après avoir évalué la portée et l'importance du projet de recherche et m'être entretenue avec le porteur du projet, autorise la collecte des données " dans l'établissement hospitalier dont j'ai la charge.

En effet cette étude intitulée, « Determinants of Compliance to Vaccination as a Means of Infection Prevention Among Healthcare Workers in the Health Districts of Yaoundé ». Sera menée par Dr. NOUKO Ariane.

A cet effet, la concernée procèdera à la collecte des données selon les recommandations et prescriptions indiquées par le Comité National d'Ethique et également sous la surveillance du personnel de l'Hôpital afin d'éviter tout dérapage lié à une mauvaise manipulation. Le non-respect des recommandations prescrites par le CNE par cette dernière sera sanctionné selon la gravité de dérapage allant d'une sanction provisoire a une expulsion définitive de l'enceinte de l'établissement.

Ce document lui est délivré pour servir et valoir ce que de droit.

Le directeur



Victorine Nkongo
Médecin
Gynécologue-Obstétricienne

Appendix 10: Fiche d'information

Titre de l'étude : Déterminants de la compliance à la vaccination comme mesure de prévention des infections chez le personnel de santé dans les Hôpitaux de District de Yaoundé

Superviseur : Pr. TAKOUGANG Innocent

Investigateur principal : Dr NOUKO Ariane

Invitation : Nous vous invitons à participer à notre étude de recherche intitulée « Déterminants de la compliance à la vaccination comme mesure de prévention des infections chez le personnel de santé dans les Districts de Santé de Yaoundé ». Avant de vous décider, il est important que vous compreniez pourquoi la recherche est effectuée et ce qu'elle impliquerait pour vous. Veuillez prendre le temps de lire ces informations et d'en discuter avec d'autres si vous le souhaitez. S'il y a quelque chose qui n'est pas clair ou si vous souhaitez plus d'informations, veuillez nous demander.

Quel est le but de l'étude ? Le contrôle des infections chez les travailleurs de la santé est un problème de santé publique dans les pays en voie de développement ; la vaccination est un moyen majeur de contrôle des infections. Au Cameroun, très peu d'études ont été menées à ce jour pour explorer les déterminants de la compliance à la vaccination comme moyen de contrôle de l'infection chez les personnels de la santé. Cette étude sera menée dans les hôpitaux de district de la ville de Yaoundé. L'objectif est d'estimer la couverture vaccinale et d'identifier les déterminants associés à la vaccination chez les professionnels de santé. Cette étude est destinée aux prestataires de soins de santé. La collecte des données est prévue pour durer 3 mois.

Procédure d'étude : Un questionnaire de quatre pages vous sera remis à remplir. Votre participation est gratuite, volontaire et anonyme. Vous avez le droit de vous retirer de l'étude. Vos données seront conservées au cas où nous en aurions besoin pour une analyse plus approfondie.

Considérations éthiques : Il n'y aura aucun risque pour votre vie si vous participez à cette étude.

Allons-nous vous payer pour votre participation ? Nous ne vous payerons pas pour votre participation à l'étude.

Adresse du chercheur principal :

Faculté de Médecin et des Sciences Biomédicales

Département de Santé Publique - Ministère de l'enseignement supérieur

WhatsApp: 672 22 71 04

E-mail : arianenouko@gmail.com

Adresse CRERSH : Tél : 222 21 20 87/ 677 94 48 89/677 75 73 30

E-mail: crersh_centre@yahoo.com

Appendix 11: Information notice

Title of the study: Determinants of compliance to vaccination as a means of infection prevention among healthcare workers in Yaoundé District Hospitals

Supervisor: Pr. TAKOUGANG Innocent

Principal investigator: Dr NOUKO Ariane

Invitation: We invite you to participate in our research study entitled "**Determinants of compliance to vaccination as a means of infection prevention among healthcare workers in the health districts of Yaoundé**". Before you make up your mind, it's important that you understand why the research is being done and what it would mean for you. Please take the time to read this information and discuss it with others if you wish. If there is anything that is unclear to you or if you would like more information, please do not hesitate to ask us.

