T.C.

YEDITEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF PUBLIC HEALTH

EVALUATION OF THE VACCINATION STATUS OF LIBYAN CHILDREN UNDER 5 YEARS OLD A CROSS SECTIONAL STUDY

MASTER THESIS

MAHA MUFTAH ELDARASI

Istanbul-2022

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Director of Institute of Health Sciences

Prof. Dr. Bayram YILMAZ

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

20.02.2022

MAHA MUFTAH ELDARASI

DEDICATION

This thesis is dedicated to my lovely family (my mother and father, my husband and my children)

ACKNOWLEDGEMENTS

First and foremost, praise and thanks to God, almighty, for his showers of blessing throughout my thesis research to complete the work successfully.

I would like to thank my university, the university of Benghazi for nominating me for master's study, and my country, Libya, for giving me the scholarship to continue my studies.

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LIST OF ABBREVIATIONS

BCG	Bacillus Calmette-Guerin
EPI	Expanded Immunization Program
Hib	Haemophiles influenza type b
HPV	human papillomavirus
NIP	National Immunization Programme
OPV	oral polio vaccine
PCV	pneumococcal conjugate vaccine
PHC	primary health care
WHO	World Health Organization

ABSTRACT (ENGLISH)

Eldarasi,M. (2022) Evaluation Of The Vaccination Status Of Libyan Children Under 5 Years Old A Cross Sectional Study ,Yeditepe University, Institute of Health Science, Department of Public health, MSc Thesis, Istanbul .

The aim of this study is to evaluate the vaccination status of Libyan children under 5 years old Across sectional study was conducted in three Libyan regions (37 cities) data on 405 children were collected from caregivers , the information collected include sociodemographic characteristic of caregivers and child , access of vaccination services, vaccination coverage and timeline ,the data was collected online through internet survey by using google form during the period from 14th of June to 3 of August , 2021 .The proportion of completely vaccination was 46.4% and the proportion of children who are take the vaccination on time was 62% , children aged 12 months and +18 months were significantly more completely immunized (53.2% and 65.9% respectively) 69.3% of the mothers' and 58% of the fathers' education level were university. Children which were given advice about vaccination were significantly more immunized than others, The biggest vaccination problem was the lack of vaccine (73.3%), then the lack of syringes or some other supply needed for vaccination (13.3%).We found the mean reason of incompletely vaccination is unavailability of vaccine because of stockout of vaccines, that is mean we need more effort from local authority to increase quality and number of the health centers to avoid vaccine preventable diseases specially after illegal migration.

Keywords: Vaccines, Delay, Libya , Timeliness, Vaccine coverage, Vaccination, Immunization

ÖZET (TURKISH)

Eldarasi,M. (2022) 5 yaşından küçük Libyalı çocukların aşılama durumunun değerlendirilmesi: Kesitsel bir çalışma . Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Halk Sağlığı, Yüksek Lisans Tezi, İstanbul.

Bu kesitsel çalışmada 5 yaş altındaki Libyalı çocukların mevcut aşılanma durumlarınındeğerlendirilmesi amaçlanmaktadır Bu çalışmanın amacı, 5 yaş altı Libyalı çocukların aşı durumlarını değerlendirmektir. Üç Libya bölgesinde (37 şehir) Bakım verenlerden 405 çocuğa ilişkin veri toplandı kesitsel bir çalışma yapılmıştır. , aşı hizmetlerine erişim, aşı kapsamı ve zaman çizelgesi, veriler 14 Haziran - 3 Ağustos 2021 tarihleri arasında google formu kullanılarak internet anketi aracılığıyla çevrimiçi olarak toplanmıştır. Tam aşılanma oranı % 46.4 ve çocuk oranı Aşıları zamanında yaptıranların oranı %62, 12 aylık ve +18 aylık olan çocukların aşılarının anlamlı olarak daha fazla olduğu (sırasıyla %53.2 ve %65.9) annelerin %69.3'ü ve babaların eğitim düzeyinin %58'i üniversitedir. Aşı konusunda tavsiye verilen çocuklar, diğerlerine göre önemli ölçüde daha fazla aşılanmıştır. En büyük aşı sorunu aşının olmaması (%73,3), ardından aşı için gerekli şırınga veya diğer malzemelerin olmaması (%13,3) olmuştur.Eksik aşılamanın ortalama nedeninin aşıların stokta olmaması nedeniyle aşı bulunamaması olduğunu bulduk, yani özellikle yasadışı göç sonrası aşı ile önlenebilir hastalıklardan kaçınmak için sağlık merkezlerinin kalitesini ve sayısını artırmak için yerel yönetimlerin daha fazla çaba göstermesi gerekiyor.

Anahtar Kelimeler: Aşılar, Gecikme, Libya, Zamanındalık, Aşı kapsamı, Aşılama, Bağışıklama

1-INTRODUCTION and PURPOSE

1.1 Background

Immunization is a worldwide health and development success story, saving millions of lives each year. Between 2010 and 2018, the measles vaccination alone prevented 23 million fatalities [1]. The number of babies immunized each year has reached an all-time high of more over 116 million, or 86 percent of all infants born. Immunization can currently prevent more than 20 life-threatening illnesses [2]. Since 2010, 116 nations have launched vaccines that they had not previously used, including vaccines against pneumococcal pneumonia, diarrhea, cervical cancer, typhoid, cholera, and meningitis [3].

With the Alma-Ata Declaration in 1978, the World Health Organization (WHO) publicly accepted primary health care (PHC) as a means of providing detailed, broadly accepted, impartial, and cost effective health care services, including childhood immunization, to all countries. [4]. In September 2000, 189 nations signed the Millennium Declaration, which aimed to establish an environment that promotes development and poverty eradication. The objectives and goals are intertwined, and some have an impact on mother and child health [5]. Goals four and five are concerned with reducing child mortality through child survival interventions and improving maternal health in general, with vaccination recognized as an important component in reducing vaccine-preventable illnesses[6]. In 1974, the World Health Organization (WHO) started a regular children vaccination program after a successful effort to eliminate smallpox. The program is called the Expanded Immunization Program (EPI) and involves regularly scheduled services at health institutions as well as targeted outreach sites[7].

Nonetheless, significant obstacles remain. Immunization benefits are not fairly distributed: coverage varies greatly across and within nations. In unstable, conflict-torn environments, some communities – frequently the poorest, most marginalized, and most vulnerable – have limited access to vaccination programs[8.]

In 2020, global coverage fell from 86 percent in 2019 to 83 percent, and the number of infants under the age of one year who did not receive basic vaccinations increased to 23 million, the highest number since 2009. Furthermore, the number of children who are fully unvaccinated has grown by 3.4 million. In 2020, there were just 19 vaccine launches announced, which is fewer than half of any year in the previous two decades [9].

Every year, 20 million infants are not given a complete course of even basic vaccinations, and many more are not given newer vaccines. Over 13 million of them do not receive the "zero dose" vaccinations via immunization programs[10].

Progress has slowed or even reversed in some nations, and the danger of complacency undermining previous gains is significant. Measles and vaccine-derived poliovirus outbreaks serve as sharp reminders that vigorous vaccination programs and good disease surveillance are required to maintain high levels of coverage and eradicate illnesses. Because measles is so contagious, its presence acts as a warning sign (the "canary in the coal mine") indicating poor health-care coverage and gaps. Surveillance for measles cases exposes populations and age groups that are un- or under-immunized, as well as vaccination programs and overall primary health care systems that are insufficient, highlighting areas that require special attention and interventions. High measles vaccination coverage indicates a robust immunization program, which might indicate a strong foundation for primary healthcare. The second dose of measles vaccine provides a chance to increase attention on enhancing immunization programs to reach children beyond their first year of life and to expand vaccination services across the lifespan[10-3].

1.2 (Rationale) Justification

According to a WHO report on vaccination services in Libya, over a quarter of a million children under the age of one are at risk of contracting vaccine-preventable diseases as a result of critical shortages in vaccine supplies. The estimate is based on a 25% reduction in coverage consistent with the duration of the stock-out. There are severe shortages of hexavalent vaccination, which protects against six illnesses, before the start of 2020. (Diphtheria, tetanus, pertussis, poliomyelitis, Hemophilus influenzae type b and viral hepatitis B). Oral polio vaccination, which is given at birth and again at nine months, is also in critical low supply. Children in difficult-to-reach and conflict-affected areas are especially vulnerable since they may have missed certain vaccine doses. Many migrants, refugees, and internally displaced children may have missed or not got their basic vaccination doses in their home country, according to WHO and UNICEF. In Libya, the estimate of 73 percent has altered from the prior revised figure of 97 percent [11].

After performing a literature review, we have found few studies about childhood vaccination in Libya and these studies does not reflect the situation of all cities, we decided to conduct this research thesis aiming to evaluate vaccination status in Libya for children under five years old.

1.3-Objectives of the Study

1.3.1- General Objective

The purpose of this study is to evaluate the vaccination status of children under 5 years old in Libya

1.3.2 Reaserch Questions

1- What is the vaccination rate of children under 5 years old in Libya in accordance with the national vaccination schedule?

a. What are the comparative vaccination rates by age groups?

b. What are the differences in vaccination rates between regions/cities?

c. What are the biopsychosocial, economic, cultural, etc. factors affecting vaccination rates?

2-What are the hindering factors that occur during the execution of the national vaccination calendar?

3-Is the scope of the national vaccination calendar compatible with the current profile of the country in terms of vaccine-preventable diseases?

2-GENERAL INFORMATION

2.1-Immunity & Types of immunity

Immunity refers to a person's capacity to identify microorganisms and avoid becoming infected as a result of them. The immune system's purpose is to assist the body detect and remove harmful bacteria before they may cause disease or damage. Innate and adaptive immunity are the two types of immunity [12]**.**

2.1.1-Innate Immunity

The immune system that is present when we are born is known as innate immunity. It is the first line of protection against pathogens in our body. Physical barriers such as skin and mucous membranes, as well as specific cells and proteins that can identify and destroy pathogens, make up the immune system. The difficulty with these specific cells and proteins is that they can kill a germ, but the innate immune system forgets about them after the germ is gone. It doesn't provide the rest of the body with any information about the pathogen. The body cannot prepare itself to combat this virus if it should re-infect the body without this knowledge.

