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**QUALIFICATION WORK**

on the topic: « **ANALYSIS OF MODERN APPROACHES TO THE PREVENTION OF COVID-19 IN GLOBAL PRACTICE** »

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## ANNOTATION

The qualification work examines the general principles of infection prevention in countries with SARS-CoV-2 transmission among the population and the attitude to temporary measures introduced by the state. A survey of pharmacy visitors was conducted regarding their awareness of Covid-19.

The qualification work consists of the introduction, three chapters, conclusions and the list of the studied literature.

The total amount of makes 52 pages of the text, including 11 tables and 23 figures. The bibliography contains 58 names of the studie.

*Key words*: COVID-19, coronavirus, prevention, pharmacist, survey, vaccination, temporary measures.

## АНОТАЦІЯ

У кваліфікаційній роботі розглянуто загальні принципи профілактики інфекції у країнах із передачею SARS-CoV-2 серед населення та ставлення до тимчасових заходів, запроваджених державою. Проведено опитування відвідувачів аптек щодо їх обізнаності до Covid-19.

Кваліфікаційна робота складається з вступу, трьох розділів, висновків та літератури. Загальний обсяг складає 52 сторінок, у тому числі 11 таблиць та 23 фігур. Бібліографія містить 58 найменувань.

*Ключові слова:* COVID-19, коронавірус, профілактика, фармацевт, опитування, вакцинація, тимчасові заходи.

**CONTENTS**

## ABBREVIATIONS

COVID-19 - Coronavirus disease 2019

CDC - Centers for Disease Control and Prevention

EMA - European Medicines Agency

EU - European Union

Hib - Haemophilus influenzae type b

HIV - human immunodeficiency virus

ID - Identity document

LMIC - Low - and middle - income countries

MP - Medical Products

NHS - National Health System

PC - Pharmaceutical Care

SARS-CoV-2 - Causative agent of the coronavirus disease

PC - Pharmaceutical Care

USA - United States of America

WHO - World Health Organization

# INTRODUCTION

**Relevance of a subject.** In late 2019, the novel coronavirus spread rapidly, prompting the World Health Organization (WHO) to declare a public health emergency and characterize it as a pandemic in March 2020. The virus that causes coronavirus disease 2019 (COVID-19) has been designated as a severe acute respiratory disease.

The emergency phase of COVID-19 is over, but the virus continues to spread and threaten the lives of people, especially the elderly, those with chronic diseases, those who are immunocompromised, or pregnant women.

Safe and effective vaccines help prevent severe disease and death from COVID-19. In 2021 alone, COVID-19 vaccines saved an estimated 14.4 million lives [49]. Vaccination also reduces the likelihood of new strains of the virus emerging. On 30 January 2020, the WHO Emergency Committee provided public health advice and proposed formal interim recommendations to prevent the spread of infection for all countries [47]. It lists the measures that need to be put in place to prevent Covid-19 at the state level. Communicating country risks and engaging communities are critical public health measures in all countries. Countries should have prepared for rapid, regular communication with the population. Infection prevention interventions aimed at reducing transmission include universal source control, early detection and isolation of suspected cases, vaccination, quarantine after exposure, and the use of appropriate personal protective equipment.

Despite the optimistic vision of the future, it is believed that the government should invest more in health emergency preparedness.

**To achieve the put purpose** the following **tasks** of the research were definite:

- to analysis of concept of vaccination as a socio-economic category;
- to study of the experience of the appearance and spread of the coronavirus disease;
- to analysis of information needs of consumers of vaccines against COVID-19.

**The subject of the study** was the theoretical and methodological basis concept of vaccination, temporary measures introduced by the state.

**The objects of the study** were Covid statistics; WHO website, published reports of countries.

**Methods of researches.** The research material was data from World Health Organization reports, analyzed using analytical, comparative and generalization methods.

**The practical significance of the work** is used in the development of general principles of infection prevention, (using the example of Morocco).

**Scientific novelty.** The main areas of prevention of infectious diseases are analyzed, state measures and their impact on the population are summarized.

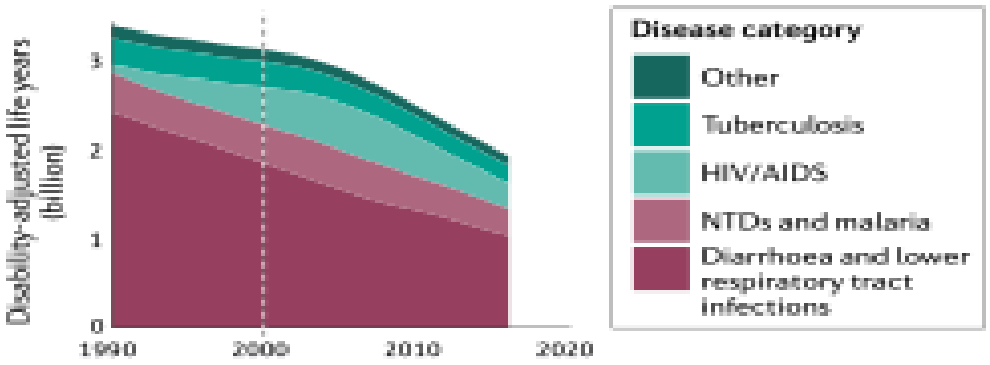
**Structure and volume.** The qualification work consists of the introduction, three heads, conclusions and the list of the studied literature.

# CHAPTER 1. VACCINATION AS A MEDICAL AND SOCIAL PROBLEM.

## 1.1. The concept of vaccination as a socio-economic category

Infectious diseases are dangerous due to their complications, which can lead to disability, and some even to death. There are various means of protection against an unpleasant infection, one of them is immunization, that is, increasing human immunity. Infectious diseases, which can be protected by immunization, are transmitted from an infected person to a healthy person, as a rule, by airborne droplets.

In premodern times, colonization, slavery and war led to the global spread of infectious diseases, with devastating consequences. Human diseases such as tuberculosis, polio, smallpox and diphtheria circulated widely, and before the advent of vaccines, these diseases caused substantial morbidity and mortality [35]. However, in the past two decades, medical advances, access to health care and improved sanitation have reduced the overall mortality and morbidity linked to infectious diseases, particularly for lower respiratory tract infections and diarrhoeal disease (fig. 1.1).

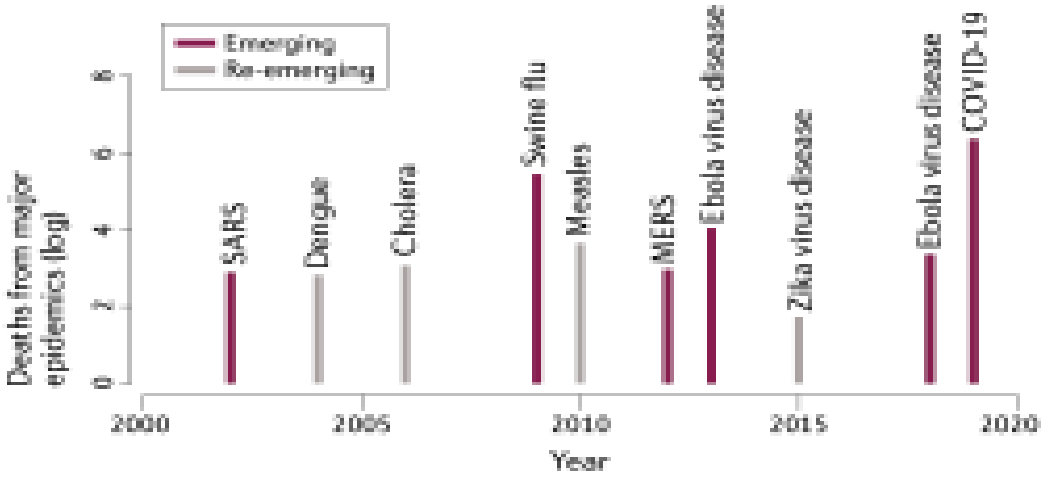



Source: Our World in Data.

Fig.1.1 Disability-adjusted life years lost from infectious diseases.

The burden of infectious diseases remains significant in low- and lower-middle-income countries, while mortality and morbidity from neglected tropical diseases, human immunodeficiency virus (HIV), tuberculosis and malaria remain high. In addition, mortality from new and recurrent infections, compared with

seasonal and endemic infections, has persisted throughout the twenty-first century (fig. 1.2). This points to a possible new era of infectious diseases, defined by outbreaks of new, reemerging and endemic pathogens that are rapidly spreading due to global connectivity and range shifts due to climate change.




Source: World Health Organization.

Fig.1.2 Infographic of changes in mortality from major epidemics over the past 20 years.

New infections chart a pathway beginning with emergence, followed by local-scale transmission, movement beyond borders and possible global-scale spread. Global changes may differentially affect the risk of emergence, the dynamics of disease within a local population and the global spread of diseases between populations.

Around the world, vaccine-preventable diseases cause significant harm to society in terms of morbidity, mortality and economic burden. Vaccination is one of the most important medical advances in history [43].

For the first time, the introduction of a small amount of the virus subcutaneously began to be practiced in the X-XI centuries in Central Asia. Later, this practice spread throughout the world: the nasal method of administration was increasingly used in Asia and Africa, and subcutaneous injections - in Europe. In 1721, variolation began to be carried out in England [6].

The terms "vaccine" and "vaccinology" came into use shortly after Edward Jenner discovered the smallpox vaccine. Jenner called the smallpox vaccine "the

smallpox vaccine." For his contributions, Jenner is often called the "father of vaccinology" (although this epithet is sometimes also used to refer to Louis Pasteur). The word vaccine comes from vacca, the Latin term for cow [4]. The first use of the term "vaccine" is credited to the Swiss physician Louis Odier (1748–1817), and the terms "vaccinate" and "vaccinate" were first used by Richard Dunning (1710–1797) [8].

Vaccines are the optimal disease prevention strategy because they are effective, efficient and cost-effective; however, it is clear that the effectiveness of vaccines is limited by their use. A vaccine is “an inactivated or attenuated pathogen or component of a pathogen (nucleic acid, protein) that, when administered to a host, stimulates a protective response by cells of the immune system,” or it is an “immune-biological substance” designed to provide specific protection against a specific disease” [38].

The process of administering a vaccine is called vaccination. Vaccination is the process of protecting susceptible people from disease by administering a live or modified agent (such as oral polio vaccine), a suspension of killed organisms (as in whooping cough), or an inactivated toxin (as in tetanus).

Vaccination is a simple, safe and effective way to protect against diseases before a person comes into contact with their pathogens. Vaccination uses the body's natural defense mechanisms to create resistance to a number of infectious diseases and makes the human immune system stronger. Vaccination can protect the body from infection, avoid important complications and complications from it.

The purpose of vaccination is to protect individuals at risk of disease. Children, older adults, people with weakened immune systems, people living with chronic diseases, and people living in areas where the disease is endemic are most often at risk. Vaccination is a common strategy for disease control, eradication, eradication or containment.

Immunization is “the artificial induction of active immunity by introducing into a susceptible host a specific antigen of a pathogenic organism” [48].

Immunization (according to the World Health Organization) is a process in which a person gains immunity, or becomes resistant to infectious illness, and which results in I'm worried about the introduction of the vaccine [48].

However, immunization and vaccination are often used interchangeably (fig.1.3). Vaccinology combines the principles of microbiology, immunology, epidemiology, public health and pharmacy, among others [11].

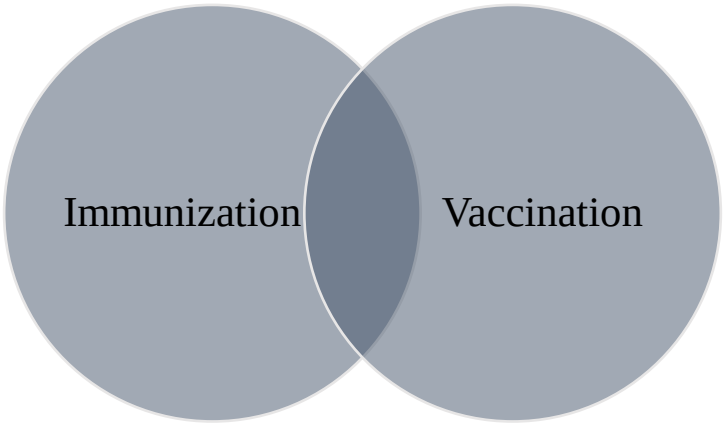



Fig.1.3 The relationship between immunization and vaccination.

Like diseases, vaccines train the immune system to produce specific antibodies. However, vaccines contain only killed or weakened forms of pathogens of a particular disease - viruses or bacteria - that do not lead to disease and do not pose a risk of complications associated with it.

Infections that can be prevented by vaccination include: whooping cough, diphtheria, tetanus, polio, measles, mumps, rubella, hepatitis B, Hemophilus infection, pneumococcal infection, meningococcal infection, rotavirus infection, chicken pox, hepatitis A, papillomavirus infection, and others.

The introduction and widespread use of vaccines have had a profound impact on the emergence of a number of infectious diseases. Smallpox was eradicated from around the world - the last naturally occurring case was in 1977 - and smallpox vaccination stopped [8]. Polio is on the verge of eradication. Vaccines have been proven to be an effective, safe and cost-effective means of controlling and eliminating life-threatening infectious diseases. They save approximately 2 to 3 million lives every year [11]. However, to achieve herd

immunity through vaccination, it is important that vaccination coverage of the population is above a certain disease-specific threshold [29].

**Achievement of vaccination** [8,48]

Every year, thanks to vaccinations, 2.5 million children's lives are saved in the world. Here are some facts about vaccination achievements:

- thanks to vaccination, humanity defeated natural smallpox;
- the incidence of poliomyelitis has decreased by 99%, just a little more and humanity will destroy this terrible disease forever;
- the incidence rate of tetanus, diphtheria, whooping cough, rubella, meningitis, and liver cancer decreased;
- global mortality from measles decreased by 75%;
- the annual death rate from neonatal tetanus decreased by more than 13 times.

### 1.2. Addressing the social issues around vaccination.

Immunization is a global health and development success, saving millions of lives every year. Vaccines reduce the risk of infection by targeting the body's natural defenses. Today's world has vaccines to prevent more than 20 life-threatening diseases, helping people of all ages live longer and healthier lives.

Immunization is a key component of primary health care and an undeniable human right. It is also one of the best health investments money can buy. Vaccines are also critical to preventing and controlling infectious disease outbreaks. They underpin global health security and will be a vital tool in the fight against antimicrobial resistance.