What is the purpose of the study? Infection control among healthcare workers is a public health problem in developing countries; vaccination is a major arm of infection control. In Cameroon, very few studies have been carried out to date to explore the determinants of compliance to vaccination as a means of infection control among healthcare workers. It will be carried out in District Hospitals of the city of Yaoundé. The goal is to estimate vaccination coverage and identify determinants associated with vaccination among healthcare workers. This study is intended for healthcare providers. Data collection is planned to last 3 months.

Study procedure: You will be given a four-page questionnaire to complete. Your participation is free, voluntary and anonymous. You have the right to withdraw from the study. Your data will be kept in case we need it for further analysis.

Ethical considerations: There will be no risk to your life if you participate in this study. Are we going to pay you for your participation? We will not pay you for your participation in the study.

Principal investigator's address:

Faculty of Medicine and Biomedical Sciences

Department of Public Health - Ministry of Higher Education

WhatsApp: 672 22 71 04

Email: arianenouko@gmail.com

CRERSH address: Tel: 222 21 20 87/677 94 48 89/677 75 73 30

E-mail: crersh_centre@yahoo.com

Appendix 12: Fiche de consentement éclairé

Je, soussigné _____ déclare accepter, librement, et de façon éclairée, de participer comme sujet à l'étude intitulée :

Titre : Déterminants de la compliance à la vaccination comme mesure de prévention des infections chez le personnel de santé dans les Hôpitaux de Districts de Yaoundé

Sous la direction du Professeur TAKOUGANG Innocent

Promoteur : Unité de recherche du département de Santé Publique, FMSB, UYI

Investigateur principal : Dr NOUKO Ariane, MD, MPH, Tel : 672227104/656744736, Email : arianenouko@gmail.com

But de l'étude : Identifier les déterminants associés à la compliance à la vaccination comme mesure de prévention des infections chez le personnel de santé dans les districts de Santé de Yaoundé.

Engagement du participant : l'étude va consister à remplir complètement le formulaire en utilisant des informations réelles.

Engagement de l'investigateur principal : en tant qu'investigateur principal, je m'engage à mener cette recherche selon les dispositions éthiques et déontologiques, à protéger l'intégrité psychologique et sociale des personnes tout au long de la recherche et à assurer la confidentialité des informations recueillies.

Liberté du participant : le consentement pour poursuivre la recherche peut être retiré à tout moment sans donner de raison et sans encourir aucune responsabilité ni conséquence. Les réponses aux questions ont un caractère facultatif et le défaut de réponse n'aura aucune conséquence pour le sujet.

Information du participant : le participant a la possibilité d'obtenir des informations supplémentaires concernant cette étude auprès de l'investigateur principal, et ce dans les limites des contraintes du plan de recherche.

Confidentialité des informations : toutes les informations concernant les participants seront conservées de façon anonyme et confidentielle. Le traitement informatique n'est pas nominatif. La transmission des informations concernant le participant pour l'expertise ou pour la publication scientifique sera elle aussi anonyme.

Déontologie et éthique : le promoteur et l'investigateur principal s'engagent à préserver absolument la confidentialité et le secret professionnel pour toutes les informations.

Fait à Yaoundé le

Signatures :

Le participant

L'investigateur principal

Appendix 13: Informed consent form

I, the undersigned _____ declare that I freely and informally accept to participate as a subject in the study entitled:

Title: Determinants of compliance to vaccination as a means of infection prevention among healthcare workers in the Yaoundé District Hospitals

Under the Supervision of Professor TAKOUGANG Innocent

Promoter: Department of Public Health, FMSB, UYI

Principal investigator: Dr NOUKO Ariane, MD, MPH, Tel: 672227104/656744736, email: arianenouko@gmail.com

Aim of the study: To identify determinants associated with compliance to vaccination as a means of infection prevention among healthcare workers in the health districts of Yaoundé.

Participant's commitment: the study will consist of completely filling out the form using real information.

Commitment of the principal investigator: as principal investigator, I commit myself to conduct this research according to the ethical and deontological provisions, to protect the psychological and social integrity of people throughout the research and to ensure confidentiality of the information collected.