2.1.2-Adaptive Immunity

Adaptive immunity is a type of defense that our body develops when it comes into contact with antigens, which are germs and other foreign substances in the body. Antibodies are produced when the body detect antigens and fights them. Antibodies take around 14 days for our body to produce. More crucially, the body remembers this struggle so that it may detect and attack the same antigen faster the next time it encounters it. One of the most significant ways that immunity develops is through antibody production [13].

Adaptive immunity is divided into two categories: active and passive **figure (1).**

• **Active Immunity -** antibodies produced by a person's immune system when the body is exposed to an antigen as a result of a sickness or an immunization (i.e., a flu shot). This sort of immunity is long-lasting.

• **Passive Immunity**: Antibodies were given to a person after they have been exposed to an antigen to prevent or treat illness. Passive immunity is passed down from mother to child via the placenta before delivery and breast milk thereafter. Antibodies-containing blood products, such as immune globulin, can also be used to provide it therapeutically. This sort of immunity takes effect quickly but only lasts a few weeks or months [13-14-15].

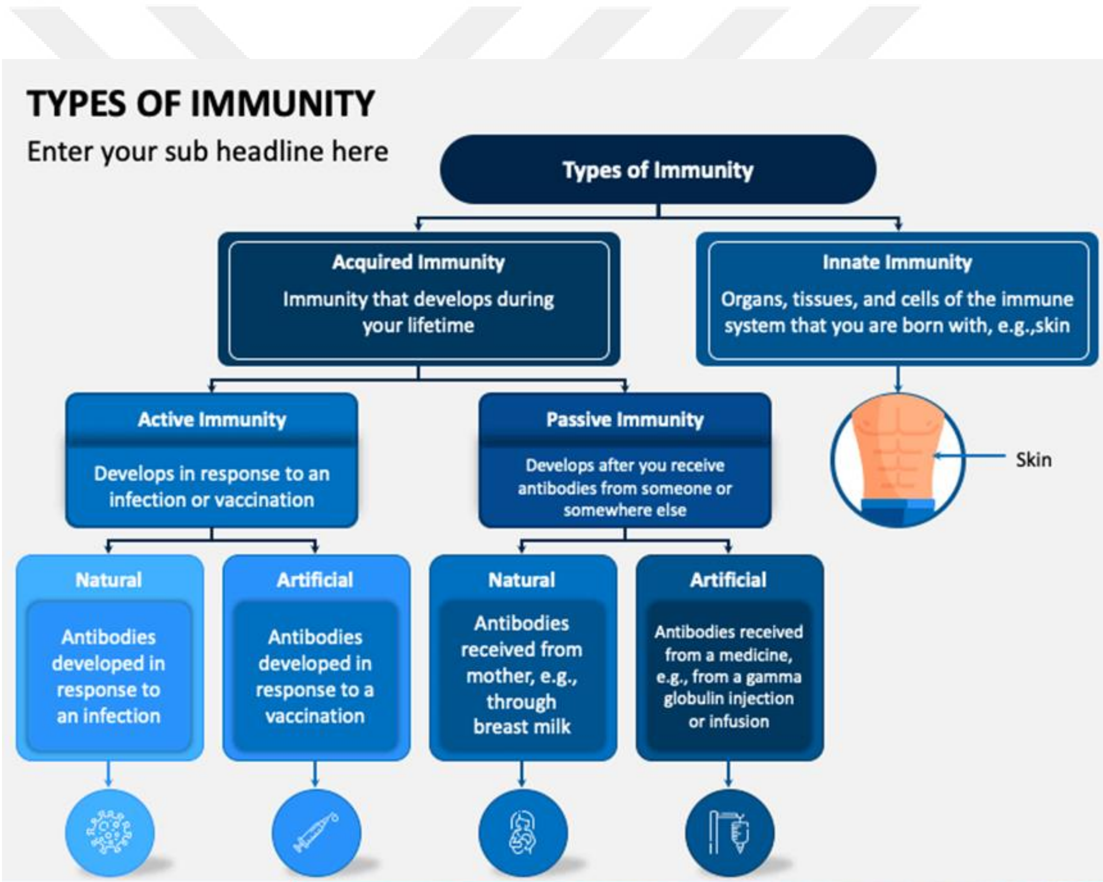


Figure (2.1) Types of Immunity

2.2-Vaccine and Types of Vaccines

The term "vaccine" comes from the Latin Variolae vaccinae (cowpox), which Edward Jenner proved could prevent smallpox in humans in 1798 [16-17-18-19]. Vaccines are biologics that help people develop active adaptive immunity to certain illnesses. Vaccines usually contain drugs that resemble the disease-causing microorganisms and are often made from one of the killed or attenuated microorganisms, their toxins, or their surface proteins, which are introduced by mouth, injection, or nasal spray to stimulate the immune system in humans and help them recognize and destroy foreign agents. The immune system will learn to detect and battle illnesses if you are exposed to it later in life. As a result, you will not become unwell, or you may become infected inadvertently. The body generates antibodies against particular germs and creates defense throughout the development of immunity. Regardless of how a vaccine is manufactured, the antibody stops the individual from producing sickness or reduces the severity of the disease the next time he comes into contact with that microbe.

To develop protection, the earliest human vaccines against viruses used weakened or attenuated viruses. Cowpox, a poxvirus that was similar enough to smallpox to protect against it but didn't generally cause significant disease, was included in the smallpox vaccine. Rabies was the first virus to be attenuated in a lab and used to develop a human vaccine.

Vaccines are created utilizing a variety of methods. They could contain live viruses that have been attenuated (weakened or altered so that they don't cause illness), inactivated or killed organisms or viruses, inactivated toxins for (bacterial illnesses in which the bacterium's toxins, not the bacteria themselves, cause sickness), or only portions of the pathogen (both subunit and conjugate vaccines fall under this category).[20-21]

Measles, mumps, and rubella (through the combination MMR vaccination), varicella (chickenpox), and influenza are among the live, attenuated vaccines presently recommended as part of the U.S. Childhood Immunization Schedule (in the nasal spray version of the seasonal flu vaccine). In addition to live, attenuated vaccines, the immunization schedule includes vaccines of every other major type **Table (1)** for a breakdown of the vaccine types on the recommended childhood schedule.

Vaccines come in a variety of types. Each kind is intended to train the body's immune system in how to combat certain bacteria and the diseases they might cause.

Scientists evaluate how the body's immune system reacts to the pathogen, who has to be vaccinated against the germ, and the best technology or technique to manufacture the vaccine while developing vaccinations. Scientists choose the sort of vaccination to develop based on a variety of criteria. Vaccines come in a variety of types, including

- Live-attenuated vaccines
- Inactivated vaccine
- Toxoid vaccines
- Subunit, recombinant, polysaccharide, and conjugate vaccines
- Messenger RNA (mRNA) vaccines
- Viral vector vaccines

Various vaccine kinds need different approaches for development. Each of the vaccination kinds is discussed in detail in the sections below**.**

2.2.1-Live Attenuated Vaccines

There are several methods for producing attenuated vaccines. One of the most common techniques is to pass the disease-causing virus through a series of cell cultures or animal embryos (typically chick embryos). Using chick embryos as an example, the virus is produced in a series of embryos. With each passage, the virus improves its ability to reproduce in chick cells but loses its ability to multiply in human cells. A virus that will be used in a vaccine can be "passaged" through up to 200 separate embryos or cell cultures. The virus will eventually be unable to replicate properly (or at all) in human cells, making it suitable for use in vaccines. All methods involving the transmission of a virus via a non-human host result in a virus that can be recognized by the human immune system but does not reproduce effectively in a human host.

When a human is given the vaccine virus, it will not be able to grow large enough to cause disease, but it will stimulate an immune response that will protect the individual from future infection. The possibility of the vaccination virus reverting to a disease-causing form must be considered.

Mutations may occur when the vaccination virus replicates in the body, resulting in a more virulent strain. Although this is highly unlikely due to the vaccine virus's limited ability to reproduce, it is considered when developing an attenuated vaccination. It's worth noting that mutations in the oral polio vaccine (OPV), a live vaccine that's eaten rather than injected, are fairly common. In rare cases, the vaccination virus can mutate into a virulent form, resulting in paralytic polio. As a result, the OPV vaccine is no longer used in the United States, and the inactivated polio vaccine has replaced it on the Recommended Childhood Immunization Schedule (IPV). The protection provided by a live, attenuated vaccination generally outlasts that of a dead or inactivated vaccine.

2.2.2 Inactivated Vaccines

Inactivated vaccines are an alternative to attenuated vaccines. This type of vaccine is made by inactivating a pathogen with heat or chemicals such as formaldehyde or formalin. This disables the pathogen's ability to replicate while keeping it "alive" so that the immune system can recognize it. ("Inactivated" rather than "killed" is commonly used to refer to viral vaccines of this type, as viruses are not considered to be alive.)

Pathogens that have been killed or inactivated cannot replicate and thus cannot revert to a more virulent form capable of causing disease (as discussed above with live, attenuated vaccines). They do, however, provide less protection than live vaccines and are more likely to require boosters to create long-term immunity.

inactivated vaccines on the U.S. Recommended Childhood Immunization Schedule include the inactivated polio vaccine and the seasonal influenza vaccine (in shot form).

2.2.3-Toxoids

Some bacterial diseases are caused by a bacterium-produced toxin rather than the bacterium itself. Tetanus, for example, is caused by a neurotoxin produced by the Clostridium tetani bacterium rather than the bacterium itself (tetanospasmin). Immunizations are possible against this pathogen by inactivating the toxin that causes disease symptoms. This can be accomplished, as with organisms or viruses used in killed or inactivated vaccines, through treatment with a chemical such as formalin, as well as through the use of heat or other methods.