At the same time, according to the World Health Organization, more than 20 million people in the world did not receive the necessary vaccines [48]. Fears about possible side effects and not always justified prejudices about vaccination are the reason why many adults refuse to vaccinate themselves and their children.

As defined by the Centers for Disease Control and Prevention (CDC), vaccines are drugs that stimulate the human immune system to develop immunity against specific infectious diseases. Vaccination involves the implementation of

active immunization artificially, that is, the formation of specific immunity to an infectious agent/toxin in response to vaccination.

Today, the following types of vaccines are allocated (tabl.1.1) [12,48].

Table 1.1

Classification of vaccination preparations

| **TYPES OF VACCINE** | **DISCRIPTION** | **EXAMPLES** |
|---|---|---|
| *Live vaccines* | contain live attenuated (weakened, non-virulent) strains of bacteria, viruses, or rickettsiae | tuberculosis vaccine, measles, mumps, and rubella vaccine, oral polio vaccine, varicella vaccine smallpox |
| *Inactivated (inanimate) vaccines* | contain inactivated by physical (temperature, ultraviolet radiation, etc.) or chemical (formaldehyde, alcohol) effects on microorganisms or their individual antigens | vaccines that contain whole microorganisms are called corpuscular, and vaccines that contain split microorganisms are called split vaccines |
| *Anatoxins* | contain inactivated exotoxins of infectious agents, which lose their toxic properties during the manufacturing process, but retain their immunogenicity. The use of toxoids contributes to the creation of antitoxic immunity — that is, protection against the toxin, but not against the infectious agent. Since toxoids have relatively low immunogenicity, adjuvants are used for their production - substances that increase the immunogenicity of toxoids (for example, aluminum salts). | diphtheria, tetanus, and pertussis toxoids |
| *Chemical vaccines* | contain antigens of microorganisms obtained from them chemically | vaccine for the prevention of Hib infection, the polysaccharide vaccine for the prevention of meningococcal infection |
| *Recombinant vaccines* | contain antigens of microorganisms obtained by methods of genetic engineering. The production of recombinant vaccines involves introducing the gene of an infectious agent into the genome of another organism, followed by the synthesis of the necessary antigen | vaccine against hepatitis B, rotavirus infection, papillomavirus infection. |

Also, drugs for active immunoprophylaxis are divided into monovalent (intended to form protection against one infection, for example against hepatitis B) and combined (intended to form protection against ≥2 infections) [17].

The high level of coverage of the population by vaccination (about 95%) is the basis for the formation of collective immunity, which prevents the spread of the infection even when it is imported from another country. Herd immunity is very important for people who cannot be vaccinated due to health conditions and have contraindications to vaccination. In a society with a high level of vaccination coverage, such people can be calm, because they are protected by herd immunity, most people are vaccinated and cannot infect them with a dangerous infection. That is why vaccination provides not only personal protection against infectious diseases, but also protection of people who need it most of all, but cannot get vaccinated due to contraindications.

More vaccines have been developed and others are already in the late stages of clinical trials, making this decade the most productive in the history of vaccine development. More money is available for immunization through innovative financing mechanisms. And more creative energy, knowledge, and technical know-how is being put to use through the development of public-private partnerships – forged to help advance the immunization-related global goals.

The vaccine industry is experiencing a new, more dynamic period. Since the year 2000, the global vaccine market has almost tripled – reaching over US$ 17 billion in global revenue by mid-2008, and making the vaccine industry one of the fastest growing sectors of industry. Most of this expansion comes from sales in industrialized countries of newer, more costly vaccines, which account for more than half of the total value of vaccine sales worldwide.

In 2020, the World Health Assembly endorsed the Immunization Agenda 2030, the 2021–2030 global strategy that envisions a world where everyone, everywhere, at every age, fully benefits from vaccines [47]. According to WHO, total immunization coverage for 2022 varies among countries. We have identified

the main diseases and compiled them into a table by region of immunization coverage in the world [48,58] (tabl.2.2).

Table 2.2

Global immunization coverage in 2022.

| Viral disease | Pathogen | Global coverage | European region | South-East Asia | Western Pacific |
|---|---|---|---|---|---|
| Haemophilus influenza (meningitis, pneumonia) | Haemophilus influenzae type b (Hib) | 76% | 93% | 91% | 32% |
| Hepatitis B | HepB | 84% | 80% | 45% | 18% |
| Cervical cancer | Human papillomavirus | 21% | 16% | - | - |
| Meningitis | Neisseria meningitidis | 85% | - | - | - |
| Pneumococcal infections | Streptococcus | 60% | 83% | - | 23% |
| Yellow fever | Flavivirus genus | 45% | - | 45% | - |
| Tetanus | Clostridium tetani | 84% | 43% | 52% | 67% |
| Rubella | Family Togaviridae, Genus Rubivirus | 68% | 23% | 80% | - |
| Diarrhoeal disease | Rotaviruses | 51% | 88% | 77% | 70% |
| Polio | Poliovirus | 84% | 94% | 91% | 91% |

Today, in all developing countries of the world, regular vaccination against measles, poliomyelitis, diphtheria, tetanus, whooping cough and tuberculosis is carried out. Several new ones have been added to the basic package of vaccines that have been standard for many years.

This is immunization against hepatitis B, which is available to children in 147 of the 192 countries that are members of the WHO; from Haemophilus influenzae type b (Hib), which is recommended in those countries where there are facilities for it (carried out in 89 countries) [58].

The yellow fever vaccine is available in approximately two-thirds of countries where there is a risk of yellow fever outbreaks.

Regular immunization against rubella is carried out in 111 countries. Immunization programs can cover adolescents and adults (depending on the specific disease), as well as newborns and young children [47].

In 2022, 14.3 million infants did not receive a first dose of DPT vaccine, and a further 6.2 million infants were only partially vaccinated, indicating insufficient access to immunization and other health services. Of these 20.5 million children, more than 60% live in 10 countries: Angola, Brazil, Democratic Republic of Congo, Ethiopia, India, Indonesia, Mozambique, Nigeria, Pakistan and the Philippines [57].

Monitoring vaccination data at the subnational level is critical to helping countries prioritize and adapt vaccination strategies and plans to close gaps in immunization coverage and ensure everyone receives life-saving vaccines.

The right to health care - this is the right to access preventive care medical care and the right to receive benefits from medical care in accordance with the provisions of the national law and practice.

In accordance with Article 8 of the Convention for the Protection of Human Rights and Fundamental Freedoms, everyone has the right to respect for his private and family life, home and correspondence [12].

Public authorities may not interfere with the exercise of this right unless the interference is lawful and necessary in a democratic society:

- in the interests of national and public security or the economic well-being of the country;
- to prevent disorder or crime;

- to protect health or morals or to protect the rights and freedoms of others.

"Medical care" in the sense of the Declaration on the Policy on Ensuring Patient Rights in Europe - are types of medical, nursing or related services that provided by health care and treatment institutions preventive institutions. They correspond to the financial, human and material resources of society and aim to ensure permanent access to necessary medical care for all without any discrimination [15]. This declaration also contains important for general new trend of provisions that establish equality of rights patients of a therapeutic and preventive nature.

Medical care should be considered as a provision medical service, which include not only detection and treatment of the disease, but also prevention (prophylaxis) and rehabilitation. Prevention should include medical examinations, vaccinations, etc. High-quality and affordable prevention is the basis of medical care, as it is called save health and save treatment costs. It should be considered that modern international standards and progressive legal opinion reasonably recognize prevention is an integral part of the concept of "medical help".

In general, the analysis of international documents allows conclude that international medical standards care is patient-centered, exclude any discrimination, establish guarantees of availability of necessary medical care and are aimed at prevention and early detection of the disease. Aid must take into account the individual needs of the patient and is focused not only on performing the necessary manipulations, but also on avoiding unjustified suffering and pain, ensuring work capacity and the possibility of personal satisfaction urgent needs of the patient.

When there is a threat of a particularly dangerous infectious disease or mass spread of dangerous infections-diseases in certain territories and objects can profanatory preventive vaccinations against this are carried out infectious disease according to epidemic indications. To carry out preventive vaccinations, it is

possible to administrative coercion, as security, should be avoided solving public health issues, when public interests of preservation and strengthening of the public health prevail over the private interests of the violation of the rights and private interests of individuals.

In its judgment of 28 April 2021 (CASE OF VAVRICKA AND OTHERS v. THE CZECH REPUBLIC), the European Court of Human Rights emphasized that there is general agreement that vaccination is one of the most successful and cost-effective health measures and that each state should try to achieve the highest possible level of vaccination among its population [45]. The Convention and other international instruments place a positive obligation on Contracting States to take appropriate measures to protect the life and health of persons under their jurisdiction [12].

The exercise of the right to vaccination is preceded:

- by the development and registration of a safe, effective vaccine in the state;
- accessibility vaccines for citizens;
- awareness of the properties of the vaccine and the consequences of its administration.

The benefits of vaccination, one of the most cost-effective public health interventions, have not fully reached the target beneficiaries in many low- and middle-income countries (LMIC) [48]. Although the field of vaccine research and vaccinology has received much attention since the discovery of smallpox vaccine by Edward Jenner (1749-1823) in 1798, more than two centuries later, approximately 20% of deaths among children under 5 years of age are due to diseases that preventable with currently licensed vaccines [22]. Since the discovery of the smallpox vaccine, a number of vaccines have become available. Vaccine Research and Vaccinology witnessed something of a "renaissance in vaccine research and use" in the early 1970s and 1980s, and now, in the 21st century, there are licensed vaccines against nearly 27 pathogens and ongoing research into vaccine candidates against almost 130 pathogens [17].

Immunoprophylaxis allows us to speak only conditionally about "infection control". Modern man and infectious agents are under constant, regular changes that made vaccination not always a one hundred percent remedy provision of real individual or collective specific immunity from infection [7]. However, today vaccination is recognized as the only one an effective means of combating infections, viruses, so cases of mandatory vaccination, i.e., restrictions, cannot be excluded the right to vaccination, in order to develop a collective immunity, reduction of serious consequences of infection.

Preventive vaccinations are carried out: only by medical workers who have received appropriate training; with mandatory provision of objective medical information persons who are vaccinated or their legal representatives about the effectiveness of preventive measures vaccinations and possible post-vaccination complications; with a mandatory preliminary medical examination to determine the patient's condition and decide on vaccination [18].

## Conclusions to the I Chapter

Today, immunization is considered one of the most effective methods of combating all kinds of dangerous diseases: tetanus, diphtheria, hepatitis, whooping cough and many others. The essence of the method is to give a person a special vaccine that activates the body's protective reactions. This process was first carried out at the end of the 18th century.

Vaccines stimulate the body's own immune system to protect a person from the corresponding infectious disease. The result of vaccination is the formation of specific post-vaccination immunity. In addition to mandatory vaccinations, there are recommended vaccinations that are actively used in the world to prevent diseases. The results of recent scientific studies indicate that vaccines prevent the development of about 60 infectious diseases.

Vaccination coverage of the population at the level of 95% makes it possible to ensure full protection of the population from outbreaks and epidemics of infectious diseases that can be prevented by vaccinations - this is called collective immunity.

# CHAPTER 2. STUDY OF THE EXPERIENCE OF THE APPEARANCE AND SPREAD OF THE CORONAVIRUS DISEASE.

## 2.1. The COVID-19 pandemic: historical aspects.

Throughout history, infectious diseases have posed a danger to the life and health of society. Microbial diseases (bacteria, viruses, parasites, and fungus) have instigated disaster throughout human history . Emerging and re-emerging microbial diseases along with multiple drug-resistant, pandrug-resistant, extensively drug-resistant are now taking place at skyrocket high-speed. Infectious diseases constantly arise and spread with unprecedented speed. According to the World Health Organization, the world has seen several outbreaks and epidemics caused by more than 20 infectious agents over the past decade [50].

Over the past two decades, the emergence of coronavirus-related diseases has created global challenges for health care systems. SARS-CoV-2 (the causative agent of the coronavirus disease COVID-19) is the latest addition to this growing list of unwanted new agents. On January 30, 2019, WHO declared COVID-19 a public health emergency of international concern and a pandemic [50].

Coronaviruses are a huge family of viruses that cause diseases ranging from the common cold to more severe diseases such as MERS, SARS and the current global pandemic, COVID-19 [1]. There is no clear pharmacologic intervention, medical treatment, or vaccine for the novel coronavirus. However, many of the pathological challenges of COVID-19 are currently being treated with available clinical options, and thus current treatment planning is largely based on the clinical context of each patient [23].

An outbreak of the virus was first reported in Wuhan, China, in December 2019. On January 30, 2020, the World Health Organization declared the outbreak a public health emergency of international concern and a pandemic on March 11. As of March 24, 2024, over 775 million cases have been reported worldwide [24]; More than 7 million confirmed deaths[4], making the COVID-19 pandemic one of the deadliest in history [1,51]. In January 2020, Chinese scientists discovered the cause of a previously unknown pneumonia, from which many people died in

the city of Wuhan. They found genes of a positive, single-stranded virus classified as subgroup B in the cells of the patients' respiratory organs. This virus was completely new, but it had a lot of similarities with the coronavirus that caused the SARS pandemic in 2002-2004: SARS-CoV (tabl.2.1) [34,56].

Table 2.1

Chronology of Covid-19 incidence

| **Years** | **Chronology of development** |
|---|---|
| 2019 | For the first time, an outbreak due to infection with a new coronavirus was recorded in Wuhan in China. |
| 2020<br>2021 | WHO declared the epidemic an international emergency.<br>On March 11, WHO declared a pandemic of the disease, which was given the name COVID-19 (Corona Virus Disease).<br>February 2020, the number of infected people in China reached a peak of 15 thousand per day.<br>During January - February 2020, most countries introduced restrictive measures such as a state of emergency, curfew, quarantine, restriction of movement, and the work of a number of enterprises was suspended.<br>During 2020-2021, several waves of the pandemic were recorded, in addition, several strains of coronavirus were identified.<br>The number of deaths directly or indirectly related to the COVID-19 pandemic between January 1, 2020 and December 31, 2021 was approximately 14.9 million. |
| 2022<br>2023 | By the beginning of 2022, the total number of identified cases of infection exceeded 285 million, thus, the proportion of those infected with coronavirus amounted to almost 4% of the world's population, and 5.5 million people died.<br>The largest number of cases of the disease - about 20 million - were detected in a month in the USA, in France the maximum was registered - over 500 thousand infected per day, the next surges in incidence occurred in India (350 thousand infected per day), Argentina (140 thousand) , Poland and the Czech Republic (about 55 thousand). In April 2022, the incidence rate dropped to 24 million new infections. However, in early May, WHO reported an increase in incidence in more than 50 countries, which was caused by the spread of subtypes of the omicron variant.<br>By the beginning of 2023, in most countries of the world, the main restrictions on Covid were lifted; at the beginning of the year, some countries transferred COVID-19 to the category of seasonal influenza. |
| 2024 | Currently, 650,408,425 cases of coronavirus have been confirmed in the world, 6,648,050 people have died, and 6,27,410,420 have recovered.<br>Cases of the disease have been recorded in 185 countries. In Russia, 21,628,829 cases of coronavirus infection have been detected, 392,176 people have died.<br>The largest number of people infected with coronavirus is in the United States - 98,962,019 people. |

From December 2019 to today, the COVID-19 pandemic has continued to spread throughout the world. TO by mid-March 2021, countries around the world had recorded more than 123 million cases of the disease - almost five times more than the previous year - and more than 2.7 million deaths associated with this disease. Although the number of new cases has now decreased, the global health community has already has administered nearly 400 million vaccine doses, finally showing some signs of hope and progress [16,56,58].