Freedom of the participant: the consent to continue the research can be withdrawn at any time without giving any reason and without incurring any liability or consequences. Answers to questions are optional and failure to answer will have no consequences for the subject.

Information of the participant: the participant has the possibility of obtaining additional information concerning this study from the principal investigator, and this within the limits of the constraints of the research plan.

Confidentiality of information: all information concerning participants will be kept anonymous and confidential. Computer processing is not personal. The transmission of information about the participant for expertise or for scientific publication will also be anonymous.

Deontology and ethics: the promoter and principal investigator undertake to absolutely preserve confidentiality and professional secrecy for all information.

Done in Yaoundé on.....

Signatures:

The participant

The principal investigator

Appendix 14: Fiche d'enquête

THEME : «Déterminants de la compliance à la vaccination comme mesure de prévention
des infections chez le personnel de santé dans les Hôpitaux Districts de Yaoundé»

Date : ____/____/2024

Questionnaire N° _____

Consigne : S'il vous plaît entourez le chiffre correspondant à la bonne réponse

I. DONNEES SOCIO-DEMOGRAPHIQUES

1. **Age :** _____ ans
2. **Sexe :** 1= masculin 2 = féminin
3. **Statut matrimonial :** 1 = célibataire 2 = marié(e)
4. **Religion :** 1= Catholique 2=protestant 3=Musulman 4= Autre Chrétien 5= Aucun
5. **Région d'origine :** 1= Adamaoua 2= Centre 3=Est 4=Extrême-Nord 5=Littoral
6=Nord 7= Nord-ouest 8= Ouest 9= Sud 10= Sud-ouest
6. **Niveau d'étude :** 1 = primaire 2 = secondaire 3 = supérieur
7. **Nombre d'années d'étude :** _____ ans
8. **Grade :** 1 = Médecin spécialiste 2= Médecin généraliste 3 = infirmier(e)
4 = sage-femme/maïeuticien 5 = aide-soignant(e) 6= technicien(ne) laboratoire
7=personnel d'hygiène 8= Autres.....
9. **Statut administratif :** 1 = fonctionnaire 2 = contractuel 3 = stagiaire
10. **Service actuel :** _____
11. **Temps déjà passée dans ce service :** _____ ans _____ mois
12. **Nombre d'année de service hospitalier depuis la formation** _____ ans _____ mois

II. CONNAISSANCE SUR LES VACCINS COMME MESURE DE PREVENTION DE L'INFECTION EN MILIEU HOSPITALIERE

13. **Selon vous, le vaccin est-il un moyen indiquer pour la prévention d'infections en milieu
des soins ?** 1= Oui 2= Non
14. **Parmi les vaccins suivant, lesquels sont obligatoires en milieu des soins?**
1=COVID19 2= Tuberculose 3= Hépatite B 4= Tétanos 5= Méningite
6= Cholera 7= Diphtérie 8= Poliomyélite 9= Coqueluche 10= Grippe
15. **Parmi les vaccins suivants, lesquels sont recommandés en milieu des soins ?**
1=COVID19 2= Tuberculose 3= Hépatite B 4= Tétanos 5= Méningite
6= Cholera 7= Diphtérie 8= Poliomyélite 9= Coqueluche 10= Grippe

16. Parmi les vaccins suivants, lesquels sont avantageux d'être administré chez les personnels de Santé ?

1= Papillome 2= Tuberculose 3= COVID19 4= Grippe 5= Diphtérie 6= Hépatite B

17. Ces informations sont-elles disponibles dans votre FOSA ? 1= Oui 2= Non

18. Quelle est votre source d'information pratique relative à la vaccination ?

1= Revue Scientifique 2= Article 3= Conférence médicale 4= Radio 5= Télévision 6= collègues

7= Autres préciser.....