Toxoids are vaccines composed of inactivated toxins. Toxoids can be compared to dead or inactivated vaccines., but are sometimes given their own category to highlight the fact that they contain an inactivated toxin, and not an inactivated form of bacteria[21-22-23].

2.2.4. Subunit and Conjugate Vaccines

Both subunit and conjugate vaccines contain only fragments of the pathogens against which they protect. Subunit vaccines use only a portion of a target pathogen to elicit an immune response. This can be accomplished by isolating a specific protein from a pathogen and presenting it as a stand-alone antigen. Subunit vaccines include the acellular pertussis vaccine and the influenza vaccine (in shot form).

Genetic engineering can be used to create a different type of subunit vaccine. A vaccine protein-coding gene is inserted into another virus or producer cells in culture. The vaccine protein is produced when the carrier virus replicates or when the producer cell metabolizes.

This method yields a recombinant vaccine: the immune system recognizes the expressed protein and provides future protection against the target virus.

The human papillomavirus (HPV) vaccine is another genetically engineered vaccine. There are two types of HPV vaccines available, one that protects against two strains of HPV and the other four, but both are made in the same way: a single viral protein is isolated for each strain. Virus-like particles (VLPs) are formed when these proteins are expressed. These VLPs contain no viral genetic material and cannot cause illness, but they do stimulate an immune response that provides future protection against HPV.

Conjugate vaccines are similar to recombinant vaccines in that they are created by combining two different components. Conjugate vaccines, on the other hand, are made from bacteria coat fragments. These coats are chemically linked to a carrier protein, and the resulting combination is used to create a vaccine. Conjugate vaccines are used to elicit a stronger, combined immune response: typically, the "piece" of bacteria being presented would not elicit a strong immune response on its own, whereas the carrier protein would. The bacterial fragment cannot cause illness, but when combined with a carrier protein, it can generate immunity against future infection. . The vaccines currently in use for children against pneumococcal bacterial infections are made using this technique.[21]

2.2.5.Messenger RNA Vaccines

For decades, researchers have studied and worked with mRNA vaccines, and this technology was used to create some of the COVID-19 vaccines. Proteins are produced by mRNA vaccines in order to elicit an immune response. When compared to other types of vaccines, mRNA vaccines have several advantages, including shorter manufacturing times and, because they do not contain a live virus, no risk of causing disease in the person being vaccinated. [24].

2.2.6.Viral Vector Vaccines

Scientists have been researching viral vector vaccines for decades. Some recent Ebola vaccines used viral vector technology, and several studies have focused on viral vector vaccines against other infectious diseases such as Zika, flu, and HIV. This technology was also used to create COVID-19 vaccines by scientists.

To provide protection, viral vector vaccines use a modified version of another virus as a vector. Several viruses, including influenza, vesicular stomatitis virus (VSV), measles virus, and adenovirus, which causes the common cold, have been used as vectors. Adenovirus is one of the viral vectors used in some COVID-19 vaccines that are currently being tested in clinical trials[25].

Table 2.1 Types of Vaccines

Vaccine type	Vaccines of this type
Live attenuated	Measles, mumps, rubella (MMR combined vaccine) Varicella (chickenpox) Influenza (nasal spray) Rotavirus
Inactivated/Killed	Diphtheria, tetanus (part of DTaP combined immunization)
Subunit/conjugate	Hepatitis B Influenza (injection) Haemophilus influenza type b (Hib) Pertussis (part of DTaP combined immunization) Pneumococcal Meningococcal Human papillomavirus (HPV)

2.3. How Vaccines Work with the Immune system:

Vaccines offer disease-specific active immunity. Vaccines do not cause illness in people, but they might fool the body into thinking it has a disease so it can fight it. This is how a vaccination works: the vaccine is given to the patient, it includes antigens for a specific illness, which the immune system recognizes as foreign invaders, prompting the immune system to produce antibodies to neutralize the antigens. Following that, the immune system retains these antibodies in case the person is ever exposed to the illness [26-27].

Vaccines are administered to prevent illnesses and, eventually, to eradicate them. When a vaccine is administered to a large part of the population, it protects both those who get it and those who are unable to receive it. "Herd immunity" is the term for this notion. When a large portion of the population has been vaccinated and is immune to a disease, they do not become ill, and there is no one to spread the sickness to others. This herd immunity protects the unvaccinated population from infectious illnesses (diseases that transmit from person to person) for which a vaccine exists[28-29].

2.4. Benefits of vaccination

Immunization is a critical component of primary health care since it reaches more people than any other health or social service. Individuals, communities, countries, and the entire globe gain from it. It's a three-fold investment in the future.

First; Saving lives and preserving people's health are two of the most important things we can do[30]. Immunization has substantially decreased the number of people who die from infectious illnesses. The mortality rate of children under the age of five years fell by 24% between 2010 and 2017, credited in major part to vaccination. Vaccines also protect children against handicap, which can hinder their growth and cognitive development, allowing them to not only live but also thrive[31].

Vaccines benefit not only infants and children, but also adults; after 5–8 years, cancer-causing HPV prevalence was reduced by 83 percent among girls aged 13–19, and the prevalence of precancerous lesions was reduced by 51 percent among girls aged 15–19 in countries where the vaccine against human papillomavirus (HPV) was introduced[32].

Out-of-pocket expenses for health care have a devastating impact on household budgets in many nations, possibly plunging families into poverty. Vaccines will help avoid an estimated 24 million people from slipping into poverty by 2030 by reducing families' health-care spending and contributing to financial protection, which is a fundamental component of universal health coverage[33].

Second, immunization is the cornerstone of a healthy, productive population, and it improves countries' production and resilience. Infection prevention lowers the cost on health-care systems, and a healthier population is more productive. Children who are protected from infectious illnesses do better in school and contribute more to national growth and wealth.

Stopping disease epidemics is inconvenient and expensive. Outbreaks have the potential to overwhelm and destabilize public health programs, clinical services, and health systems. They may also have a negative impact on travel, trade, and development in general. Treatment expenses and lost production are frequently borne in the case of seasonal illnesses like influenza[30].

Immunized communities are more resistant to infectious disease outbreaks, and strong health systems and immunization programs allow for rapid detection and response to minimize their impact. For example, immunization against measles in 94 low- and middle-income countries returned an estimated US$ 76.5 for every US$ 1 invested in vaccination, and the full economic impact of the Ebola virus outbreak in 2014–2016 returned an estimated US$ 76.5 for every US$ 1 invested in vaccination, and the full economic impact of the 2014–2016[34-35].

Vaccines are a crucial component in the struggle against new and re-emerging pathogens, enabling a safer, better, and wealthier world. Pathogens are not restricted by national borders, and people moving locally and internationally can quickly transmit diseases. As the world becomes more urbanized, huge, dense populations emerge, increasing the risk of infectious disease transmission and epidemics. Climate change also exposes new people to vector-borne diseases and may modify the patterns and intensity of seasonal infections. Between 2030 and 2050, climate change is predicted to result in 60 000 more malaria fatalities each year [36]. This tendency might be reversed if a malaria vaccine that is now being studied in three African nations is successful. Infectious illness detection, prevention, and response are so critical to global health security.

Infectious illnesses are becoming increasingly resistant to antibiotics and other antimicrobials all over the world. Immunization not only protects people from drug-resistant infections, but it also reduces their spread and the need for and use of antibiotics, contributing to the fight against antimicrobial resistance. It is estimated that widespread use of the pneumococcal conjugate vaccine (PCV) could reduce the number of days on antibiotics for pneumonia in children under the age of five by 47%, equivalent to 11.4 million days on antibiotics per year[37].

Immunization and disease monitoring are key capabilities mandated by the International Health Regulations (2005), since they contribute to robust, long-term health systems capable of responding to infectious disease outbreaks, public health threats, and crises. (A 10% improvement in key skills needed by the International Health Regulations (2005), such as surveillance and risk communication, is linked to a 19% reduction in cross-border infectious risks.) Furthermore, all vaccination efforts should include the proper management and disposal of vaccine waste, which contributes directly to patient safety and quality of care while also minimizing environmental and climatic risks[38].

2.5. Past Contribution of Vaccination to Global Health

Vaccination has been used for hundreds of years. In 17th century China, Buddhist monks ingested snake venom to gain immunity to snake bites, and variolation (smearing a skin rip with cowpox to gain immunity to smallpox) was performed. After inoculating a 13-year-old child with vaccinia virus (cowpox) and demonstrating immunity to smallpox in 1796, Edward Jenner is regarded the pioneer of vaccinology in the West. The first smallpox vaccine was created in 1798. The methodical application of widespread smallpox vaccination in the 18th and 19th centuries resulted in the disease's global eradication in 1979 [16-17-18-19].

In humans, Louis Pasteur's discoveries paved the way for the creation of live attenuated cholera and inactivated anthrax vaccines (1897 and 1904, respectively). In the late 19th century, the plague vaccine was also developed. Bacterial vaccine development exploded between 1890 and 1950, including the Bacillus Calmette-Guerin (BCG) immunization, which is still in use today, Alexander Glenny perfected the use of formaldehyde to inactivate tetanus toxin in 1923. In 1926, the same approach was employed to develop a diphtheria vaccine. The development of a pertussis vaccine took much longer, with a whole cell vaccine being approved for use in the United States in 1948.

Alexander Glenny perfected the use of formaldehyde to inactivate tetanus toxin in 1923. In 1926, the same approach was employed to develop a diphtheria vaccine. The development of a pertussis vaccine took much longer, with a whole cell vaccine being approved for use in the United States in 1948. The Salk (inactivated) polio vaccine and the Sabin (live attenuated oral) polio vaccine were produced between 1950 and 1985 using viral tissue culture techniques. Polio has been eradicated in many parts of the globe as a result of widespread vaccination. For use in vaccinations, attenuated measles, mumps, and rubella strains were created. Measles is the next disease to be vaccinated against.