The scale of the human toll caused by the COVID-19 pandemic is becoming increasingly clear as scientists and epidemiologists examine available data and draw conclusions where data is lacking. A major study published recently found that COVID-19 was one of the leading causes of death in 2020 and the leading cause of death in 2021 worldwide. COVID-19 kills more people than coronary heart disease, which killed 8.9 million in 2019, and cancer, which killed 9.5 million in 2018. Covid ranked third among causes for 2021 mortality. Only cardiovascular diseases and cancer kill more people (fig.2.1) [34].

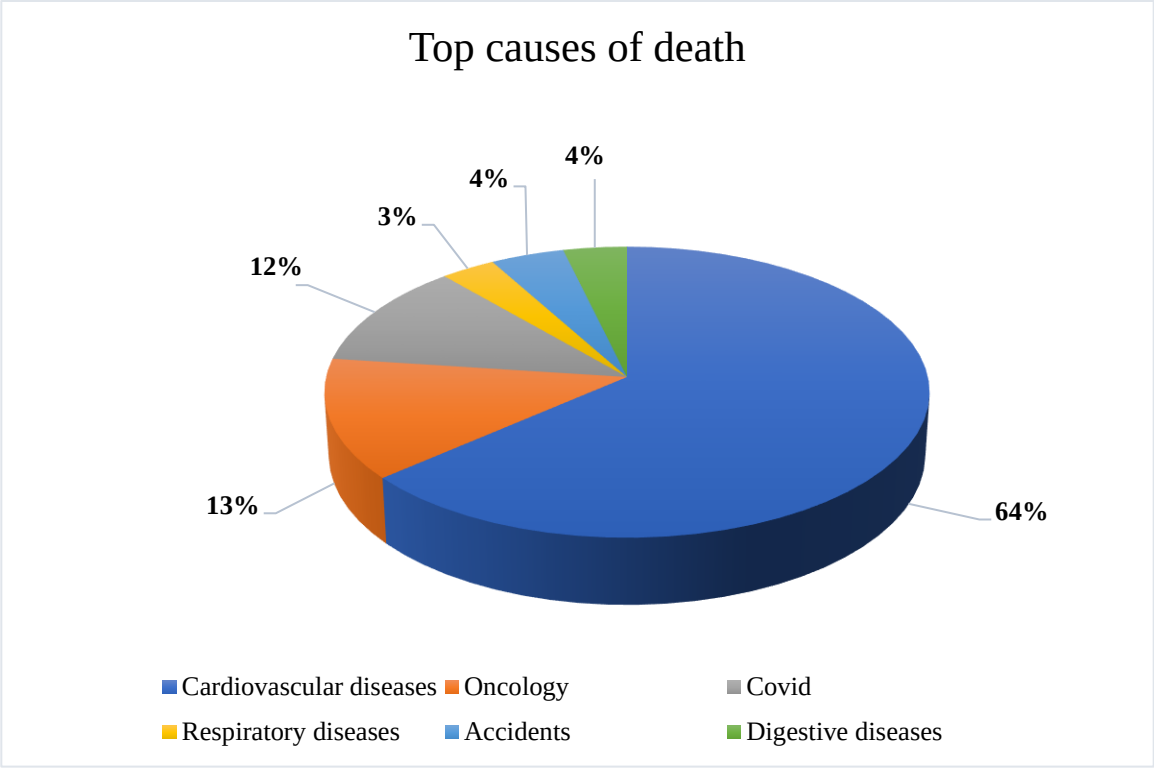



Fig.2.1 Top causes of death, 2021.

Realistically calculating the impact of the pandemic matters. This affects the response of governments and health systems, as well as the distribution of financial assistance and vaccines. Using statistical data, we have generated a chart that shows the change in coronavirus indicators during 2020-2024 (fig.2.2) [41,51-58].

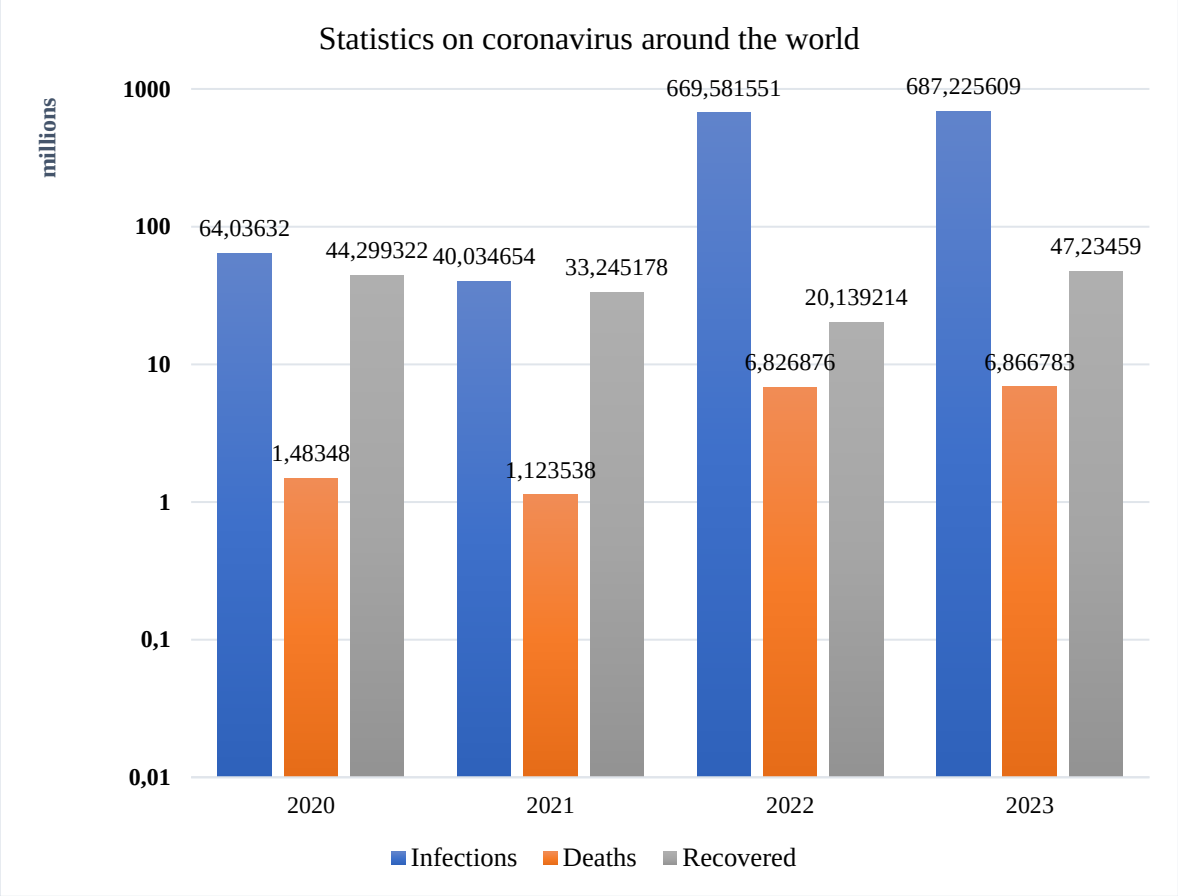



Fig. 2.2 Statistics millions on coronavirus around the world, 2020-2023.

**2.2 Organization of medical and pharmaceutical care for Covid-19.**

In 2020, the coronavirus disease 2019 (COVID-19) pandemic caused by the SARS-CoV-2 virus became a major public health emergency. This situation required governments and health sectors to adopt new measures to prevent infections, save lives, and minimize the overall effects of the disease [52]. Health systems have been overwhelmed by the pandemic and have resorted to a variety of strategies and actions to reorganize processes and workflows to improve the efficiency of services at different stages of the pandemic.

Within the public and general health system, the primary function of offering preventive, curative, rehabilitative and rehabilitative actions is the basis for society to achieve full health, increase productivity and protect communities [3] [54]. The COVID-19 pandemic has suddenly shifted the priorities of health systems, exposing the weaknesses of many systems that were already overwhelmed and had limited capacity [16,21]. Thus, overcoming the pandemic involved immediate action to optimize and expand response capacities and long-term action to restructure public health systems so that they are better prepared to deal with public health emergencies [16,25].

The WHO Regional Office for Europe has developed technical guidance to provide health system decision makers with actionable information and reference on the steps to be taken to strengthen the COVID-19 response (fig.2.3) [6,53].

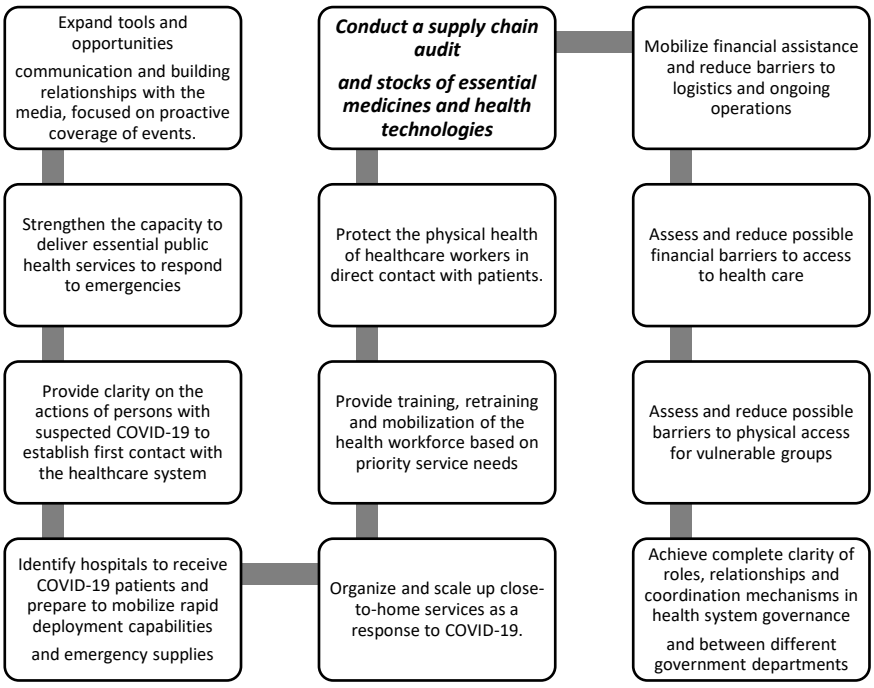



Fig.2.3 COVID-19 Response Recommendations for Healthcare Systems.

The COVID-19 pandemic opened up an important epidemiological discussion about the expansion in frequency and proportion of emerging infectious diseases with the capacity to become pandemics in this century [39]. There are several signs that indicate this change: the emergence of new infectious agents or the mutations of existing viruses, which may be even more infectious;

infections in different animal species; development of antimicrobial resistance; higher incidence of infectious diseases due to globalization, international movement of people and goods, climate change, relaxation of public health measures, and introduction of infectious diseases in isolated areas [42].

Among the challenges of the COVID-19 pandemic, activities related to the management of pharmaceutical services have had a significant impact on the delivery of care and have been the object of planning and optimization. The responsibility of providing supplies and medications to patients with COVID-19 and other illnesses [6] and offering clinical support and assistance to users required pharmacists to take on new roles and adapt their regular routines [19].

It is important to consider the impact of these changes, disseminate effective actions, and share lessons learned so that healthcare providers are better prepared to deal with future emergencies [10].

Continued access to medicines was a challenge seen at the beginning of the pandemic. Government measures, coordinated with medicines regulatory authorities, have been implemented to facilitate access to medicines in several countries (fig.2.4) [55].

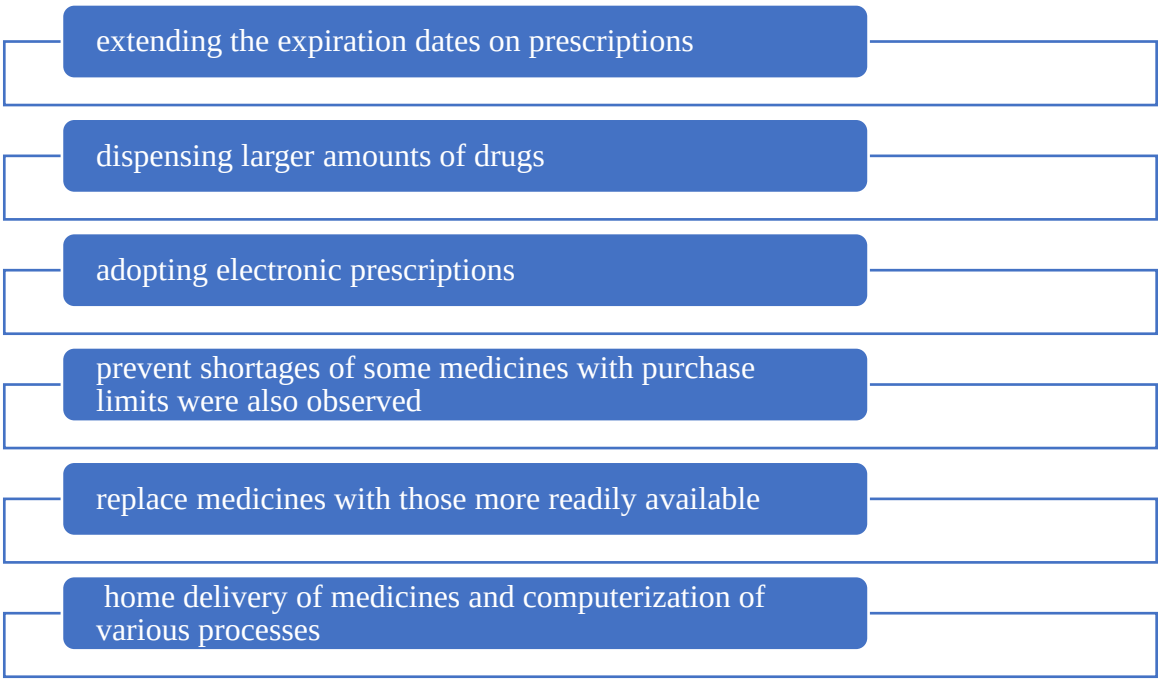



Fig.2.4 Government measures that were taken to facilitate access to medicines at the onset of COVID-19.