III. ENVIRONNEMENT DE TRAVAIL

19. Comment trouvez-vous votre environnement de travail par rapport à l'exposition aux infections ? 1= Risque Elevée 2= normal 3= Aucun risque

20. Votre service organise-t-il des activités d'information sur la vaccination comme mesure de protection des infections ? 1= Oui 2= Non

21. Si oui, à quelle fréquence ? 1 = Régulièrement 2= Parfois 3= Pas du tout

22. Etes-vous satisfait du planning des séances de vaccination dans votre formation sanitaire ? 1= Oui 2= Non

IV. COVERTURE ET COMPLIANCE VACCINAL

23. Avez-vous déjà été vacciné contre l'hépatite virale B ? : 1 = Oui 2 = Non

Si Oui, précisez le nombre de doses reçues : 1= 1 dose 2 = 2 doses 3 = 3 doses

Si Oui, Date de la dernière dose : (Mois +/-Années)

Si Oui, avez-vous eu des effets indésirables a la vaccination ? 1=Oui 2= Non

Si Oui, lesquels ? 1= fièvre 2= Maux de tête, 3= Gonflement des ganglions lymphatiques a l'aisselle 4= plaie importante qui a mis du temps a guérir 5= Autres, précisez.....

Si vous n'avez pas reçu ce vaccin, pour quelle raison ? 1= Doutes sur la nécessité réelle des vaccins 2= Peur des effets secondaires 3=vaccin indisponible

4= Cout élevée 5= Pour des raisons religieuse et philosophique 6= Expérience négative avec les vaccins

24. Avez-vous déjà été vacciné contre le Covid 19 ? : 1 = Oui 2 = Non

Si Oui, quel type de vaccin : 1 = SINOPHARM 2 = ASTRAZENECA 3 = Janssen/JOHNSON and JOHNSON 4= PFIZER

Si Oui, précisez le nombre de doses reçues : 1= 1 dose 2 = 2 doses 3 = 3 doses

Si Oui, Date de la dernière dose : (Mois +/-Années)

Si Oui, avez-vous eu des effets indésirables a la vaccination ? 1=Oui 2= Non

Si Oui, lesquels ? 1= fièvre 2= Maux de tête, 3= Gonflement des ganglions lymphatiques a l'aisselle 4= plaie importante qui a mis du temps a guérir 5= Autres, précisez.....

Si vous n'avez pas reçu ce vaccin, pour quelle raison ? 1= Doutes sur la nécessité réelle des vaccins 2= Peur des effets secondaires 3=vaccin indisponible
4= Cout élevée 5= Pour des raisons religieuse et philosophique 6=
Expérience négative avec les vaccins

25. Avez-vous déjà été vacciné contre la Tuberculose ? : 1 = Oui 2 = Non

Si Oui, précisez le nombre de doses reçues : 1= 1 dose 2 = 2 doses 3 = 3 doses

Si Oui, Date de la dernière dose : (Mois +/-Années)

Si Oui, avez-vous eu des effets indésirables a la vaccination ? 1=Oui 2= Non

Si Oui, lesquels ? 1= fièvre 2= Maux de tête, 3= Gonflement des ganglions lymphatiques a l'aisselle 4= plaie importante qui a mis du temps a guérir 5= Autres, précisez.....

Si vous n'avez pas reçu ce vaccin, pour quelle raison ? 1= Doutes sur la nécessité réelle des vaccins 2= Peur des effets secondaires 3=vaccin indisponible
4= Cout élevée 5= Pour des raisons religieuse et philosophique 6=
Expérience négative avec les vaccins

26. Avez-vous déjà été vacciné contre le tétanos ? : 1 = Oui 2 = Non

Si Oui, précisez le nombre de doses reçues : 1= 1 dose 2 = 2 doses 3 = 3 doses 4= 4doses 5-5doses

Si Oui, Date de la dernière dose : (Mois +/-Années)

Si Oui, avez-vous eu des effets indésirables a la vaccination ? 1=Oui 2= Non

Si Oui, lesquels ? 1= fièvre 2= Maux de tête, 3= Gonflement des ganglions lymphatiques a l'aisselle 4= plaie importante qui a mis du temps a guérir 5= Autres, précisez.....