Vaccine resistance has always existed in some communities, despite evidence of health benefits from vaccination programs. The late 1970s and early 1980s saw an increase in vaccine lawsuits and decreasing profitability, resulting in a drop in the number of businesses manufacturing vaccinations. The establishment of the National Vaccine Injury Compensation Program in the United States in 1986 helped to halt the drop. The impact of this era may still be seen in supply shortages and the media activities of an increasingly vocal anti-vaccination campaign.

Molecular genetics, with its enhanced insights into immunology, microbiology, and genomes, has been utilized to vaccine development over the last two decades. Recombinant hepatitis B vaccines, the less reactogenic acellular pertussis vaccine, and novel ways for making seasonal influenza vaccinations are all examples of recent achievements. Molecular genetics paves the way for a bright future in vaccine development, including the development of new vaccine delivery systems (e.g., DNA vaccines, viral vectors, plant vaccines, and topical formulations), new adjuvants, more effective tuberculosis vaccines, and vaccines against cytomegalovirus (CMV), herpes simplex virus (HSV), respiratory syncytial virus (RSV), staphylococcal disease, streptococcal Allergies, autoimmune disorders, and addictions may potentially be treated using therapeutic vaccinations [39-40-41-42].

2.6. Factor Effecting on the Vaccination Status

The key factors influencing on the children immunizations operate on five levels.

(1) Intra-personal: individual child characteristics; (2) Inter-personal: parental and household determinants; (3) Community: community features and service delivery elements; (4) Institutional: worldwide coordination of vaccination efforts (5) Public policy - policy quality, coverage, and enforcement[43].

In addition, Conflict, underinvestment in national immunization programs, vaccine stock-outs, and disease outbreaks such as COVID-19 all contribute to the disruption of health systems and limit the sustainable supply of vaccination services. Approximately 42% (9.6 million) of unvaccinated and under-vaccinated babies live in fragile or humanitarian settings including (conflict-affected nations). These kids are the ones who are most susceptible to disease epidemics[44].

2.6.1 Socio-economic and demographic characteristics

Variables such as maternal education and household economic situation have been demonstrated to influence children immunization at an interpersonal level in disadvantaged countries. Educated mothers and husbands were more likely than uneducated women and husbands to completely vaccinate their children. It was consistent with research published in Nigeria[45], India[46-47], Indonesia[48], and Turkey[49] In certain research, the education of mothers was linked to decreased coverage [50-51-52].In some studies, found female gender had low vaccination coverage than male[49-51] but on others like Libya studies theirs no different[53-54] and low family income, large families, high parity, a lack of vaccination knowledge, and inadequate communication and information all contribute to behaviors in which preventative actions are not prioritized as family priority, and these characteristics are positively related to a lack of vaccination [55].

In addition, divorced mothers were three times less likely to complete immunization schedules of their children compared to mothers who were married[56], married women have adequate knowledge of immunization that is improve complete schedule of vaccination[57].

A cross sectional study in Angola find the families which have between 2 and 3 children, there children are full immunization compared with other families have one child[58]

2.6.2 Access and Quality of Vaccination Service

Strengthening the communication, education and information skills of health service providers is an important step to improve health services in general. In some studies, we found the heath workers are the most important source of information regarding the vaccination[59-60]

Access to health-care facilities based on the distance are important factor to complete vaccination, Confounder variables for vaccine non-uptake were identified as the necessity for transportation and the availability of transportation. Spending more than 60 minutes to get to the nearest health institution, on the other hand, was shown to have a significant negative impact on vaccine uptake. Accessibility was shown to have no relationship with missed immunization chances, which appeared to be related to the quality of health facility services[61]. in some studies, like in areas of Nigeria and most parts of sub-Saharan Africa it was association as demonstrated by other studies in Uganda and Bangladesh. [62-63] In contrary to findings from Mozambique[64] Malaysia and other Nigeria study Waiting time was not a major influence for those who did not receive childhood immunizations. The availability of immunization health facilities approximately five kilometers from their homes and free immunization provided by government hospitals or clinics to the children may have benefited the mothers and outweighed the risks of failing to immunize their children as a possible explanation for the insignificant result in this studies[65-66].

the stock out of vaccines effect on full immunization and vaccine specific full dose coverage's we can showed in Ethiopia study [67].

2.7 Timely Vaccination

Timely vaccination, also known as age-appropriate vaccination, is sometimes used interchangeably with up-to-date vaccination to refer to receiving specified vaccines by a specific age or date[68-69-70], children were considered to have received a recommended childhood vaccine in a timely manner if they received it within the specified timeframe[71-72]. Vaccination before that age is considered early vaccination, and vaccination after that age is considered late vaccination[60-70]. It should be noted that the timeliness cut-points have an impact on the calculation of coverage rates. While there may be circumstances that require only timely vaccines to be counted, there are other cases where excluding doses administered after a very short lag (e.g., 1 month) will artificially lower coverage. As a result, in some cases, calculating timely vaccination should be accompanied by calculating coverage with a less stringent lag time[73].

Delayed vaccine delivery can lead to extended periods of vulnerability among children, and the presence of such a pool of susceptible youngsters can lead to an epidemic when a case of a certain vaccine-preventable illness develops[74]. The timely delivery of vaccinations as suggested has been discovered to be unusual, which may provide a difficulty to fulfilling the primary goal of immunization programs, which is to avoid disease outbreaks[75].

They are difference between one country to another in vaccine administration For example, Measles vaccine is administered later in England[76] compared with Ghana and Nigeria because of the higher risks of transmission of the disease so, delay of the vaccine in these countries may cause epidemic [77-78-79].

Individual, community and health services-based factors have been linked to an increased risk of delayed immunization [80-81]. In Italy, however, hospital-based immunization programs have been linked to vaccination delays[82].

2.8. Health System and Vaccination in Libya

Since 1951, when it began with meager resources: 14 hospitals (1,600 bed capacity) and a small number of health centers, Libya's health care system has come a long way. The country's planned development process began in 1972, with the first three years National Transformation Plan (197375) emphasizing that access to health services was a right of every citizen. Between 1970 and 1979, community health centers were established. "Health for all" has been the mandate of the Libyan government since 1980, with the government providing free universal health coverage.In Libya, rather than a purely state-run model, there is a mixed system of public and private health care. In urban and rural areas, health care is provided through a network of primary health care units, centers, polyclinics, rehabilitation centers, and general hospitals, as well as a number of tertiary care specialized hospitals. The health-care delivery system is divided into three levels.:

1) The first level consists of primary health care units (which provide curative and preventive services to 5,000 to 10,000 citizens), primary health care centers (which **include vaccination regulation** services to 10,000 to 26,000 citizens), and polyclinics (which are

staffed by specialized physicians and contain laboratories, radiological services, and a pharmacy). These polyclinics serve between 50,000 and 60,000 people. the first level.

2) At the second level, general hospitals in rural and urban areas provide care to those referred from the first level.

3) Tertiary care specialized hospitals and medical centers comprise the third level[83].

2.8.1-Vaccination in Libya

Prior to 2019, Libya's immunization coverage rates were consistently high, with coverage for all antigens calculable and measured to be 97 percent or higher. Libya's success in the management of vaccine preventable diseases can be demonstrated by the fact that the country has been declared polio free since 1991, with no cases of tetanus recorded since 1993. Libya is currently in the early stages of measles eradication, though some transmission occurs within the country, with 32 cases reported in 2016[11] . Some reports from 2014 to 2016 indicate that the coverage rate for measles in children under the age of five is around 75%, but the reliability of these data sources is unknown..

In the past Rotavirus disease accounted for 24 – 45% of diarrheal hospitalizations among children during the period 1980-2009 [84-85] In 2009, the World Health Organization recommended the inclusion of rotavirus vaccine in the national immunization programs of all countries globally and particularly in those countries with high child mortality due to diarrhea [86]. In Libya, a live attenuated pentavalent vaccine based on a human rotavirus strain was introduced during October 1, 2013[87].

In 2019, 74 percent of the children’s population in Libya received the bacillus Calmette-Guérin (BCG) vaccine, which provides immunization against tuberculosis (TB). In the same year, 73 percent of the children received the third dose of diphtheria and tetanus toxoids and pertussis (DTP3) vaccination, and the same share was vaccinated against measles.

In 1972, Libya made mandatory vaccination for all antigens on the immunization schedule. **Table (2. 2)**. shows Libya's current immunization schedule . New vaccines were added to the national vaccination program in 2014: human papillomavirus vaccine and injectable polio vaccine, which were added to the previously used pentavalent vaccine Vaccines included in the National Immunization Programme (NIP) are universally recommended and provided at no cost to all resident children, including immigrants.

The zero dose vaccinations (BCG, OPV, and HepB) are administered in the hospital at birth. PHC facilities provide the remaining vaccines on the schedule. When children enter school at the age of six, they must provide proof that they are fully immunized in order to ensure complete vaccination coverage. The school health services conduct a second check of immunization status at the age of 12, following the completion of primary school. The Ministry of Health closely monitors the cold chain to ensure that all vaccines are of optimal quality when administered, and no vaccination is permitted in the private sector.

2.8.2- EPI &Libyan Vaccine Program history:

Libyan vaccine program is long lasting. It started in the sixties of the last century, and being evolute with time. Libya was the 1st country to introduce BCG vaccination on massive scale, Libya in 1971 has passed a legislation, that made BCG vaccination compulsory The program is being upgraded continuously, MMR was introduced in the early 90ties, and being given at 12 and 18 months. Hep B vaccine was First introduced in 1993, then we went back and immunized, those born in 91, and 92 and went back further and immunized those born in 88,89 and 90.