The pandemic led to the rapid implementation of interventions previously only being delivered in a small number of pharmacies or still at the planning stage, such as telehealthcare; this was the case in a hospital in Spain that organized a medicines delivery service in community pharmacies close to the patients [39]. A similar service was organized in Saudi Arabia for the delivery of biological medicines which adopted various strategies for the organization of the entire logistics chain and temperature control for the transport and storage of medicines [26,30].

Remote care, characterized by telepharmacy services, showed rapid development and stands out as an action adopted by various countries to provide guidance and monitor the use of medicines by patients [14,13,26,44]. Several guidelines for the implementation of telepharmacy and the use of digital technologies have been issued by the governments of several Brazilian states and by the government of Australia authorizing or regulating the practice of pharmaceutical care [14,26]. In Australia the government allowed pharmacists to carry out telephone medication reviews and telehealth for specific programs promoting the discussion of individual cases and review of medicines by the pharmacist [15, 25].

The description of a telepharmacy service implemented in Spain during the pandemic, shows the details of how it works, and the results obtained, making it an important model to be replicated in other locations. It highlighted the role of pharmacists in combating COVID-19 there was good acceptance by the population [10]. The use of information and communication technologies highlights the importance of a minimum digital infrastructure for the operation of telepharmacy and other digital solutions.

In the interventions related to the acquisition and distribution of medicines, the studies reported a desire by managers to ensure the maintenance of the supply chain throughout the pandemic. Thus, several interventions attempted to address this situation through mediation and dialogue with government institutions, manufacturers, and regulatory agencies to minimize the shortage of essential

items [10]. An interesting initiative was reported in a hospital in Spain which described a new process to maintain the supply chain during the pandemic [36]. Another in western Kenya guaranteed continuous access to medicines in a rural area with the revolving fund pharmacy model. The health care system of all countries is focused on responding to the outbreak of COVID-19.

In table 2.2, we have provided examples of legal solutions that have been taken by different countries to address drug shortages [10,16-18,37,57].

Tabl.2.2

Legal solutions to the problem of drug shortages during the COVID-19 pandemic

| Country | taking the drug from alternative sources | replacement of the drug in a different dosage | generic | therapeutic replacement | extempore | import of drug from another country |
|---|---|---|---|---|---|---|
| Austria | + | | + | | | + |
| Belgium | + | + | + | | + | + |
| Denmark | + | | + | | + | + |
| France | | + | + | + | + | |
| Germany | + | + | + | | + | + |
| Greece | + | + | + | | | + |
| Italy | + | | + | | + | |
| Norway | | | + | | | |
| Netherlands | + | + | + | + | + | + |
| Poland | + | + | + | | | |
| Spain | | | | + | + | |
| Sweden | | | + | | + | + |
| United Kingdom | + | | | | | |

Pharmaceutical care represents a concept introduced after 1990. According to this, the pharmacists' activity focuses on patients and aims to provide adequate therapies that lead to safe therapeutic results, as well as to improve the quality of life [7]. Thus, the traditional activity of preparation and development of drugs has

been gradually replaced by pharmaceutical services that mostly focus on the patients' needs and the particularities of their pathologies [8,9]. But, with the onset of this pandemic, the activities of all professional categories, including the pharmaceutical activities, have been disturbed and this crisis deeply and continuously marked the practice of pharmacists [10]. Pharmacists are considered the most accessible professionals from the health sector and they support the medical practice [11].

**2.3. Analysis of methods for the prevention of covid-19.**

In recent years, the entire world has faced one of the most serious challenges in the history of mankind – the COVID-19 pandemic. This infection, caused by the SARS-CoV-2 coronavirus, has had a global impact on people's health and lifestyle. As of April 2024, the number of countries (as well as autonomous territories) in which the coronavirus was detected was a total of 229. The number of people affected by the COVID-19 infection was 704,387,988. Fatal cases made up 1 percent of the total number of patients [53-58].

The spread of the virus across the planet affects all spheres of activity, and the world economy in particular. One of the most powerful tools to combat this virus is vaccination.

COVID-19 is an acute respiratory disease that is transmitted by airborne droplets and can lead to severe consequences, including hospitalization and death. Elderly people and people with chronic diseases are especially vulnerable to the virus.

Vaccines against COVID-19 are designed to stimulate the human immune system and create resistance to the virus. They can prevent severe illness and reduce the chance of infection, which is critical to reducing the spread of the virus.

Vaccination against COVID-19 remains relevant and important even for those who have contracted this infection. We have identified several key reasons why vaccination is useful and recommended even after an illness (tabl.2.3) [3,37,40].

Table 2.3

The main priorities of vaccination.

| | |
|---|---|
| **Additional protection** | After experiencing COVID-19, the body produces some immunity, but it can be incomplete and temporary. Vaccination strengthens immunity and makes it more resistant. |
| **Protection against new strains of infection** | The virus is constantly mutating and new variants can bypass the immunity acquired after the disease. Vaccines teach the body to fight different strains. |
| **Reducing the risk of re-infection** | Vaccination reduces the risk of re-infection and makes sick people less vulnerable. |
| **Protecting others** | Vaccinated people can be a barrier to the spread of the virus, helping society achieve herd immunity. |
| **Fewer complications if sick** | Vaccination reduces the likelihood of severe disease and hospitalization, saving lives and health care resources. |
| **Faster recovery** | Vaccination after an illness can help the body recover faster and avoid chronic complications. |
| **Safety and efficacy** | Vaccines have undergone rigorous clinical trials and proven safety and efficacy. They are recommended by world health authorities. |

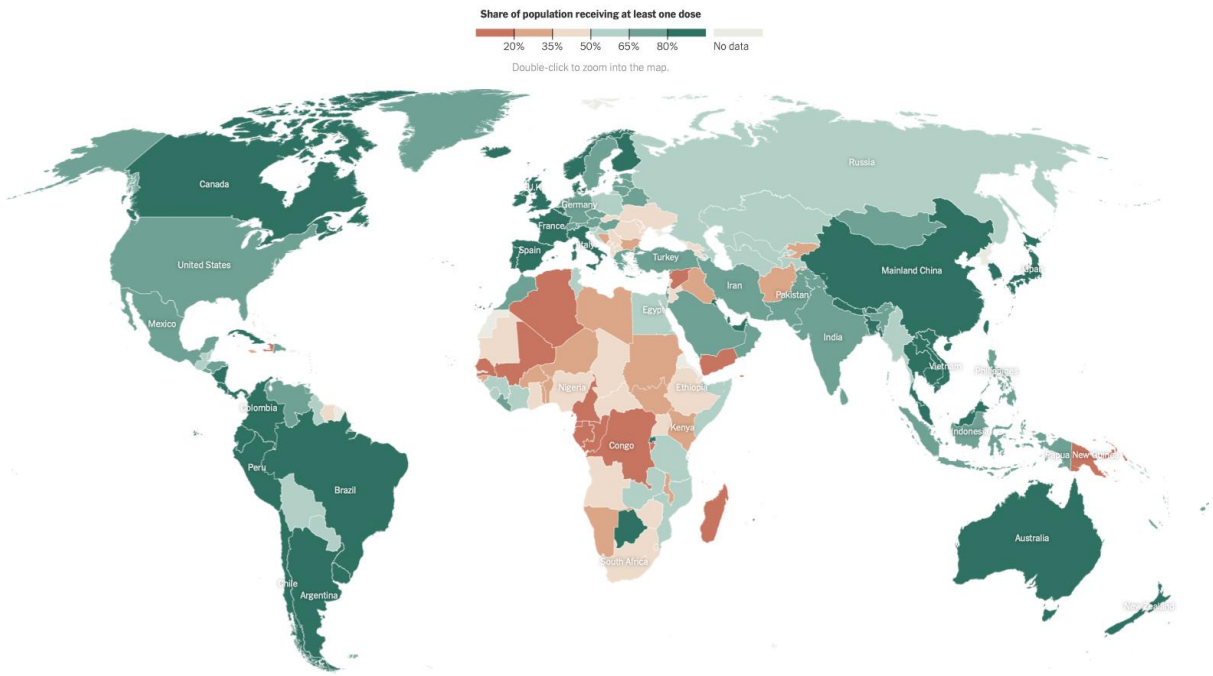
It is important to note that after an illness, it is recommended to wait for some time before vaccination, according to the doctor's recommendations. Vaccination is a key tool in the fight against COVID-19 and the creation of herd immunity, which allows a return to a more normal life. Currently, 990 developments are underway for vaccines and drugs against the coronavirus infection, but only units are used. Three vaccines have so far shown efficacy on 2021 year (tabl.2.4) [47,53,56].

Table 2.4

Types of vaccines and their action

| **Types** | **Action** | **Efficiency** |
|---|---|---|
| *Pfizer-BioNTech and Moderna* | These vaccines use mRNA technology and are among the most effective. They teach the immune system to recognize and fight the protein that is on the surface of the virus. | 95% |
| *AstraZeneca and Johnson & Johnson* | These vaccines are based on viral vectors and stimulate the immune system to attack the virus. They are less expensive to manufacture and have good efficiency. | 94% |
| *Sinovac* | This vaccine was developed in China and has its own unique method of fighting the virus. | 70% |

From the beginning of the pandemic, more than 5.55 billion people worldwide have received a dose of a Covid-19 vaccine, equal to about 72.3 percent of the world population. This map shows the stark gap between vaccination programs in different countries (fig.2.5) [51].




Source: our world in data.

Fig.2.5 Vaccination progress worldwide.

In accordance with WHO recommendations, countries that have experienced community transmission of the virus and are at risk of entering the epidemic stage should immediately implement and adapt universal distancing measures and movement restrictions, in addition to other health and public health measures to reduce exposure people to become infected and suppress transmission of the virus, which included the following [56]:

- personal protective measures that reduce the risk of person-to-person transmission of the virus, such as hand washing, physical distancing and “respiratory etiquette”;
- community-based measures to reduce contact between people, such as canceling public events, the closure of non-essential workplaces and educational institutions and the reduction of public transport services;
- measures to reduce the risk of importation or reintroduction of the virus from areas of intense spread, such as restrictions on domestic and international travel, expanded screening and quarantine;
- measures to ensure the protection of health workers and vulnerable groups, such as providing adequate personal protective equipment.

Vaccination policy has changed dramatically during COVID-19, with the rapid emergence of population-wide vaccination mandates, domestic vaccine passports, and differentiated restrictions based on vaccination status.

Modern vaccines have had a significant impact in reducing morbidity and mortality associated with COVID-19, but to mandatory vaccination, some countries have added policies to restrict people's access to work, education, public transportation, and public life based on COVID-19 vaccination status.

Since 2021, governments have introduced a sound policy of mandatory proof of vaccination to combat COVID-19. We have outlined the main directions for limiting certain life opportunities in the table 2.5 [41].

Table 2.5

Examples of mandatory COVID-19 vaccination proof policies.

| **Intervention** | **Countries** |
|---|---|
| *"No stamp, no job" mandates (eg, government employees, key workers, public and private sector)* | Australia, Canada, China, Costa Rica, Croatia, Czech Republic, Denmark, Egypt, Fiji, France, Ghana, Hungary, Italy, Latvia, Lebanon, New Zealand, Oman, Poland, Philippines, Saudi Arabia, Tunisia, Turkey, Ukraine, USA |
| *Healthcare worker mandates* | Australia, Britain, Canada, Croatia, Czech Republic, England, Finland, France, Germany, Greece, Hungary, Lebanon, New Zealand, Poland, USA (some states) |
| *Internal vaccine passports to attend social events, restaurants, bars, fitness facilities, entertainment venues and for bus/train/airport travel* | Australia, Austria, Britain, Bulgaria, Canada, CzechRepublic,Italy,Israel,Kenya,Lebanon,Morocco,Netherlands,Romania,Serbia,Singapore,Switzerland, Denmark, Egypt, France, Germany, South Korea, Ukraine, USA (some states) |
| *School-based mandates* | Canada (several provinces), Costa Rica, Lithuania and USA (some states) |
| *Full country mandatory vaccination* | Austria, Ecuador, Germany, Indonesia, Micronesia, Turkmenistan, Tajikistan |
| *Full population mandate for the elderly* | Czech Republic, Greece, Malaysia |

These policies spread around the world and included: workplace mandates (of "no punch, no work"); green passes/vaccination passports that restrict access to social activities and travel (Israel, Australia, Canada, New Zealand and most European countries); school mandates (most North American universities); differential isolation measures for the unvaccinated (Austria and Australia); use of vaccination rates when lifting quarantines and other restrictions (Australia, Canada, New Zealand); differentiated access to health insurance and health care (Singapore, Italy); and mandatory vaccination of the entire population with taxes, fines, and imprisonment for the unvaccinated (Philippines, Austria, Greece) [37].

This is an approximate list of state decisions that will already change in 2022. There are significant differences in how countries recognize immunity from infectious diseases, allow for religious, philosophical and medical exceptions, and

include testing as an alternative to vaccination. In addition, some countries have implemented a combination of policies and measures, so each is not mutually exclusive. As of March 2022, some countries have also changed course and decided not to implement this policy due to changing epidemiological circumstances and social resistance.

## Conclusions to the II Chapter

After COVID-19 had been declared a pandemic and precautionary measures such as lockdowns were instituted, access to medicines became more difficult [5]. During the first wave of the disease services was overwhelmed, and there was increased demand for medicines used for hospitalized patients, affecting the supply of these medicines for other patients [1, 5, 6]. Remote healthcare services and telepharmacy became essential for the continuity of pharmaceutical care services, accelerating the implementation of developments ongoing before the pandemic [30]. As a result, information and communication technologies were further developed during the pandemic for improved functionality. Other approaches such as the implementation of home dispensing services helped to maintain medicines for chronically ill patients [23,28,29].