Si vous n'avez pas reçu ce vaccin, pour quelle raison ? 1= Doutes sur la nécessité réelle des vaccins 2= Peur des effets secondaires 3=vaccin indisponible
4= Cout élevée 5= Pour des raisons religieuse et philosophique 6=
Expérience négative avec les vaccins

27. Avez-vous déjà été vacciné contre le Choléra ? : 1 = Oui 2 = Non

Si Oui, précisez le nombre de doses reçues : 1= 1 dose 2 = 2 doses 3 = 3 doses

Si Oui, Date de la dernière dose : (Mois +/-Années)

Si Oui, avez-vous eu des effets indésirables a la vaccination ? 1=Oui 2= Non

Si Oui, lesquels ? 1= fièvre 2= Maux de tête, 3= Gonflement des ganglions lymphatiques a l'aisselle 4= plaie importante qui a mis du temps a guérir 5= Autres, précisez.....

Si vous n'avez pas reçu ce vaccin, pour quelle raison ? 1= Doutes sur la nécessité réelle des vaccins 2= Peur des effets secondaires 3=vaccin indisponible
4= Cout élevée 5= Pour des raisons religieuse et philosophique 6=
Expérience négative avec les vaccins

28. Quelles est la source de financement des vaccins que vous avez reçu ? 1=
Gratuit 2= sources personnelle 3= financée par Hôpital 4=Autres, précisez.....

Appendix 15: Data collection form

THEME: COMPLIANCE TO VACCINATION AMONGST HEALTH CARE WORKERS

Date: ____/____/2024

Questionnaire N° _____

Instructions: Please circle the number corresponding to the correct answer.

II. SOCIO-DEMOGRAPHIC DATA

1. **Age :** _____ years
2. **Sex :** 1= Male 2 = Female
3. **Marital status:** 1 = Single 2 = Married
4. **Religion:** 1=Catholic 2=Protestant 3=Muslim 4=Other Christian 5= None
5. **Region of origin:** 1= Adamaoua 2= Centre 3= East 4= Far North 5= Littoral 6= North 7= North West 8= West 9= South 10= South West
6. **Level of Education:** 1 = primary 2 = secondary 3 = tertiary
7. **Number of years of study:** _____ years
8. **Grade:** 1 = Specialist doctor 2= General practitioner 3 = Nurse 4 = Midwife/midwife 5 = Care assistant 6= Laboratory technician 7= Hygiene staff 8= other:
9. **Administrative status:** 1 = civil servant 2 = contractual 3 = trainee
10. **Service where you work:** _____
11. **Time already spent in this department:** _____ years _____ months
12. **Number of years of hospital service since training:** _____ years _____ months

II. KNOWLEDGE ON VACCINATION AS A METHODE OF INFECTION PREVENTION IN HOSPITAL SETTING

13. **In your opinion, is vaccination an appropriate means of preventing infections in healthcare settings?** 1= Yes 2= No
14. **Which of the following vaccines are compulsory in health care settings?**
1=COVID19 2= Tuberculosis 3= Hepatitis B 4= Tetanus 5= Meningitis 6= Cholera 7= Diphtheria 8= Poliomyelitis 9= Whooping cough 10= Influenza
15. **Which of the following vaccines are recommended for use in healthcare settings?**
1=COVID19 2= Tuberculosis 3= Hepatitis B 4= Tetanus 5= Meningitis 6= Cholera 7= Diphtheria 8= Poliomyelitis 9= Whooping cough 10= Influenza

16. Which of the following vaccines should be administered to healthcare workers?

1= Papilloma 2= Tuberculosis 3= COVID19 4= Influenza 5= Diphtheria 6= Hepatitis B

17. Is this information available in your health facility? 1= Yes 2= No

18. What is your source of practical information about vaccination?

1= Scientific journal 2= Article 3= Medical conference 4= Radio 5= Television 6= Colleague 7= Other: specify.....