The last case of confirmed paralytic polio in Libya was in October 1991. Libya has been through the switching process from TOPV to b.OPV in May 2016 including the fighting zoons. Now adays immunization against polio, now include 2doses of oral polio (BOPV), at birth and at 9months of age , in addition to 5 doses of injectable polio at 2,4,6,18 months and 6 years, In response to reported cases of paralytic polio from Syria and Nigeria , Libya has conducted 4 polio vaccination campaigns against polio[83-85-88]

During the sixties of the last century, Libya vaccine program included immunization against:

- BCG, Measles, poliomyelitis.
- Diphtheria, Tetanus, whooping cough

Table (2.2) Libyan EPI 2007

Age/Months	Item specification
Birth	BCG+ T-OPV & Hepatitis B
2M	Penta (DTP+ HBV + HIB) +OPV
4M	Penta (DTP+ HBV + HIB) +OPV
6M	Penta (DTP+ HBV + HIB) +OPV
12M	MMR + OPV
18M	DPT+ MMR
6Y	DT + OPV
15Y	Td Adult + OPV

HPV introduced in 2013 for girls aged 15year, in 2017 HPV moved to the age of 12year , and to close the gap we immunizing the 13 and 14y old

Table (3.2) Upgraded EPI 2017-2018

Age/Months	Item specification
Birth	BCG+ b-OPV & Hepatitis B
2M	Hixa (DTaP+ HBV + HIB+IPV) +Rota RotaVairus +PCV
4M	Hixa (DTaP+ HBV + HIB+IPV) +Rota RotaVairus +PCV
6M	Hixa (DTaP+ HBV + HIB+IPV) + Rota RotaVairus
9M	Meng conjugate A,C,Y,W 135 & b-OPV
12M	Meng conjugate A,C,Y,W 135 + PCV + MMR
`18M	Penta (DTaP+ HIB+IPV) & MMR
6Y	Tetra (TdaP+IPV) & Meng Cong
12Y (Female)	Q HPV
15	Meng conjugate & TdaP

3- MATERIAL and METHODS

3.1. Study Design

This cross-sectional study conducted with an online questionnaire containing children& vaccination information, which is intended to be completed by caregivers (parents, close relatives, etc.) of children under 5 years of age (from 0 to 4 years old both Boys and Girls) The survey link was shared using social media tools (Facebook, WhatsApp ,etc) and we asked the participants to fill out this survey , and to order to reach most of the cities ,The country was divided to 3 regions ,cluster sampling method was used for sample selection cities Cyreneica (eastern Libya), Tripolitania(western Libya) and Fezzan (southern Libya)) ,as **Table (1.3)**and select the 37 cities (albayda'a , Tripoli , Benghazi , Tajura , Al Marj , Darnah , Jalu , Murzuk , Kufra, Gharyan , Misrata , Zliten , Janzur, Tobruk, Shahhat, Khoms, Castelverde, Jadu, Zawiya, Alasaba, Ubari, Nalut, , Ajdabiya, Bani Walid, Ras Lanuf, Zintan, Sokna, Hun, Tarhuna, Sirt, sabha, Zella, Suane, Msallata , Ghadames, Shatee, Zuwara) from these regions randomly , then we conduct with 405 the households from these cities , and ask them to select one of their child to share in our study to avoid repeat the answers, especially in the first and second section of the survey , during the period from 14th of June to 3 of August , 2021, during collecting the data there was difference in response from regions and cities because of problem in electricity and internet connection specially in the south region .

Table (1.3) Libyan cities

Regions	Cities
Cyreneica (eastern Libya)	Benghazi, albayda’a, Al Marj, Shahhat, Darnah, Tobruk, Jalu, Ajdabiya, Kufra, Ras Lanuf, Darnah, Tobruk
Tripolitania (western Libya)	Tajura, Tripoli ,Janzur, Castelverde, Suane, Bani Walid, Tarhuna, Msallata Gharyan, Jadu, Alasaba, Nalut, Zintan, Ghadamis ,Zawiya, Zuwara , Misrata, Zliten Sokna, Hun, Sirt, Zella
Fezzan (southern Libya)	Murzuk, Ubari, Sabha Shatee

3.2-Study Population (Participants)

The study population were children both (male &female) their age between (0-4) from different Libyan cities, Libya population aged 0-4 years was at level of 624 thousand persons in 2020, down from 632.96 thousand persons previous 2019 , this is a change of 1.42%. in 2021 609 thousand child (313.002 males 296.444 females)[0] **figure 3.1(Population Pyramid of Libya at 2021)**

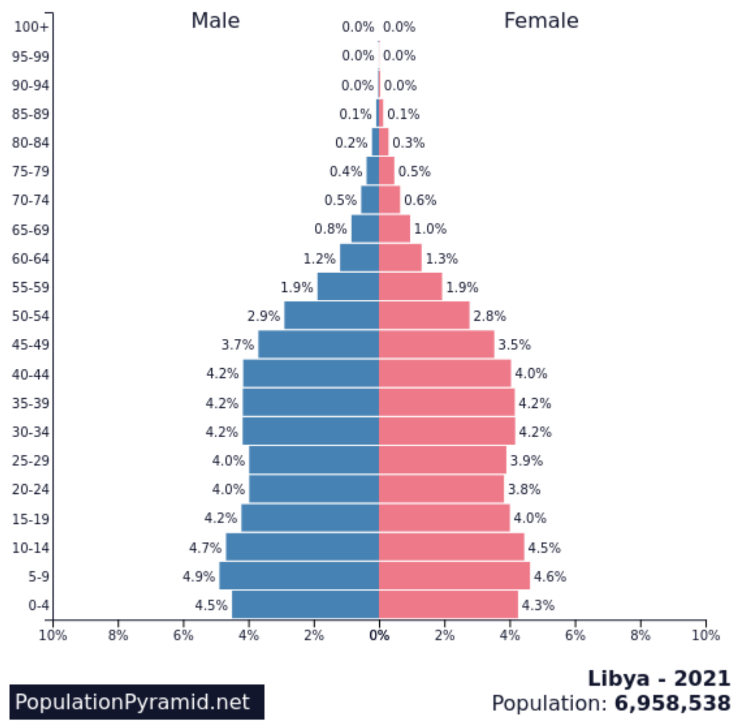


Figure 3.1 Population Pyramid of Libya at 2021

3.4 Inclusion Criteria:

Children younger than 5 years (0-4) with a vaccination card

3.5 Exclusion Criteria

- Children aged 5 years and older

-Children aged (0-4) without a vaccination card

3.6- Variables, Measurement Of Variables And Data Collection:

3.6.1-Outcome (Dependent) Variables

Childhood vaccination status for children under 5 years old in Libya

3.6.2- Independent Variables

Independent variables include age, gender, perceived household economic status, fathers', mothers' education, numbers of children.

3.7-Data collection

Data was collected by online Questionnaire which is prepared in Arabic language by using online Google form and then translated to English. The questionnaire employs a variety of dichotomous, multiple-option, checklist and free-text response formats. Questionnaire has three sections. The first section includes questions about demographics that include age, gender, perceived household economic status, and fathers', mothers' education, second section about vaccination services in Libya and the last part about vaccination status in Libya, the survey is offered ‘online’ for ease of access and to maximize exposure to participant ,we chaired the survey in childhood vaccination groups in Facebook pages that is managed by volunteer Libyan doctors and health workers , we take permission after interduce our study to them, the participant in these groups are relatives of children from different cities in Libya .

We provide an information sheet on the online survey access page, where respondents are advised that participation is voluntary and that they have the right to withdraw before submitting their survey form. Consent to participate is implied if the survey is completed.

To ensure reliability, the survey was edited and pre-tested on 20 respondents from participants who were not part of the study in the study area The questionnaire was then pilot-tested on 20 respondents of the un-sampled number of the study population. After piloting the tools, they were reviewed to ensure that they captured reliable information and modified to improve clarity before undertaking the main study.

3.8-Sample size calculation:

My total sample size is 425 children we exclude 20 surveys because the children was over age and some of surveys with wrong answers, so last sample size was 405.

The sample size with a confidence interval of %95 was calculated with the Cochran formula:

$$n_0 = \frac{Z^2pq}{e^2}$$

Where:

e is the desired level of precision (the margin of error),

p is the (estimated) proportion of the population which has the attribute in question,

q is 1 – p.

The z-value is found in a Z table

N= 1.962 * (0.10) * 0.9 / 0.032 =384

Note: because of the problem in electricity and limited source about population of children in every region, I depend on responses of caregivers in may study, so I did not calculate how many children should I select in every region

3.9 Statistical Analysis:

Statistical analysis was performed with SPSS (statistical package for the social sciences) v.25 (IBM, New York, NY). Statistical significance level was established at $p < 0.05$.

Chi-square tests were conducted to study the effect of Socio-demographic characteristics and the access and quality of vaccination service on both of immunization status and vaccination time.