Since December 2020, mass vaccination has taken place in the world. The authorities of many countries have taken measures to encourage the population to get vaccinated, or introduced mandatory vaccination at the regional level or for certain categories of the population (primarily for medical workers). According to WHO statistics, more than 13.3 billion doses of COVID-19 vaccines have been administered worldwide to date, over 5.5 billion people have received at least one dose, and 5.1 billion people have been fully vaccinated [50].

# CHAPTER 3. ANALYSIS OF INFORMATION NEEDS OF CONSUMERS OF VACCINES AGAINST COVID-19.

## 3.1. Analysis of the rate of vaccination coverage against COVID-19 in Morocco.

African countries have not escaped the spread of Covid-19. The corona virus infection first emerged in the continent in February 2020. Egypt became the first African country to report its first case of COVID-19, while Nigeria became the first African country to report a case in sub-Saharan Africa. Fortunately, Africa has previous experience preparing for and responding to various infectious disease outbreaks, including fever, measles, cholera, Ebola virus disease, HIV/AIDS and meningitis [2,27]. This experience was quickly adapted to the fight against Covid-19. Between March and May, 2020, the trajectory of the spread, hospitalization and death across Africa was minimally dispersed with confirmed cases ranging between one in Lesotho and 16443 in South Africa, and death also from zero in many countries to 665 in Egypt [2,9,33]. By June and July however, there was a sharp divergence in cases with nine countries accounting for over 80 per cent of all cases (fig.3.1) [14,57].

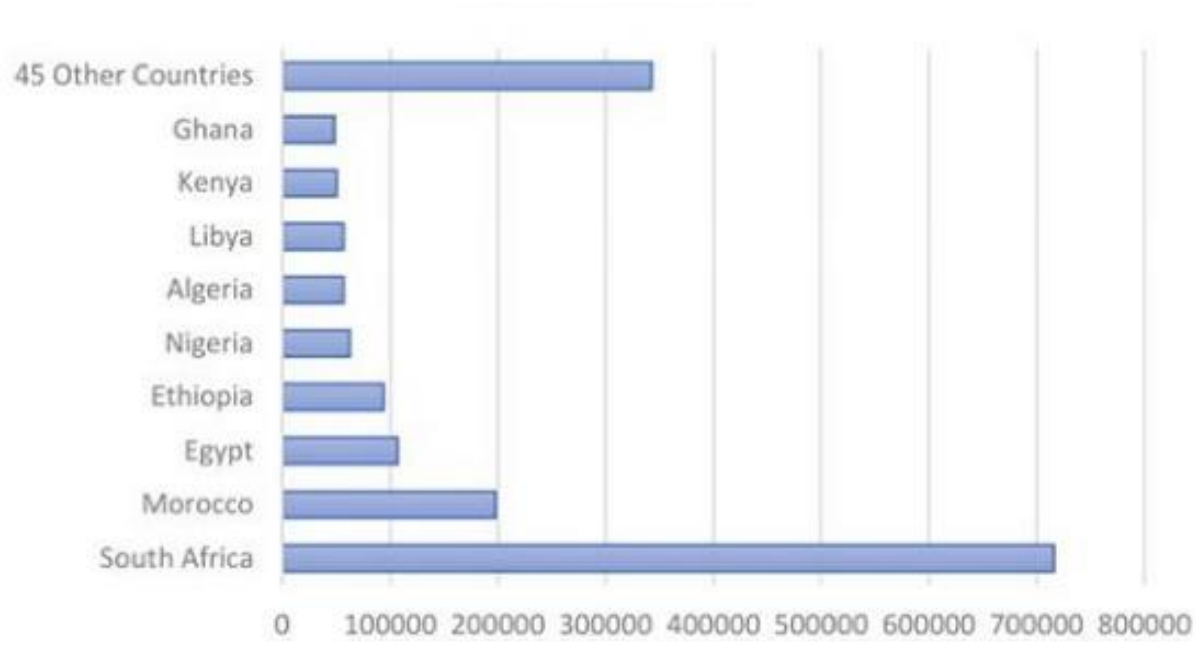



Fig.3.1 Cases in Africa.

The low number of cases compared to Europe and the United States gives rise to reasons that support rapid action before it takes hold, a young population, lower smoking prevalence compared to other countries, and experience in dealing with epidemics.

Morocco, like all countries in the world, is faced with the unprecedented situation of the global COVID-19 pandemic [31]. Since the World Health Organization announced the first warnings about the emergence and spread of this new disease, the Moroccan government has rolled out a national monitoring and response plan involving government authorities and the entire society [32].

The first case in Morocco was on March 2, 2020. The first COVID-19–associated death was announced on March 12, 2020, and the first case of local transmission was recorded on March 13, 2020. And a few days after the announcement of the others, a "health emergency" was declared and a number of measures, including containment, were put in place to contain the spread of the virus [ 32]. Morocco has a population of about 36 million people and is considered a middle-income country with limited healthcare options compared to many other countries in the region. However, the country has gained some experience in managing public health emergencies and is relatively well prepared to deal with the emerging health risks associated with the new virus, especially through training programmes and strengthening organizational and managerial capacity.

The epidemiological situation of the disease evolved in 3 stages of development of the epidemic (tabl.3.1) [20].

Table 3.1

Stages of development of the epidemic.

| | |
|---|---|
| first phase | marked by control of the situation with few cases and deaths (phase corresponding to the lockdown period) |
| second phase | corresponding with the first gradual lifting of confinement, was marked by a significant, steady increase in the number of cases |
| third phase | corresponding with a relatively generalized lifting of lockdown, was marked by an exacerbation in the number of new cases and deaths |

The organization of the national response to COVID-19 has taken a series of rigorous measures concerning the management of cases affected by the disease. Among these measures is the management of all cases in a hospital environment. Thus, any case meeting the criteria of “possible case” or “confirmed case” was hospitalized in an isolation room. Severe cases were placed in an intensive care unit. Hospitalization capacity, which was very limited at the start, has been gradually increased through the establishment of field hospitals and capacity building of hospitals responsible for handling COVID cases.

Since the announcement of the epidemic in China, the Moroccan government has deployed an institutional and risk-based communication strategy (tabl.3.2).

Table 3.2

Types of Moroccan Government Communication Strategy [20].

| | **Communication strategy** |
|---|---|
| **1.** | Different government officials, depending on their position and field of intervention, have followed one another to provide information on the epidemiological situation or measures taken. |
| **2.** | Daily press briefing on the situation linked to the epidemic was broadcasted live through national public television channels. |
| **3.** | Officials at the regional level as well as resource persons including scientists were also involved, in particular by appearing on official TV and radio channels during news bulletins and television or radio broadcasts. |
| **4.** | Multiple awareness-raising spots on preventive measures have been produced and distributed continuously to raise awareness to avoid the risk of contamination. Leaflets have been prepared to educate travelers at points of entry. |

Given the exceptional nature of the situation and in accordance with the national constitution and the regulations in force, Morocco declared a "state of health emergency" on 19 March 2020, which allowed it to take a series of preventive measures. Prevention is better than cure; hence, the spread of this disease can be controlled by paying constant attention to some basic preventative measures (fig. 3.2) [14].

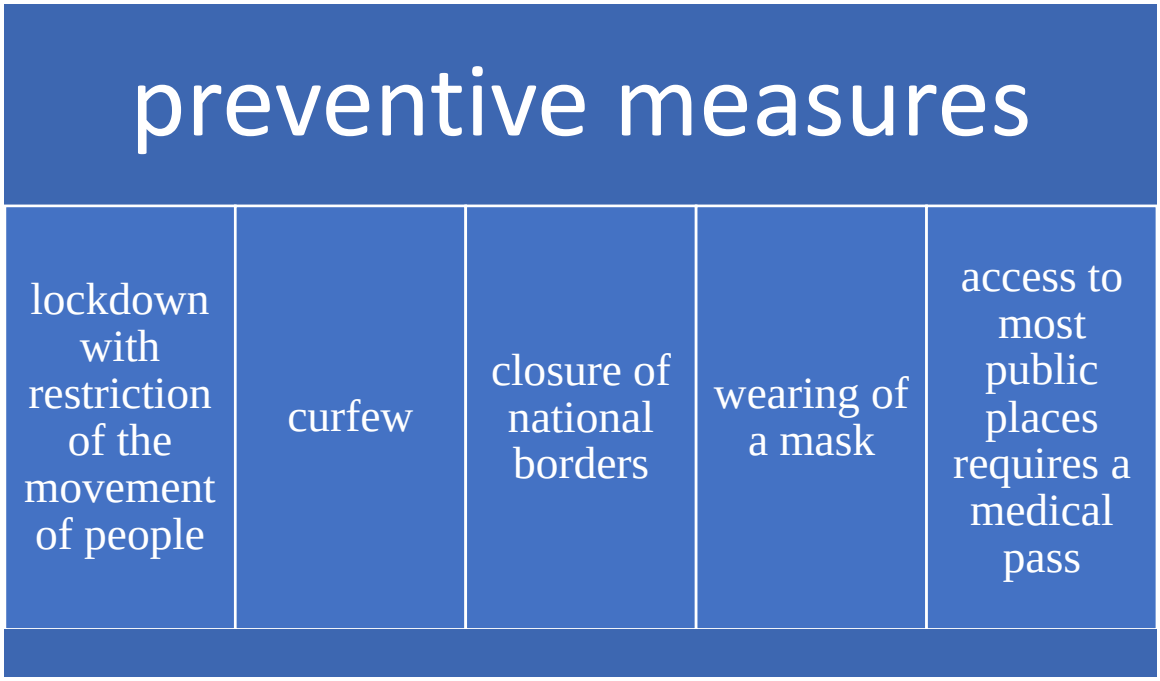



Fig. 3.2 Preventive measures to prevent the spread of Covid.

The new measures also included a ban on parties, public or private gatherings, as well as the closure of restaurants, cafes, shops and supermarkets at 20:00. Restaurants in the major cities of Casablanca, Marrakech, Agadir and Tangier were forced to close completely for three weeks. These decisions were taken in order to "strengthen the state of emergency in the field of health", which has been in force since mid-March, "based on the recommendations of the scientific and technical commission" [3].

Morocco is considered among the countries that got the virus under control early on, but when economic and social restrictions were eased, the number of cases increased considerably.

To contain the pandemic, which is hitting the economy hard, the country launched a national vaccination campaign by the end of 2020, aimed at immunizing about 20 million adults in three months.

A positive signal of the easing of quarantine is the certification of 16 Moroccan airports "Airport Health" by ACI World (Airports Council International), as well as the recognition of the Moroccan vaccination passport by the European Union in 2021[53].

Vaccinating the Moroccan population became a major public health priority, and remarkable efforts have been undertaken by the government to achieve large-scale immunization. In fact, preparations were arranged before the arrival of the first batches of vaccine doses into the country. Moroccan citizens and residents were notified about the procedure of setting up a vaccination appointment. The procedure simply entails providing one’s identity document (ID) card number to register and subsequently receive a place and date for their appointment. Any citizen or resident was automatically referred to the nearest vaccination center using its digitized identity card number.

Our Defense is the official portal of the COVID-19 vaccination campaign created by the Moroccan Ministry of Health. This platform provides information on available vaccines, mechanisms of action, vaccine development and clinical trials, potential side effects, and allows people to confirm their vaccination appointment [9,58].

The national campaign against COVID-19 was free for Moroccan citizens and foreigners living in the country and was financed by a special COVID-19 fund. On January 22, Morocco received the first batch of Oxford's AstraZeneca vaccine, consisting of 2,000,000 doses and on January 27, the first batch of the Sinopharm BIBP vaccine, consisting of 500,000 doses, arrived in the country. During this month, Morocco approved Sputnik V, Sinopharm BIBP and Oxford-Astrazeneca, and other vaccines such as Moderna and Pfizer-BioNTech were later approved. [31,32].

Morocco's vaccine rollout has been gradual, with priority given to those at high risk of contracting the virus and developing severe symptoms. Priority groups include health care workers aged 40 years and older, government employees, military personnel, teaching workers aged 45 years and older, as well as people aged 75 years and older and people living with chronic diseases. Initially, areas with high levels of circulating infection were also targeted [20].

Since vaccination began, every country has been trying to reduce the number of vaccine doses needed. Table 3.3 provides data for African countries that have started vaccination against COVID-19 as of February 28, 2021.2 The number of countries is small, and the gap between Morocco and other countries is significant [2,14,20,57].

Table 3.3

COVID-19 vaccine doses administered in African countries as of 28.02.2021

| Country | Total administered doses | Administered doses per 100 people |
|---|---|---|
| Morocco | 3597903 | 9,75 |
| Algeria | 75000 | 0,17 |
| South Africa | 70725 | 0,12 |
| Senegal | 25653 | 0,15 |
| Egypt | 1315 | 0,0 |
| Zimbabwe | 18843 | 0,13 |

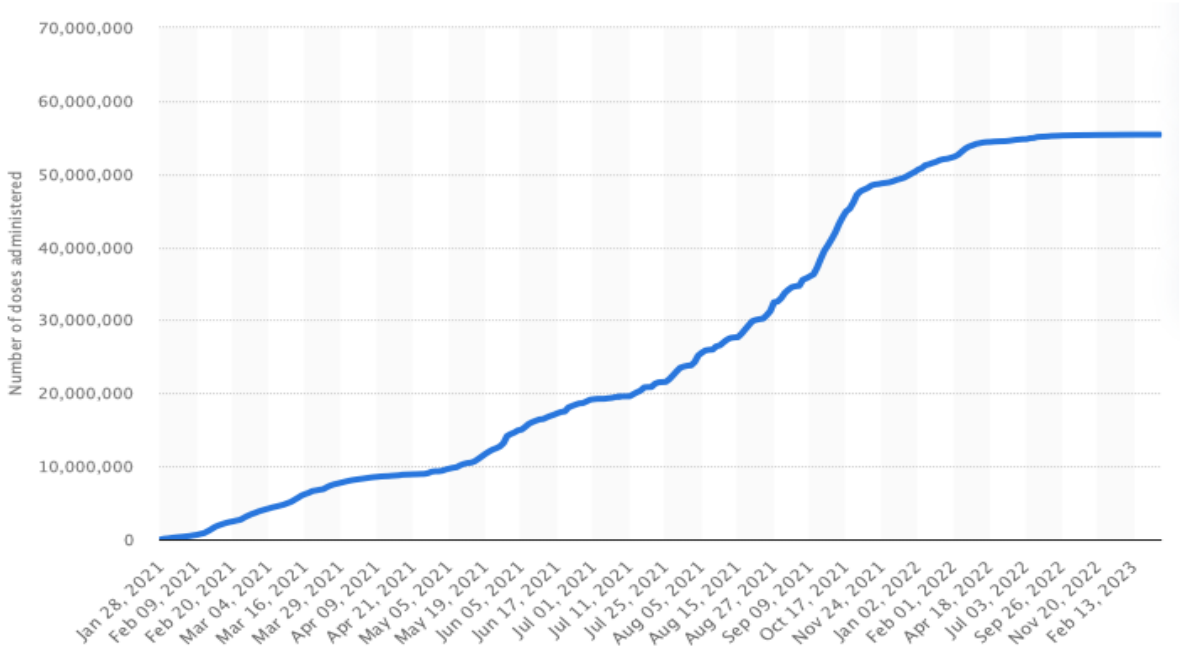
In Morocco, 3,597,903 doses were administered (9.75% per 100 population), while the vaccination rate in other countries did not exceed 1% [57].