V. WORK ENVIRONMENT

19. How do you rate your work environment in terms of exposure to infections? 1= High risk 2= Normal 3= No risk

20. Does your department organize information activities on vaccination as a measure to protect against infection? 1= Yes 2= No

21. If yes, how often? 1= Regularly 2= Sometimes 3= Not at all

22. Are you satisfied with the planning of vaccination sessions in your health facility? 1= Yes, 2= No

VI. VACCINATION COVERAGE AND COMPLIANCE

23. Have you ever been vaccinated against viral hepatitis B? 1= Yes 2= No

23.1 If yes, specify the number of doses received: 1= 1 dose 2= 2 doses 3= 3 doses

23.2 If yes, date of last dose: (Months +/-Years)

23.3 If yes, did you have any adverse reactions to the vaccination? 1=Yes 2= No

23.3.1 If yes, which ones? 1= Fever 2= Headache 3= swelling of lymph nodes in armpit 4= large sore that took a long time to heal 5= other: please specify.....

23.4 If you have not received this vaccine, what may be the cause 1= Doubts about the real need for vaccines 2= Fear of side effects 3= Vaccine unavailable 4= High cost 5= for religious or philosophical reasons 6= Negative experience with vaccines

24. Have you ever been vaccinated against Covid 19? : 1 = Yes 2 = No

24.1 If yes, what type of vaccine: 1 = SINOPHARM 2 = ASTRAZENECA 3 = Janssen/JOHNSON and JOHNSON 4= PFIZER

24.2 If yes, specify the number of doses received: 1= 1 dose 2= 2 doses 3= 3 doses

24.3 If yes, date of last dose: (Months +/-Years)

24.4 If yes, did you have any adverse reactions to the vaccination? 1=Yes 2= No

24.4.1. If yes, which ones? 1= Fever 2= Headache 3= Swelling of lymph nodes in armpit 4= Large sore that took a long time to heal 5= other, please specify.....

24.5 If you have not received this vaccine, what may be the cause? 1= Doubts about the real need for vaccines 2= Fear of side effects 3= Vaccine unavailable 4= High cost 5= for religious or philosophical reasons 6= Negative experience with vaccines

25. Have you ever been vaccinated against tuberculosis? 1 = Yes 2 = No

25.1 If yes, specify the number of doses received: 1 = 1 dose 2 = 2 doses 3 = 3 doses

25.2 If yes, date of last dose: (Months +/-Years)

25.3 If yes, did you have any adverse reactions to the vaccination? 1=Yes 2= No

25.3.1 If yes, which ones? 1= Fever 2= Headache 3= Swelling of lymph nodes in armpit 4= Large sore that took a long time to heal 5= other; please specify.....

25.4 If you have not received this vaccine, what may be the cause? 1= Doubts about the real need for vaccines 2= Fear of side effects 3= Vaccine unavailable 4= High cost 5= for religious or philosophical reasons 6= Negative experience with vaccines

26. Have you ever been vaccinated against tetanus? 1 = Yes 2 = No

26.1 If yes, specify the number of doses received: 1= 1 dose 2 = 2 doses 3 = 3 doses 4= 4doses 5=5doses

26.2 If yes, date of last dose: (Months +/-Years)

26.3 If yes, did you have any adverse reactions to the vaccination? 1=Yes 2= No

26.3.1 If yes, which ones? 1= Fever 2= Headache 3= Swelling of lymph nodes in armpit 4= Large sore that took a long time to heal 5= other, please specify.....

26.4 If you have not received this vaccine, what may be the cause? 1= Doubts about the real need for vaccines 2= Fear of side effects 3= Vaccine unavailable 4= High cost 5= for religious or philosophical reasons 6= Negative experience with vaccines

27. Have you ever been vaccinated against Cholera? 1 = Yes 2 = No

27.1 If yes, specify the number of doses received: 1 = 1 dose 2 = 2 doses 3 = 3 doses

27.2 If yes, date of last dose: (Months +/-Years)

27.3 If yes, did you have any adverse reactions to the vaccination? 1=Yes 2= No

27.3.1 If yes, which ones? 1= Fever 2= Headache 3= Swelling of lymph nodes in armpit 4= Large sore that took a long time to heal 5= other, please specify.....

27.4 If you have not received this vaccine, what may be the cause? 1= Doubts about the real need for vaccines 2= Fear of side effects 3= Vaccine unavailable 4= High-cost 5= for religious or philosophical reasons 6= Negative experience with vaccines

28. What was the source of funding for the vaccines you received? 1= Free
2= Personal sources 3= Hospital funded 4= other,
specify.....