3.10. Study Area

Libya is located in North Africa on the Mediterranean Sea's southern coast, between 18° and 33° north latitude and 9° and 25° east longitude. It is the fourth largest country in Africa, with a land area of 1,665, 000 square kilometers. It has a coastline of around 1900 kilometers and borders six other African countries (Algeria, Chad, Egypt, Niger, Tunisia, and Sudan). The major cities are concentrated along the Mediterranean coast in the country's northwestern region. Libya's population is estimated to be 6931061 million people in 2020[89]. The proportion of people living in cities is high, accounting for 88 percent of the population [11] . Libya, on the other hand, has one of the world's lowest population densities, with nearly four people per square kilometer, though this low population density is not uniform across the country. The coastal northern region is more densely populated, with 85 percent of the population living on 10 percent of the land area, whereas the larger southern region is sparsely populated, primarily due to desert. Because Libya has the largest oil reserve in Africa, oil is the backbone of the Libyan economy. In the 2016 Human Development Index[90], the United Nations Development Program ranked Libya 100th out of 188 countries. Literacy rates are high, with 91 percent literate in 2015. In 2012, the average life expectancy at birth was 75 years. [89] **(figuer 4.2)**

3.10.1 Libya's Largest Cities

Over 80% of Libyans reside in or near urban centers, and while there are several significant cities, just one has a population of more than one million people. Tripoli, Libya's capital and largest city, is the country's largest metropolis. However, there are a lot of widely disparate population estimates. Precise data are difficult to come by - estimates range from 1.1 to 2.2 million, although the most commonly proposed figure appears to be around the 1.2 million mark. Libya's second and third largest cities are Benghazi (population approximately 650,000) and Misrata (population around 300,000), which serve as the country's economic and entrepreneurial hubs, respectively. Tarhuna, Al Khums, and Az Zwyah are three more Libyan cities with populations in excess of 200,000.

figure 4.2 Libya map

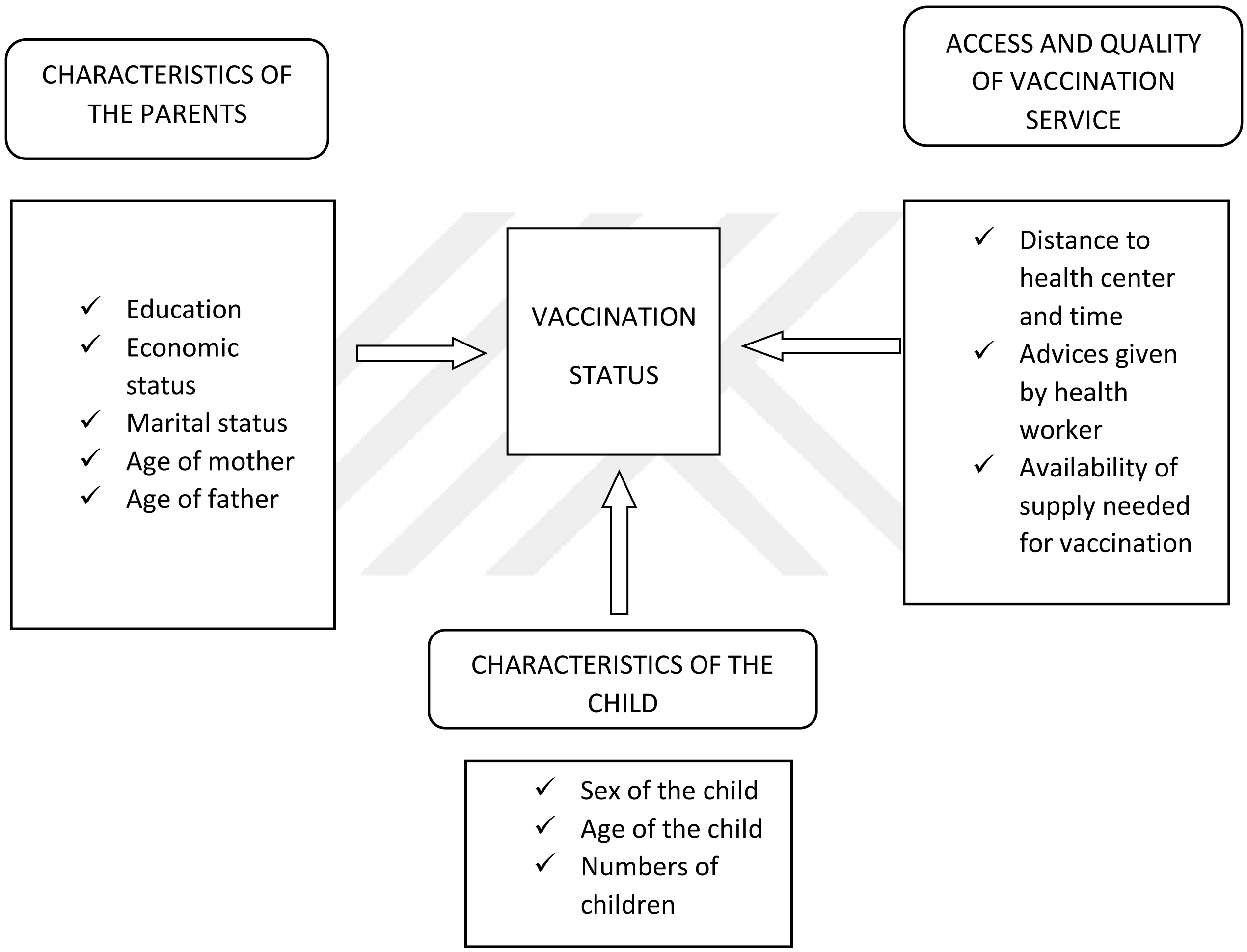
3.11- Terms and Criteria of vaccination status:

- **Partially vaccinated**: A child who missed at least one dose of the vaccines up to child age.
- **Completely vaccinated:** A child who received all of the vaccination doses up to his or her age.
- **Non-vaccinated:** A child who does not receive any dose of the vaccine.
- **Vaccinated on time (Immunization timeliness):** defined as being vaccinated at the recommended ages.
- **Vaccinated after long time:** Any child with delayed administration of one or more antigens was considered not timely vaccinated or vaccinated after long time.

3.12- Ethical considerations:

Ethical clearance for this research was obtained from the Research Committee of Libyan International Medical University and also from the Research Committee of Yeditepe University.

3.13. Conceptual Framework:



Conceptual framework for evaluate vaccination status of Libyan children under five years old

Created by the author

4. RESULTS

4.1. Sample's Description

Study sample consisted of 405 children, 45.2% were male and 54.8% were females. Most of the sample were +18 months (41.2%) and the smallest age group was less than 2 months (4.4%), while the remaining age groups ranged between 7.9% - 12.1%.

2.5% of the children were not immunized, 51.1% were partially immunized, and 46.4% were completely immunized

Table (4.1) Gender distribution in study sample.

		N	**%**
Gender	Males	183	45.2 %
	Females	222	54.8 %
	Total	405	100 %

Table (4.2) Age distribution in study sample

		N	%
Age	Less than 2 Months	18	4.4%
	2 – Less than 4 Month	48	11.9 %
	4 – Less than 6 Months	32	7.9%
	6 – Less than 8 Months	39	9.6%
	8 – Less than 9 Months	5	1.2%
	9 – Less than 12 Months	49	12.1 %
	12 – Less than 18 Months	47	11.6 %
	+18 Months	167	41.2 %
	Total	405	100 %

Table (4.3) Immunization status in study sample**.**

		N	%
Immunization status	Non immunized	10	2.5%
	Partially immunized	207	51.1 %
	Completely immunized	188	46.4 %
	Total	405	100 %

*****Partially vaccinated: A child who missed at least one dose of the vaccines up to child age

Completely vaccinated: A child who received all of the vaccination doses up to his or her age

Non-vaccinated: A child who does not receive any dose of the vaccine

4.2. Effects of Socio-demographic characteristics on immunization status

Most of the sample were +18 months (41.2%) and the smallest age group was less than 8 months (1.2%), while the remaining age groups ranged between 4.4% - 12.1%. There was a statistically significant difference in immunization status between age groups ($p < 0.001$). Most of the age groups under 12 months were partially immunized while children aged 12 months and +18 months were significantly more completely immunized (53.2% and 65.9% respectively).

Table (4.4) Effects of age distribution on immunization status.

		Total		Immunization						Sig.
				Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Age	Less than 2 Months	18	4.4%	1	5.6%	13	72.2%	4	22.2%	P < .001* $X^2 = 66.025$
	2 – Less than 4 Month	48	11.9%	1	2.1%	36	75%	11	22.9%	
	4 – Less than 6 Months	32	7.9%	2	6.3%	26	81.3%	4	12.5%	
	6 – Less than 8 Months	39	9.6%	2	5.1%	26	66.7%	11	28.2%	
	8 – Less than 9 Months	5	1.2%	0	0%	4	80%	1	20%	
	9 – Less than 12 Months	49	12.1%	2	4.1%	25	51%	22	44.9%	
	12 – Less than 18 Months	47	11.6%	1	2.1%	21	44.7%	25	53.2%	
	+18 Months	167	41.2%	1	0.6%	56	33.5%	110	65.9%	
	Total	405	100%	10	2.5%	183	45.2%	222	54.8%	

* Column percentages; other are row percentages

27.5% of the +18 months children were 1.5 years old, 30.5% years old, 19.8% were 3 years old, and 22.2% were 4 years old. Most of these children were completely immunized (1.5 years 54.3%, 2 years 68. %, 3 years 81.8%, and 4 years 62.2%). There was no statistically significant difference in immunization status between age of +18 years children (p = 0.152).

Table (4.5) Effects of age in +18 months children on immunization status

		Total		Immunization					
				Non		Partially		Completely	
		N	**%***	**N**	**%**	**N**	**%**	**N**	**%**
Age of the child	1.5 – Less than 2 Years	46	27.5 %	0	0%	21	45.7 %	25	54.3%
	2 – Less than 3 Years	51	30.5 %	1	2%	15	29.4 %	35	68.6%
	3 – Less than 4 Years	33	19.8 %	0	0%	6	18.2 %	27	81.8%
	4 Years	37	22.2 %	0	0%	14	37.8 %	23	62.2%
	Total	167	100 %	1	0.6 %	56	33.5 %	110	65.9%

* Column percentages; other are row percentages   * sig P = .152 X2 = 9.409

45.2% of sample's children were males and 54.8% were female's children, most of both genders were partially immunized (52.5% and 50% respectively) and 45.4% and 47.3% of them respectively were completely immunized, while only 2.2% and 2.7% were not immunized. No statistically significant difference was found in immunization status between gender groups (p = 0.857)

Table (4.6) Effects of gender on immunization status.

		Immunization								Sig.
		Total		Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Sex	Male	183	45.2 %	4	2.2%	96	52.5 %	83	45.4%	P = .857 $X^2 = 0.309$
	Female	222	54.8 %	6	2.7%	111	50%	105	47.3%	
	Total	405	100 %	10	2.5%	183	45.2 %	222	54.8%	

* Column percentages; other are row percentages

76.8% of the people answered the survey were mothers, 51.8% of their children were partially immunized, 46.9% were completely immunized and 1.3% were not immunized. 21.5% of the of the people answered the survey were fathers, 49.4% of their children were partially immunized, 44.8% were completely immunized and 5.7% were not immunized. And 1.7% were other relatives, however no statistically significant difference was found (p = 0.052).