Morocco has been hit economically by the pandemic and vaccination of the population has become the main priority of the government, which has provided all financial and logistical resources to achieve this goal. Morocco has been implementing a vaccination strategy, such as signing an agreement on the acquisition of vaccines, technology transfer and participation in clinical trials.

These agreements were made with several pharmaceutical companies to ensure sufficient quantities of the vaccine and reduce the risk of supply delays.

As of March 5, 2023, around 55.4 million doses of coronavirus vaccines had been administered in Morocco. The number comprised first, second, and third doses. Assuming every person needs 2 doses, that's enough to have vaccinated about 75.2% of the country's population [32].

Morocco was one of the leading countries in the COVID-19 vaccination drive on the African continent (fig.3.3).




source: Statista Research Department

Fig.3.3 Total number of coronavirus vaccination doses administered in Morocco as of March 5, 2023.

There is no one perfect statistic to compare the outbreaks different countries have experienced during this pandemic. Looking at a variety of metrics gives you a more complete view of the virus' toll on each country.

In a nation like Morocco, with poor health services and human development, ranking 121 out of 189 countries, the digitalization and the efficiency of the COVID-19 vaccination campaign has made Moroccans proud [32].

Waves of Covid-19 since 2023 have continued to decline in severity and virulence due to natural and vaccine-induced immunity and the continued decline

in severity of circulating variants [32]. There are currently a number of Omicron subvariants listed as being of concern or under surveillance.

In addition to Covid-19, seasonal viruses are currently spreading in Morocco, leading to an increase in cases of acute respiratory infections, in particular the seasonal influenza virus.

### 3.2. Study of the informational needs of the Moroccan population on vaccination.

Public health and state measures have been effective in reducing the transmission of COVID-19 in all countries of the world. WHO studies have shown that travel restrictions, border measures, quarantine for travelers arriving from affected countries, city lockdowns, restrictions on mass gatherings, isolation and quarantine of confirmed cases and close contacts, social distancing measures, mandatory wearing of masks, tracing contact tracing and testing, school closures, and the use of personal protective equipment among healthcare workers have been effective in mitigating the spread of COVID-19.

Public health interventions are an important strategy for delaying and reducing the spread of COVID-19. In particular, measures that restrict movement or lead to the closure of social services can create a significant burden on an individual. Their effective implementation requires public support and compliance.

Morocco joined early the league of African nations that received the coronavirus. Following the announcement of the first confirmed case of COVID-19 on March 02, 2020, Morocco implemented a major response plan to fight against the spread of the virus and to cope with the economic and social impacts of the health crisis [57].

In order to improve Moroccan citizens' perception of this pandemic, as well as to measure their level of awareness and satisfaction with government measures in response to this pandemic, we conducted a social survey of pharmacy visitors. This survey aims to find out citizens' views and level of support for current

policies, as well as to assess the extent to which they are following precautionary measures to prevent the spread of the virus.

The survey adopted a quantitative research method using a self-administered questionnaire at a pharmacy Al Morakab visit. The questionnaires were completed by respondents between October 2 and October 29, 2023.

The questionnaire contained 13 questions. During the processing of the survey results, we processed the data of 70 respondents. Characteristics of general information about the respondents are given in the fig. 3.4-3.5.

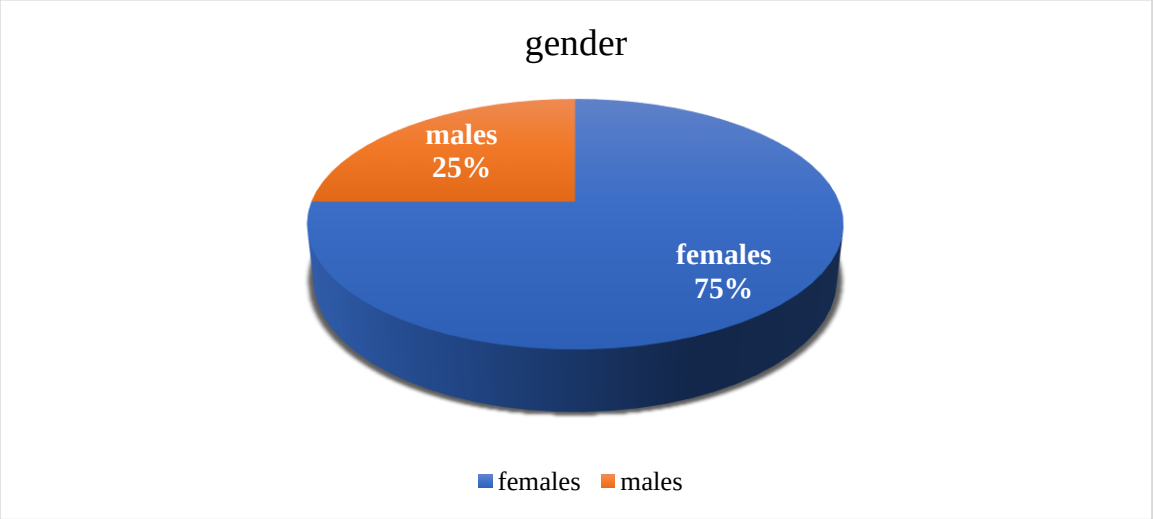



Fig.3.4 Distribution of the respondents according to gender.

Regarding the distribution of the sample by gender, the majority of the respondents were women (75%), the 18-25 age group makes up about a quarter of the participants, the 26-35 age group makes up about a third of the participants, while the 36-45 age group makes up about 23 % of participants.

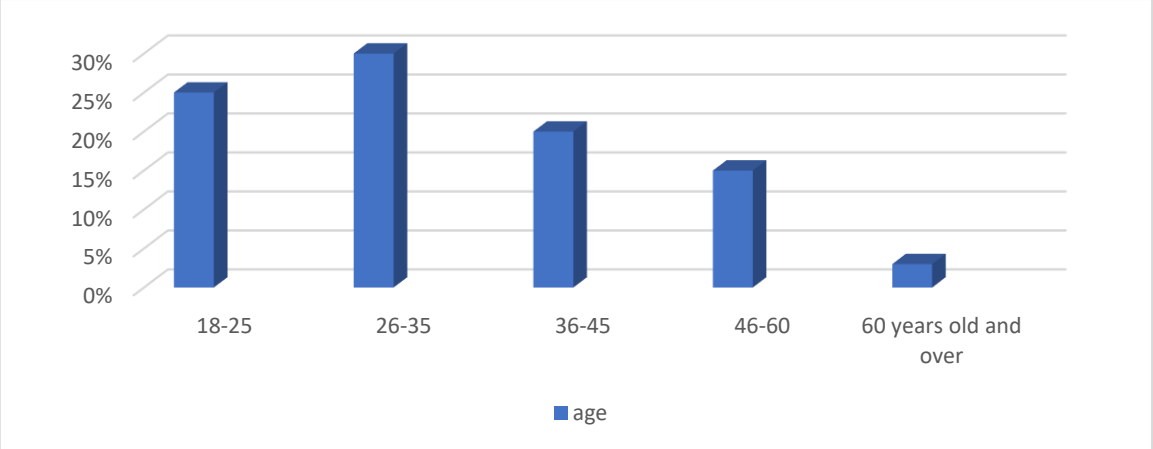



Fig.3.5 Distribution of the respondents according to age.

As for the educational level, about 46% of the respondents have a university level, 20% hold a Master's degree, 5% hold a Doctorate, while 29% have high school education level (fig.3.6).

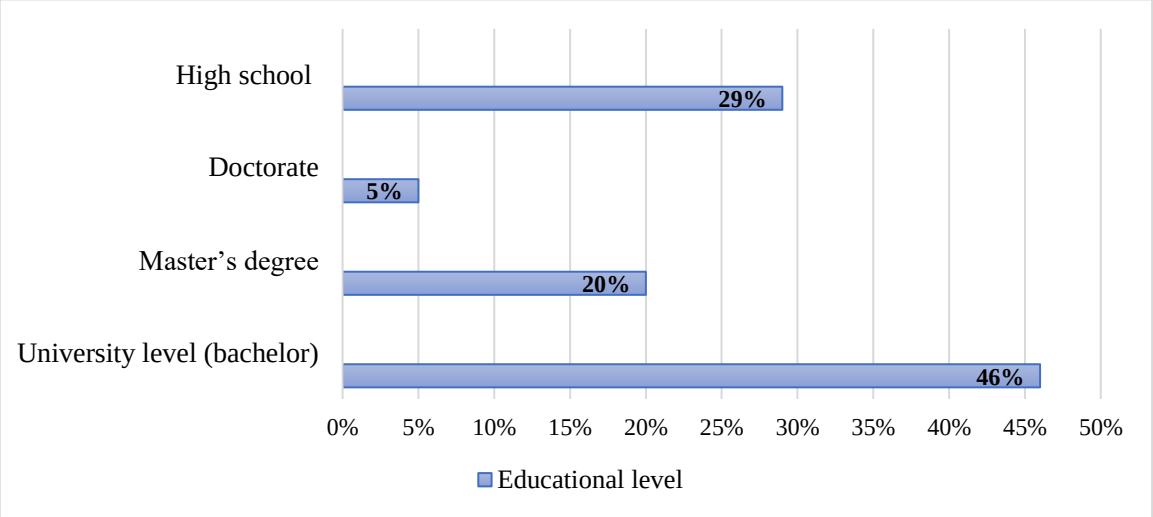



Fig.3.6 Distribution of the respondents according to educational level.

Then the respondents were asked to answer the questions: "Do You feel currently have enough information about the coronavirus situation?" In Morocco, everyone has heard about COVID-19 (100%), yet every third person (34%) Moroccans believe that they do not have enough information about this (fig.3.7).

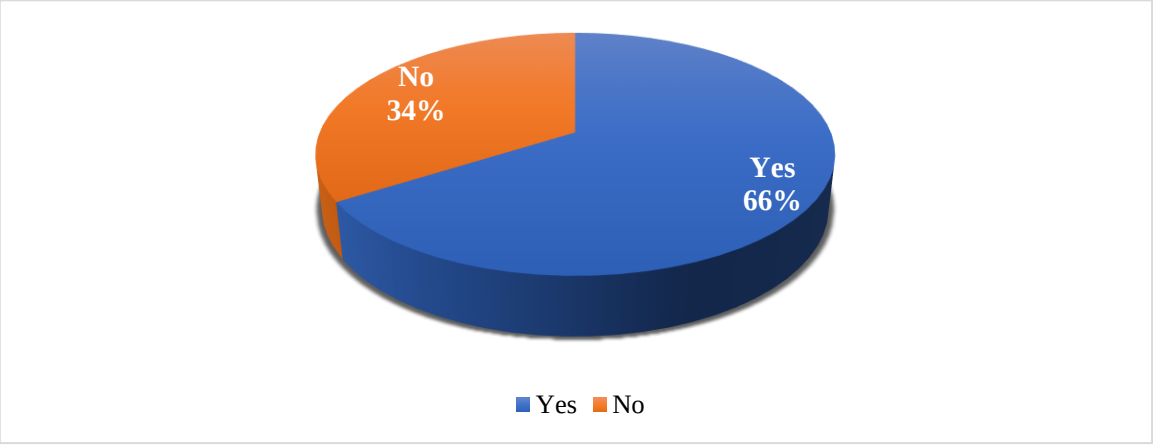



Fig.3.7 Do You feel currently have enough information about the coronavirus situation?

Next, the interviewees were asked to indicate, what information they would most like to know (fig.3.8). One in five or more would like more information about "how to cure it/is there a medicine" (22%); "how to protect against it" (21%); almost one in six is interested in "how it spreads" (17%); "what

new strains have appeared" (30%); "how quickly new strains spread"(35%); "how to get a vaccine against it"(15%); "how many doses of vaccines are enough"(40%).

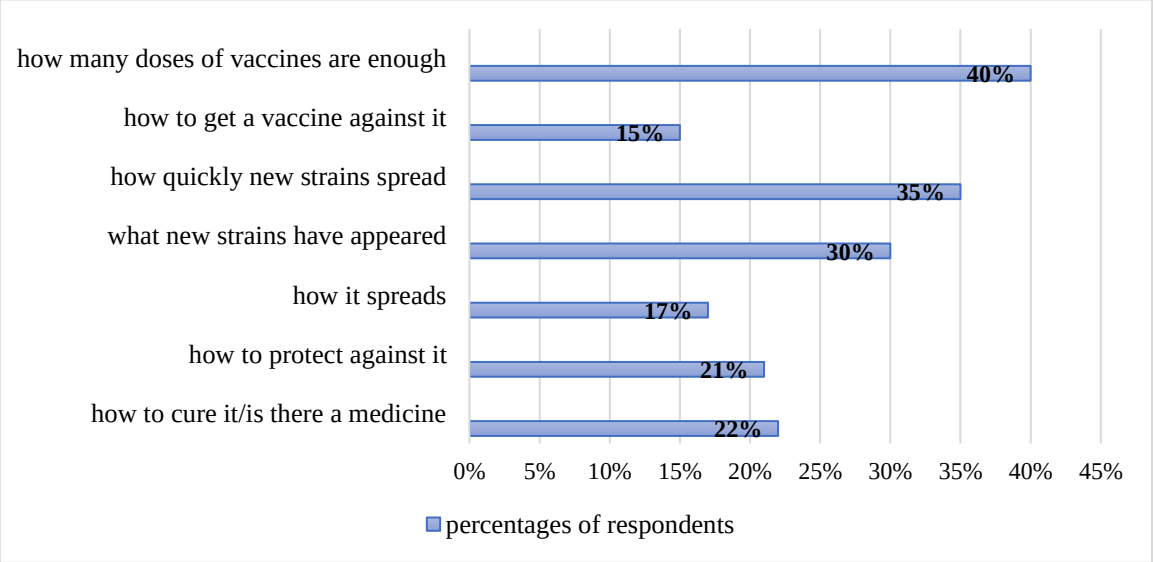



Fig.3.8 Most requested information about Covid-19.

The next set of questions focused on citizens' concerns about infection with the new coronavirus, as well as the level of the possibility of the virus spreading in Morocco and its impact on the economy. Regarding the question about the spread of the new Covid-19 pandemic in Morocco, 96% of respondents said they were concerned about the spread of the virus in the country (69% of respondents said they were very concerned and 27% worried), and only 1% said that they are not at all bothered by what is happening (fig.3.9).

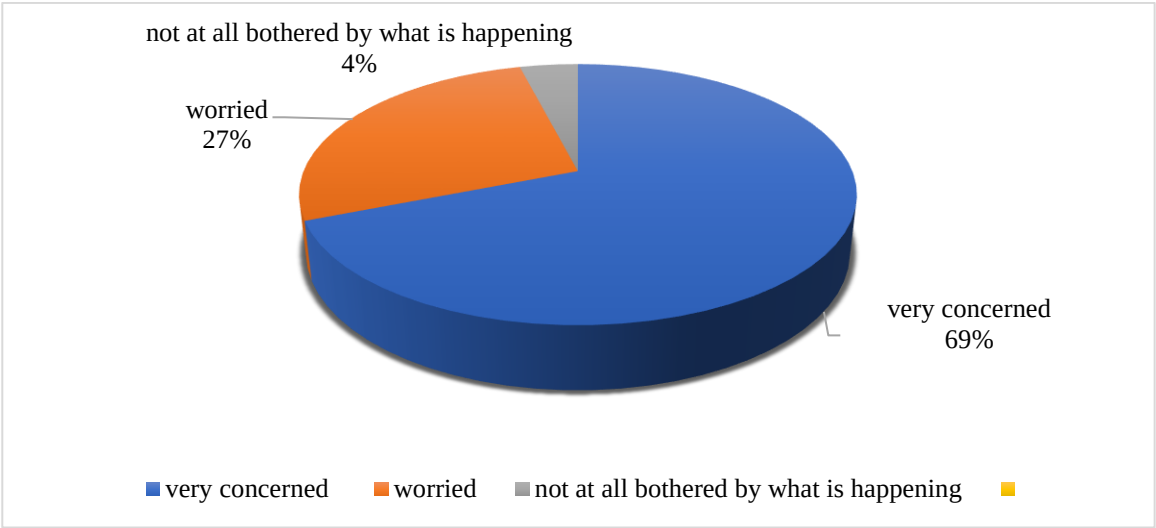



Fig. 3.9 Concerns about the spread of the new coronavirus in Morocco.

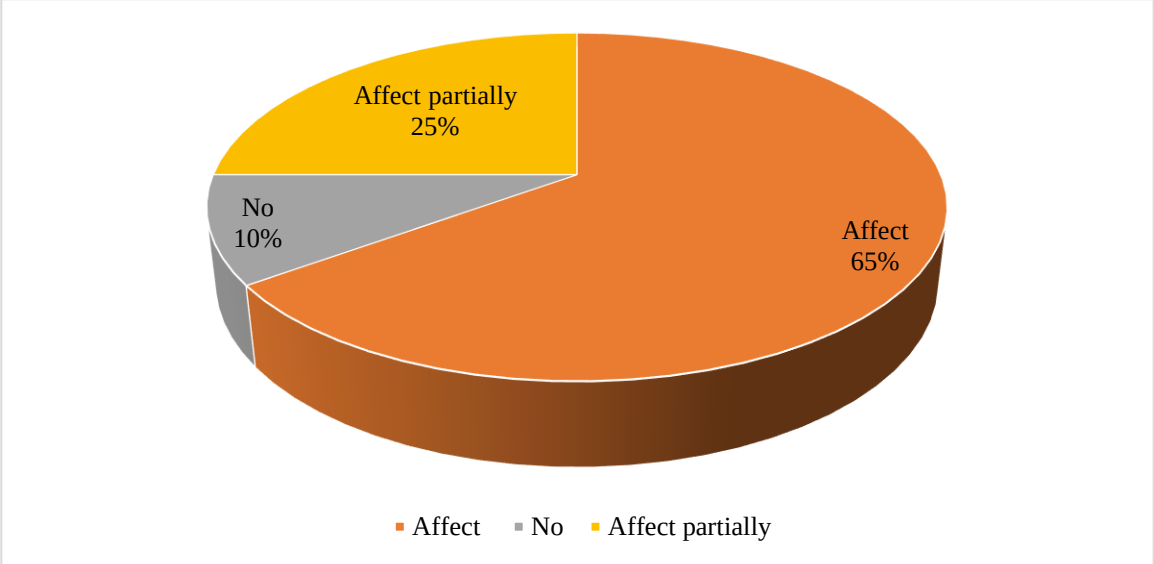



Fig.4.0 Will the coronavirus affect the Moroccan economy?

More than half of those surveyed show great concern about the economic consequences of the virus: 65% of people agree with the impact of the virus on the Moroccan economy, and only 10% do not believe that the virus can affect the country's economy.

Basic knowledge about Covid-10 prevention measures is very important to prevent its spread. The next question was about how Covid spreads (fig.4.1).

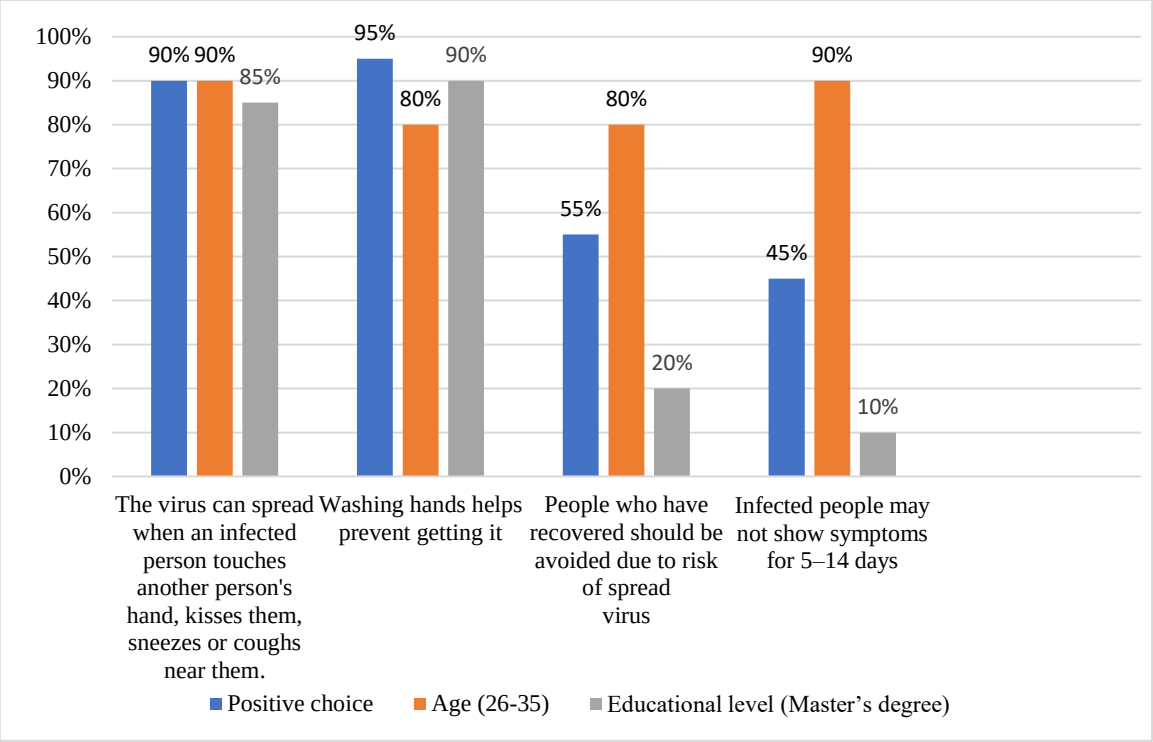



Fig.4.1 Covid spreads.

90% of respondents think COVID-19 can be spread by touch, kiss, sneeze, or cough and that washing hands helps prevent getting it (95%). More than one in two (55%) think people who have recovered from it should be avoided due to risk spreading the virus.

Since the emergence of the coronavirus disease, the Moroccan government has widely informed the population on this issue. One of the important methods of prevention is getting the right instructions. Publishing accurate health information helps alert citizens to the seriousness of the situation and take necessary precautions that can help reduce the spread of the virus.

For the concept of public awareness, questions were asked about from which sources information about Coronavirus was obtained.

The sources of directions that Moroccan citizens relied on varied, 85% of all respondents relied on the Internet, 68% followed the directions and data of the Moroccan Ministry of Health, while 11% communicated with doctors and 5% with pharmacists in order to obtain guidance on the disease, and 19% of respondents confirmed that they drew news about the Corona pandemic by communicating with their friends (fig.4.2).

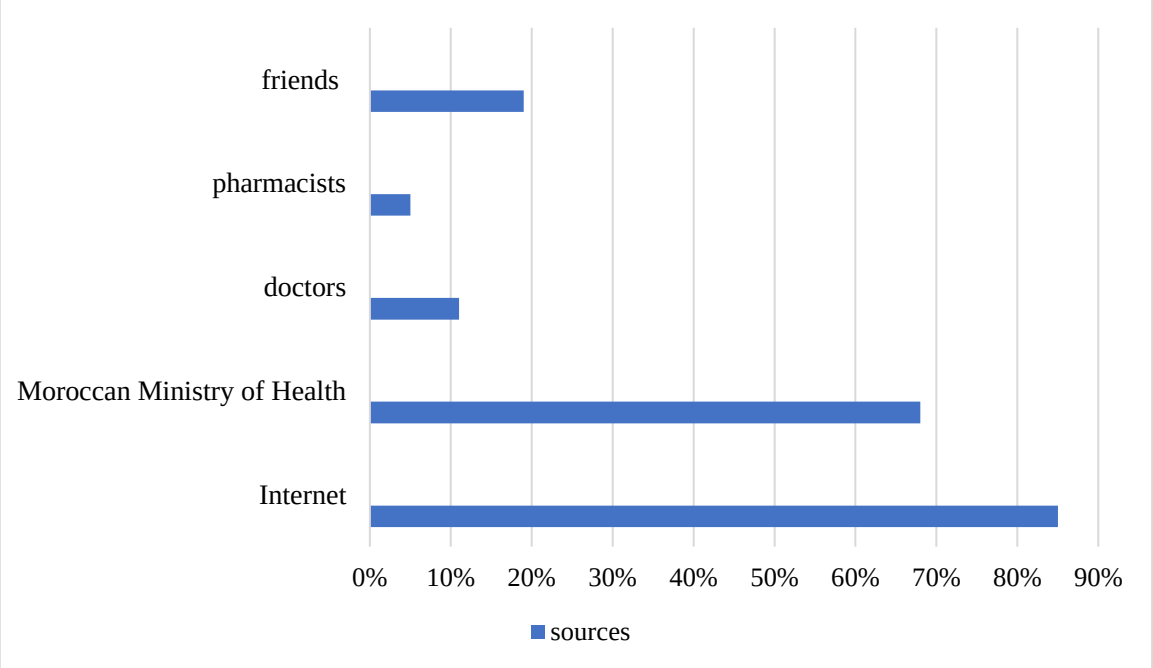



Fig.4.2 Source of directions.

Next, respondents had to indicate the precautions taken by citizens to avoid infection with coronavirus. This included washing hands several times a day, self-isolating and wearing face masks. In terms of precautions taken by respondents, 97% of participants said they washed their hands several times a day, 82% said they avoided leaving home unless absolutely necessary, and only 12% said they wore face masks (fig.4.3).

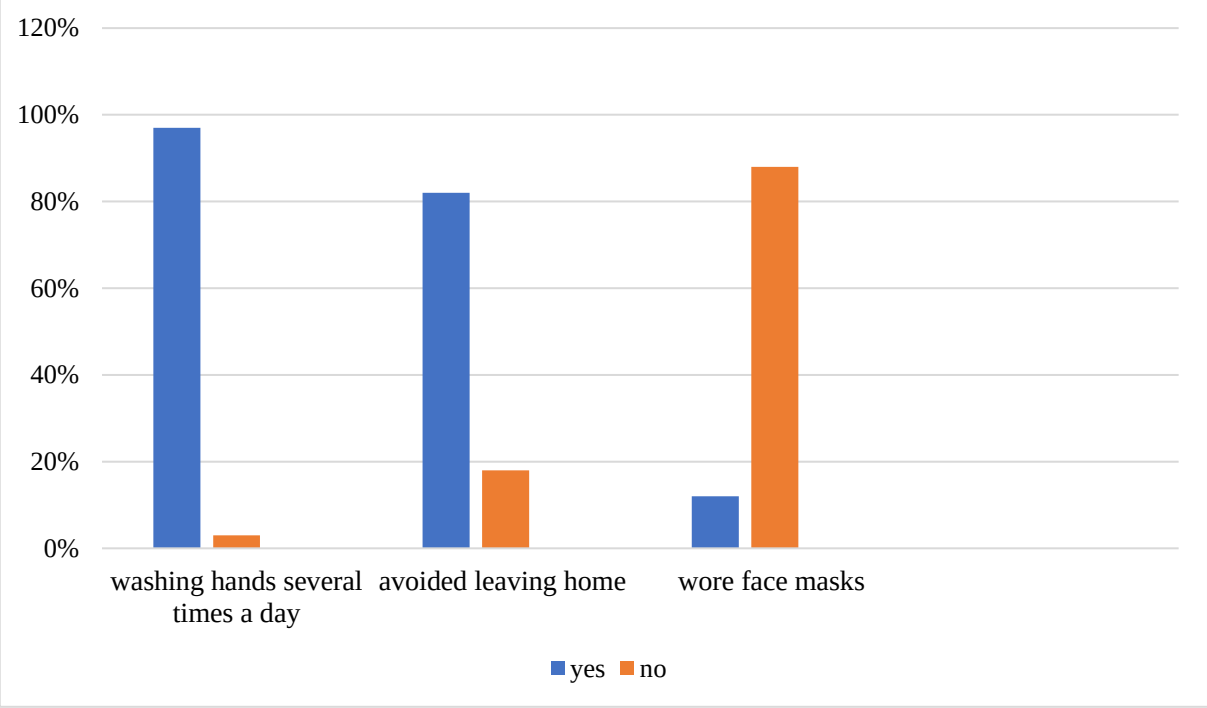



Fig.4.3 Personal precautions to avoid Coronavirus.