Table 4.7 Effects of the relationship with the child on immunization status

		Immunization								Sig.
		Total		Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Relationship with child	Father	87	21.5 %	5	5.7%	43	49.4%	39	44.8%	P = .052 $X^2 = 8.706$
	Mother	311	76.8 %	4	1.3%	161	51.8%	146	46.9%	
	Other relatives	7	1.7%	1	14.3 %	3	42.9%	3	42.9%	
	Total	405	100 %	10	2.5%	183	45.2%	222	54.8%	

* Column percentages; other are row percentages

1% of the children's mothers were less than 20 years, 45.2% were 20 – 30 years, 51.2% were 30 – 40 years, and 2.6% were above 40 years. 75% of the children of mothers less than 20 years were partially immunized and 25% were completely immunized, 55.7% of the children of mothers aged 20 – 30 years were partially immunized, 40.2% were completely immunized, and 4% were not immunized, while the percentages in the children of mothers aged 30 – 40 years were 47.2%, 51.8%, and 1% respectively, and finally the percentages in the children of mothers aged above 40 years were 50%, 40%, and 10% respectively, however, no statistically significant difference was found (p = 0.066).

Table (4.8) Effects of the age of the mother on immunization status

		Total		Immunization						Sig.
				Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Age of the mother	Less than 20	4	1%	0	0%	3	75%	1	25%	P = .066 X^2 = 10.375
	20 to less than 30	174	45.2 %	7	4%	97	55.7%	70	40.2%	
	30 to less than 40	197	51.2 %	2	1%	93	47.2%	10 2	51.8%	
	Above 40	10	2.6%	1	10%	5	50%	4	40%	
	Total	405	100 %	10	2.5%	18 3	45.2%	22 2	54.8%	

* Column percentages; other are row percentages

9.6% of the children's fathers were 20 – 30 years, 61.7% were 30 – 40 years, and 28.6% were above 40 years. 61.5% of the children of fathers aged 20 – 30 years were partially immunized, 35.9% were completely immunized, and 2.6% were not immunized, while the percentages in the children of fathers aged 30 – 40 years were 51.2%, 46.4%, and 2.4% respectively, and finally the percentages in the children of fathers aged above 40 years were 47.4%, 50%, and 2.6% respectively. However, no statistically significant difference was found (p = 0.662).

Table (4.9) Effects of the age of the father on immunization status**.**

		Total		Immunization						Sig.
				Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Age of the father	20-30	39	9.6%	1	2.6%	24	61.5 %	14	35.9%	P = .662 $X^2 = 2.404$
	31-40	250	61.7 %	6	2.4%	128	51.2 %	116	46.4%	
	> 40	116	28.6 %	3	2.6%	55	47.4 %	58	50%	
	Total	405	100 %	10	2.5%	183	45.2 %	222	54.8%	

58% of the fathers' education level were university, 17.5% were high school, 14.3% were postgraduate, and 10.1 were preparatory school. Most of the children which their fathers finished preparatory school and university and postgraduate were partially immunized (61%, 50.2%, and 53.4% respectively), while most of the children which their fathers finished high school were completely immunized (50.7%). However, no statistically significant difference was found (p = 0.178).

Table (4.10) Effects of the education level of the father on immunization status

				Immunization						Sig.
		Total		Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Education of father	Preparatory School	41	10.1 %	3	7.3%	25	61%	13	31.7%	P = .178 X^2 = 8.929
	High School	71	17.5 %	2	2.8%	33	46.5 %	36	50.7%	
	University	235	58%	5	2.1%	11 8	50.2 %	11 2	47.7%	
	Postgraduate	58	14.3 %	0	0%	31	53.4 %	27	46.6%	
	Total	405	100 %	10	2.5%	18 3	45.2 %	22 2	54.8%	

69.3% of the mothers' education level were university, 17.3% were high school, and 13.3% were postgraduate. Most of the children which their mothers finished high school and university were partially immunized (49.3%, and 54.3% respectively), while most of the children which their mothers finished high school were completely immunized (58.5%).However, no statistically significant difference was found (p = 0.363).

Table (4.11) Effects of the education level of the mother on immunization status

				Immunization						Sig.
		Total		Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Education of mother[1]	Preparatory School	0	0%	0	0%	0	0%	0	0%	P = .363 $X^2 = 4.332$
	High School	69	17.3%	2	2.9%	34	49.3%	33	47.8%	
	University	276	69.3%	6	2.2%	150	54.3%	120	43.5%	
	Postgraduate	53	13.3%	1	1.9%	21	39.6%	31	58.5%	
	Total	405	100%	10	2.5%	183	45.2%	222	54.8%	

46.9% of the children were from Cyreneica (eastern Libya), 46.4% were from Tripolitania (western Libya), and 6.7% were from Fezzan (southern Libya). 48.9% of the children from Cyreneica were completely immunized, 47.9% were partially immunized, and 3.2% were not immunized. 59.3% of the children from Fezzan were partially immunized, 33.3% were completely immunized, and 7.4% were not immunized. 53.2% of the children from Tripolitania were partially immunized, 45.7% were completely immunized, and 1.1% were not immunized. However, no statistically significant difference was found (p = 0.152).

Table (4.12): Effects of children's region on immunization status

				Immunization						
		Total		Non		Partially		Completely		Sig.
		N	%*	N	%	N	%	N	%	
Region	Cyreneica (east)	190	46.9 %	6	3.2 %	91	47.9%	93	48.9%	P = .152 X^2 = 6.706
	Fezzan (south)	27	6.7%	2	7.4 %	16	59.3%	9	33.3%	
	Tripolitania (west)	188	46.4 %	2	1.1 %	100	53.2%	86	45.7%	
	Total	405	100 %	10	2.5 %	183	45.2%	222	54.8%	

96.3% of the children's parents were married, 2.2% were divorced, and 1.5% were widowed. 51.5% of the children of married parents were partially immunized, 46.2% were completely immunized, and 2.3% were not immunized, while the percentages in the children of widowed parents were 50%, 50%, and 0% respectively, and finally the percentages in the children of divorced parents were 33.3%, 55.6%, and 11.1% respectively. However, no statistically significant difference was found (p = 0.453).

Table (4.13): Effects of marital status of children's relatives on immunization status**.**

				Immunization						
		Total		Non		Partially		Completely		Sig.
		N	%*	N	%	N	%	N	%	
Marital status	Married	390	96.3 %	9	2.3%	201	51.5 %	180	46.2 %	P = .453 X^2 = 1.551
	Widow	6	1.5%	0	0%	3	50%	3	50%	
	Divorced	9	2.2%	1	11.1 %	3	33.3 %	5	55.6 %	
	Total	405	100 %	10	2.5%	183	45.2 %	222	54.8 %	

53.6% of the children's families were at average economic status, 43.7% were at good economic status, and 2.7% were at poor economic status. 45.5% of the children of poor families were partially immunized, and 54.5% were completely immunized, while 50.2% of the children of average families were partially immunized, 46.5% were completely immunized and 3.2% were not immunized, and finally the percentages in the children of good economic status families were 52.5%, 45.8%, and 1.7% respectively. However, no statistically significant difference was found (p = 0.818).

Table (4.14) Effects of economic status of children's relatives on immunization status**.**

				Immunization						Sig.
		Total		Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Economic status	Poor	11	2.7%	0	0%	5	45.5 %	6	54.5%	P = .818 X^2 = 1.551
	Average	217	53.6%	7	3.2%	109	50.2 %	101	46.5%	
	Good	177	43.7%	3	1.7%	93	52.5 %	81	45.8%	
	Total	405	100%	10	2.5%	183	45.2 %	222	54.8%	

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28.6% of the families had 2 children, 22.7% had 1 child, 21.5% had 3 children, 15.1% had 4 children, while the rest had +4 children. 57.5%, 51.4%, 63.6%, and 66.7% of the children from families with 3, 5, 6, and 7 children respectively were completely immunized, while 55.4%, 57.8%, and 52.5% of the children from families with 1, 2, and 4 children respectively were partially immunized. However, no statistically significant difference was found (p = 0.474).

Table 4.15: Effects of the number of children in the family on immunization status.

		Total		Immunization						Sig.
				Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Number of children	1	92	22.7%	4	4.3%	51	55.4%	37	40.2%	P = .474 X^2 = 11.654
	2	116	28.6%	3	2.6%	67	57.8%	46	39.7%	
	3	87	21.5%	1	1.1%	36	41.4%	50	57.5%	
	4	61	15.1%	1	1.6%	32	52.5%	28	45.9%	
	5	35	8.6%	1	2.9%	16	45.7%	18	51.4%	
	6	11	2.7%	0	0.0%	4	36.4%	7	63.6%	
	7	3	0.7%	0	0.0%	1	33.3%	2	66.7%	
	Total	405	100%	10	2.5%	183	45.2%	222	54.8%	

* Column percentages; other are row percentages

4.3.Effects of the access and quality of vaccination service on immunization status

13.3% of sample's children had a nearby health facility and 86.7% hadn't. 70.4% of children without a nearby health facility were partially immunized, 27.8% were completely immunized, and 1.9% were not immunized, while 49.3% of children with a nearby health facility were completely immunized, 48.1% were partially immunized, and 2.6% were not immunized. Children with a nearby health facility were more significantly more immunized than children with no nearby one (p = 0.010).

Table 4.16: Effects of the existence of a nearby health facility on immunization status.

		Total		Immunization						Sig.
				Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Nearby health facility	No	54	13.3%	1	1.9%	38	70.4%	15	27.8%	P = .010 X^2 = 9.283
	Yes	351	86.7%	9	2.6%	169	48.1%	173	49.3%	
	Total	405	100%	10	2.5%	183	45.2%	222	54.8%	

4.7% of sample's children were going to the health facility on foot and 95.3% were going by any means of transportation. 57.9% of children going on foot were partially immunized and 42.1% were completely immunized, while 50.8% of children going by any means of transportation were partially immunized, 46.6% were completely immunized, and 2.6% were not immunized. However, no statistically significant difference was found (p = 0.687).