The main block of questionnaires was devoted to finding out the opinion of the population about the decisions and measures taken by the government to contain the coronavirus, which is the degree of trust in the authorities' ability to understand this pandemic, the satisfaction of citizens with government communication, and finally to find out the degree of their agree or disagree with the government's precautionary measures, such as closing schools and mosques and preventing public gatherings.

Citizens are generally satisfied with the measures taken by the government to control the coronavirus, but they are less confident about the ability of the government and the health sector to respond to the pandemic.

Moroccans' perceptions of the governmental response to COVID-19 is broadly positive. Satisfaction with the government's response is almost universal in Morocco (96% vs. 4% dissatisfied) (fig.4.4).

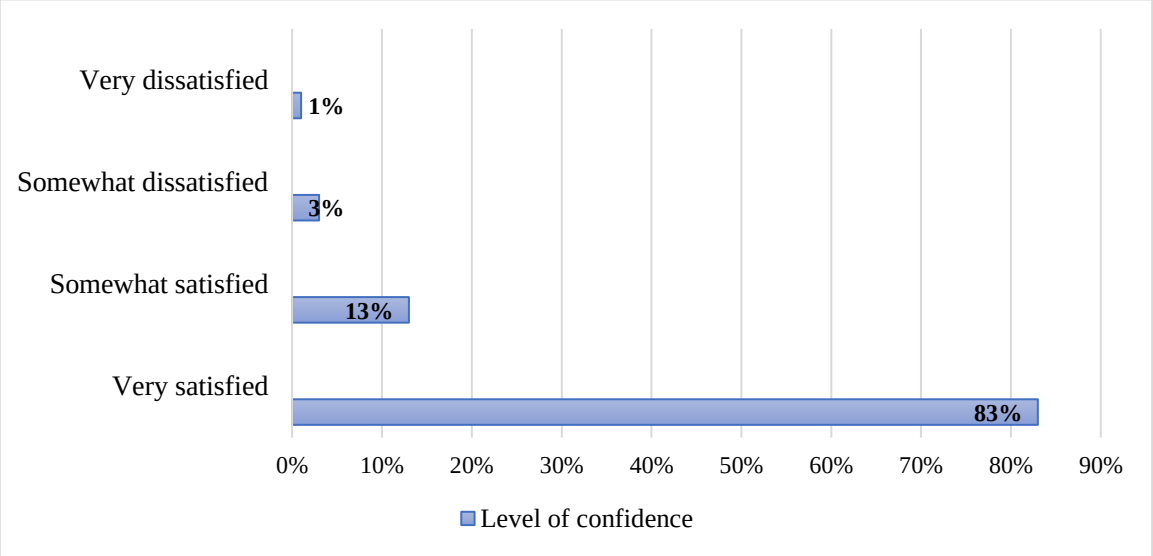



Fig.4.4 Level of satisfaction with the government's response to COVID-19.

Moroccans are also more likely than not to trust the information provided by the government – albeit less so than the level of satisfaction with the government's response might suggest (83%, including 53% 'completely' trust vs. 16%, including 4% 'not at all') (fig.4.5).

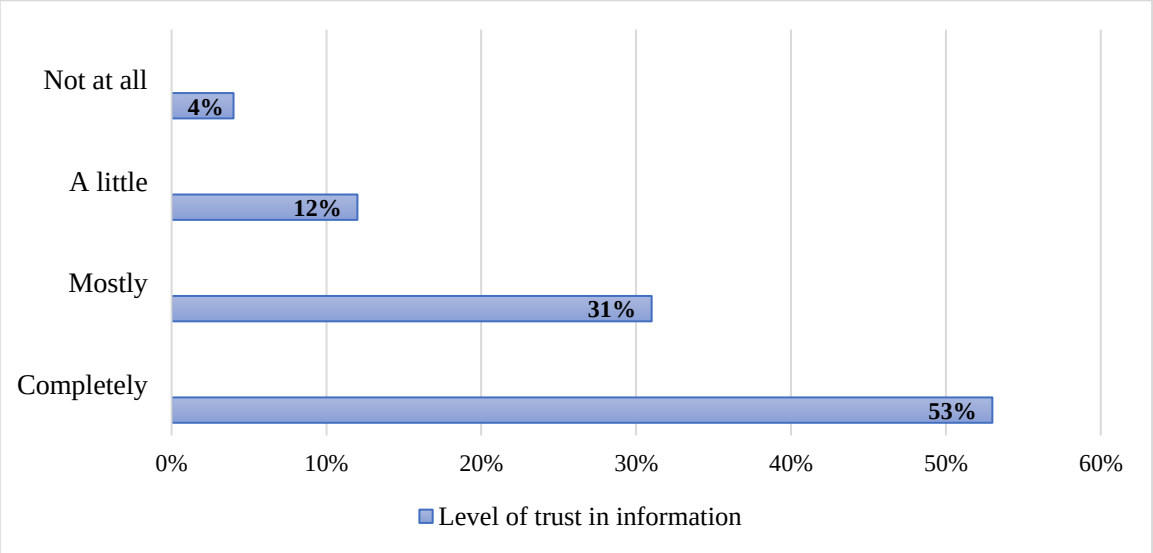



Fig.4.5 Level of confidence in information provided by the government.

After the registration of the first case of the disease in the country, the Moroccan government took a number of preventive measures.

Since the first case was reported in the country, the Government of Morocco has taken a number of preventive measures. Moroccan citizens expressed their "significant agreement" (between 72% and 100%) on the three areas of measures taken by the government (fig.4.6). Support for social measures in the area of personal health is growing. Almost all Moroccans support not shaking hands (98%); requiring those in contact with infected people to self-isolate (89%) and requiring people with COVID-19 to stay home until they recover.

Moroccans also support restricting public gatherings. 100% of respondents confirmed their agreement to "prevent mass gatherings", 92% of them agreed with the "ban on entry into and from Morocco", 93% agreed with the "suspension of the operation of public and private schools" and 90% agreed with the "suspension of Friday prayers" and joint prayers in mosques". As for those who objected to these measures, only 9% expressed disapproval of "the suspension of Friday and general prayers in mosques and said they did not agree with this measure.

Most Moroccans also support other temporary "public bans" to help slow the COVID-19 outbreak. This includes the closure of restaurants/nightclubs (99%) and markets (72%).

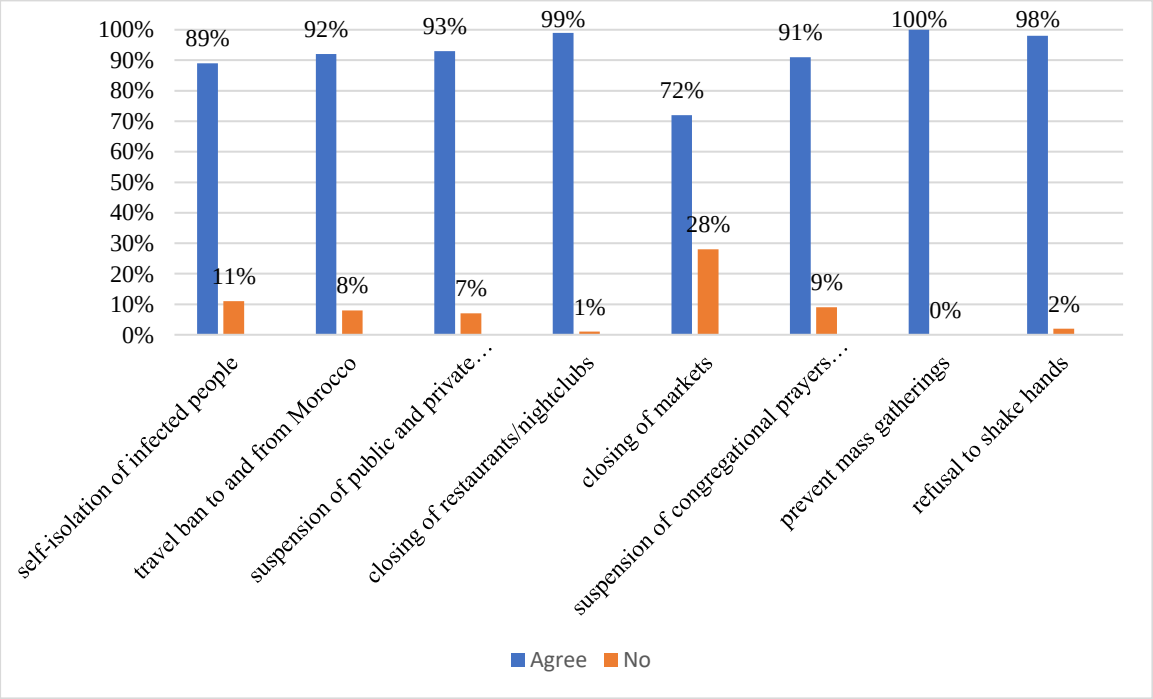



Fig.4.6 Level of public support for preventive measures.

Although the outbreak of the Covid-19 virus pandemic is on the decline around the world, but new types of coronaviruses are still developing, our survey provides insight into citizens' awareness and level of support for government policies, as well as an opportunity to assess the degree to which they comply with precautionary measures to prevent the spread of the virus. In Table 3.4 we have compiled the main measures that were taken by the government to prevent the spread of the disease.

Table 3.4

Government response to prevent the spread of Covid-19

| | **Closure measure** |
|---|---|
| **1.** | school closures at all levels; |
| **2.** | mandatory closure of all but essential workplaces; |
| **3.** | cancellation of public events; |
| **4.** | restrictions on gatherings of more than 10 people; |
| **5.** | closure of public transport; |
| **6.** | restrictions on international travel; |
| **7.** | stay-at-home orders; |
| **8.** | bans on arrivals from certain regions; |
| **9.** | joint prayers in mosques; |
| **10.** | closure of restaurants/nightclubs; |
| **11.** | wearing face masks; |
| **12.** | night curfew from 9 p.m. to 5 a.m.; |
| **13.** | vaccination campaign |

This research will help decision makers formulate more appropriate policies to control the spread of the virus in the short term, and will also help restore trust in government and public institutions in the medium to long term [28].

The results of our survey can be taken into account when developing recommendations for meeting the information needs of the population when assessing appropriate policies for controlling the spread of the virus, as well as suggesting new methods for the prevention of viral diseases.

## Conclusions to the III Chapter

Morocco is considered one of the countries that controlled the virus in the first stage of its spread. Economic and social restrictions played an important role in this.

Morocco's strict and effective response to the COVID-19 pandemic has resulted in positive results in terms of preventing severe disease and limiting the spread of the virus. This experience has highlighted the country's potential in pioneering vaccine supply and promoting vaccine self-sufficiency on the continent. Morocco undertook relatively stringent lockdown and closure measures in response to the COVID-19 pandemic.

The government called on citizens to fully comply with the measures taken, including physical distancing, general hygiene rules and the mandatory wearing of protective masks.

Proportion of population who take precautions such as social distancing, wearing masks and hand washing rates are quite high (more than 85 percent).

Based on recommendations from health authorities, the government has decided to impose a night curfew from 9 p.m. to 5 a.m. and possession of COVID-19 vaccine certificates or administrative approval issued by the competent authorities.

Support for social measures regarding personal health is high among the population. Moroccans also support restrictions on mass gatherings. Most Moroccans also support other temporary public bans to help slow the outbreak of COVID-19.

These measures and a relatively successful early vaccination campaign helped limit the spread of the virus before it appeared delta variant.

# GENERAL CONCLUSION

**1.** Global vaccine campaigns in the second half of the 20th century are one of humanity's greatest achievements. Immunization have allowed humanity to eradicate smallpox, nearly defeat polio, and ensure the survival and development of larger populations than ever before.

**2.** The World Health Organization has identified COVID-19 as a public health emergency and is urging governments to stop the virus transmission by adopting appropriate policies. In this regard, authorities have taken different approaches to cutting the chain or controlling the spread of the disease.

**3.** COVID-19 vaccines are critical to containing the pandemic, coupled with effective testing. The first vaccines to reach the approval stage are Pfizer/BioNTech, CoronaVac/Sinovac Biotech and Oxford-AstraZeneca and have been approved for use by national regulatory authorities in individual countries.

**4.** According to WHO statistics, more than 13.3 billion doses of COVID-19 vaccines have been administered worldwide to date, more than 5.5 billion people have received at least one dose, and 5.1 billion people have been fully vaccinated.

**5.** The study findings showed that in order to confronting the COVID-19 epidemic, in general, there are three approaches of "mitigation", "active control", and "suppression" and four strategies of "quarantine", "isolation", "social distance", and "lockdown" in both individual and social dimensions to deal with epidemics.

**6.** One possible approach to combating the disease is to change individual behavior and lifestyle. In addition to prevention strategies, the use of masks, personal hygiene, and public health guidelines such as sneeze and cough etiquette must be strictly followed. Drawing on current country experiences can be very helpful in selecting the precise approach for each country according to that country's characteristics and lead to lower potential costs at national and international levels.

**7.** We conducted a social survey of pharmacy visitors regarding their awareness of Covid-19 prevention measures in relation to them. The study found that the country has a sufficient level of public awareness and a high level of trust in the state.

**8.** Based on the results of the analysis, it was established that all Moroccans have heard about COVID-19 (100%), but one in three (34%) believe they do not have complete information.

**9.** 22 percent of respondents wanted more information about treatment and medication; about protection (21%); 17% were interested in distribution; about new strains and their speed (35%); how to get a vaccine from him (15%); and the number of vaccine doses (40%).

**10.** Analyzing the answers about the spread of the new pandemic, it was found that 96% of respondents are worried about the spread of the virus in the country (69% are very worried, and 27% are worried), only 1% are not worried about what is happening.

**11.** The evaluation of the answers regarding the precautionary measures of the respondents in the event of a mass spread of covid showed that 97% of the participants wash their hands several times a day, 82% do not leave the house unless absolutely necessary, and 12% wear face masks.

**12.** To prevent the spread of the disease, the Moroccan government took a number of preventive measures with which Moroccan citizens agreed (between 72% and 100%).

**13.** Regarding the restriction of mass gatherings, 92% agreed with the closure of the country, 93% agreed with the suspension of schools and 90% supported the suspension of joint prayers in mosques, and only 9% expressed their disapproval of the suspension of prayers in mosques. Other temporary public bans were also supported, including the closure of restaurants/nightclubs (99%) and markets (72%).

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