Table 4.17: Effects of the mean of transportation to the health facility on immunization status.

				Immunization						
		Total		**Non**		**Partially**		**Completely**		**Sig.**
		N	**%***	**N**	**%**	**N**	**%**	**N**	**%**	
Mean of Transportation	On foot	19	4.7%	0	0%	11	57.9 %	8	42.1%	P = .687 X^2 = .752
	Any mean	386	95.3%	10	2.6%	196	50.8 %	180	46.6%	
	Total	405	100%	10	2.5%	183	45.2 %	222	54.8%	

46.4% of the children needed less than 15 minutes to reach the health facility, 42.7% needed 15-30 minutes, 7.4% needed 1 hour, and 3.5% needed more than an hour. Most of the children needed less than 15 minutes, 1 hour and more than an hour to reach the health facility were partially immunized (51.6%, 66.7% and 50% respectively), while most of the children needed 15-30 minutes were completely immunized (49.7%). However, no statistically significant difference was found (p = 0.616).

Table 4.18: Effects of the time to reach the health facility on immunization status.

				Immunization					
		Total		**Non**		**Partially**		**Completely**	
		N	**%***	**N**	**%**	**N**	**%**	**N**	**%**
Time to reach the health facility (min)	Less than 15 minutes	188	46.4%	5	2.7%	97	51.6%	86	45.7%
	15-30 minutes	173	42.7%	4	2.3%	83	48%	86	49.7%
	1 hour	30	7.4%	1	3.3%	20	66.7%	9	30%
	> 1 hour	14	3.5%	0	0%	7	50%	7	50%
	Total	405	100%	10	2.5%	183	45.2%	222	54.8%

* Column percentages; other are row percentages == P = .616 X2 = 4.449

45.7% of the children's relatives were sometimes given advice about vaccination by the health workers, 29.6% were always given advice, and 24.7% were not given advice. Most of the children which their relatives were always were given advice about vaccination by the health workers were completely immunized (57.5%), while most of the children which their relatives were not or sometimes given advice about vaccination were partially immunized (55% and 55.7% respectively). Children which were given advice about vaccination were significantly more immunized than others (p = 0.008).

Table 4.19: Effects of getting advice about vaccination by the health workers on immunization status**.**

		Total		Immunization						Sig.
		Total		Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Advice by health workers	No	100	24.7 %	4	4%	55	55%	41	41%	P = .044 X^2 = 9.892
	Sometimes	185	45.7 %	4	2.2%	103	55.7 %	78	42.2%	
	Yes	120	29.6 %	2	1.7%	49	40.8 %	69	57.5%	
	Total	405	100 %	10	2.5%	183	45.2 %	222	54.8%	

* Column percentages; other are row percentages

64.3% of the advices were about information about the next doses of the routine vaccination, 12.8% were about the importance of complete vaccination, 12.1% were about the importance of routine vaccination, 9.8% were about the age in which the child should finish routine vaccination, and 0.3% were about each of the side effects of the vaccine, caring of the child after vaccinations, and about the importance of breastfeeding after vaccination. However, there was no statistically significant difference (p = 0.575). **Table (4.20)** .

81.5% of the children had a long waiting line during last vaccination session, and 18.5% hadn't. 52% of the children which had a long waiting line were partially immunized, 46.7% were completely immunized, and 1.3% were not immunized, while 50.9% of children which had not a long waiting line were partially immunized, 46.4% were completely immunized, and 2.7% were not immunized. However, there was no statistically significant difference (p = 0.780)

Table 4.20: Effects of the advice given by the health workers on immunization status.

		Total		Immunization					
				Non		**Partially**		**Completely**	
		N	**%***	**N**	**%**	**N**	**%**	**N**	**%**
Advice	Side effects of the vaccine	1	0.3%	0	0%	1	100%	0	0%
	Age in which you should finish routine vaccination	30	9.8%	0	0%	20	66.7%	10	33.3%
	Care for my Child after Vaccinations	1	0.3%	0	0%	0	0%	1	100%
	Importance of breastfeeding after vaccination	1	0.3%	0	0%	0	0%	1	100%
	Importance of complete vaccination	39	12.8%	2	5.1%	21	53.8%	16	41%
	Importance of routine vaccination	37	12.1%	1	2.7%	18	48.6%	18	48.6%
	Information about the next doses of the routine vaccination	196	64.3%	3	1.5%	92	46.9%	101	51.5%

* Column percentages; other are row percentages P = .575 X2 = 12.194

Table 4.21: Effects of having a long waiting line on immunization status**.**

		Total		Immunization						Sig.
				Non		**Partially**		**Completely**		
		N	**%***	**N**	**%**	**N**	**%**	**N**	**%**	
Long waiting line	No	75	18.5%	1	1.3%	39	52%	35	46.7%	P = .780 X^2 = .496
	Yes	330	81.5%	9	2.7%	168	50.9%	153	46.4%	
	Total	405	100%	10	2.5%	183	45.2%	222	54.8%	

* Column percentages; other are row percentages

35.6% of the children's relatives were moderately satisfied regarding the vaccination service, 27.9% were unsatisfied, 16.3% were very unsatisfied, 15.6% were satisfied, and

4.7% were very satisfied. Most of the children which their relatives were very unsatisfied or unsatisfied were partially immunized (62.1% and 63.7% respectively), while most of the children which their relatives were moderately satisfied, satisfied, or very satisfied were completely immunized (56.9%, 58.7%, and 52.6% respectively). Unsatisfied and very unsatisfied children were significantly less immunized then satisfied ones ($p < 0.001$, $X^2 = 31.772$)

Table 4.22 :Effects of the satisfaction regarding the vaccination service on immunization status.

				Immunization					
		Total		**Non**		**Partially**		**Completely**	
		N	**%***	**N**	**%**	**N**	**%**	**N**	**%**
Satisfaction regarding the vaccination service	Very unsatisfied	66	16.3 %	5	7.6%	41	62.1 %	20	30.3%
	Unsatisfied	113	27.9 %	2	1.8%	72	63.7 %	39	34.5%
	Moderately satisfied	144	35.6 %	1	0.7%	61	42.4 %	82	56.9%
	Satisfied	63	15.6 %	1	1.6%	25	39.7 %	37	58.7%
	Very satisfied	19	4.7%	1	5.3%	8	42.1 %	10	52.6%
	Total	405	100 %	10	2.5%	18 3	45.2 %	22 2	54.8%

* Column percentages; other are row percentages P < .001 X2 = 31.772

98% of the children's relatives requested a vaccination but been refused, while 2% didn't had this issue. However, there was no statistically significant difference ($p = 0.621$).

Table 4.23 : Effects of being refused to get the vaccination on immunization status.

		Total		Immunization						Sig.
				Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Refused to give vaccination	No	8	2%	0	0%	3	37.5%	5	62.5%	P = .621 X^2 = .952
	Yes	397	9%	10	2.5%	204	51.4%	183	46.1%	
	Total	405	100 %	10	2.5%	183	45.2%	222	54.8%	

* Column percentages; other are row percentages

The biggest vaccination problem was the lack of vaccine (73.3%), then the lack of syringes or some other supply needed for vaccination (13.3%), the child was sick (6.9%), the long waiting line (3.7%), and finally the migration, the coronavirus pandemic, and father neglection (0.2%), while 2% had no problems. Out of the children which faced the lack of syringes or some other supply needed for vaccination 59.3% were completely vaccinated, 38.9% were partially vaccinated, and 1.9% were not immunized. Out of the children which faced the lack of vaccine 52.5% were partially vaccinated, 44.8% were completely vaccinated, and 2.7% were not immunized. Out of the children which were sick 67.9% were completely vaccinated, 32.1% were partially vaccinated. Out of the children which faced long waiting line 66.7% were completely vaccinated, 33.3% were partially vaccinated. However, there was no statistically significant difference ($p = 0.054$, $X^2 = 52.196$).

Table4. 24: Effects of vaccination problems on immunization status.

				Immunization					
		Total		Non		Partially		Completely	
		N	%*	N	%	N	%	N	%
Vaccination problems	Coronavirus Pandemic	1	0.2%	0	0%	1	100%	0	0%
	Migration	1	0.2%	0	0%	1	100%	0	0%
	Father neglect	1	0.2%	1	100%	0	0%	0	0%
	No problems	8	2%	0	0%	3	37.5 %	5	62.5%
	Child was sick	28	6.9%	0	0%	9	32.1 %	19	67.9%
	Long waiting line	15	3.7%	0	0%	5	33.3 %	10	66.7%
	No syringes or some other supply needed for vaccination	54	13.3 %	1	1.9%	32	59.3 %	21	38.9%
	No vaccines	297	73.3 %	8	2.7%	156	52.5 %	133	44.8%
	Total	405	100 %	10	2.5%	183	45.2 %	222	54.8%

* Column percentages; other are row percentages

91.6% of sample's children had a vaccine during a vaccination campaign and 8.4% hadn't. 50.1% of children which had a vaccine during a vaccination campaign were partially immunized, 47.7% were completely immunized, and 2.2% were not immunized, while 61.8% of children which hadn't a vaccine during a vaccination campaign were partially immunized, 32.4% were completely immunized, and 5.9% were not immunized. However, there was no statistically significant difference (p = 0.125).

Table 4.25: Effects of having a vaccine during a vaccination campaign on immunization status.

		Total		Immunization						Sig.
				Non		Partially		Completely		
		N	%*	N	%	N	%	N	%	
Vaccination Campaign	No	34	8.4%	2	5.9%	21	61.8 %	11	32.4%	P = .125 $X^2 = 4.158$
	Yes	371	91.6%	8	2.2%	186	50.1 %	177	47.7%	
	Total	405	100%	10	2.5%	183	45.2 %	222	54.8%	

* Column percentages; other are row percentages

All of the children in this study had a vaccination card.

4. 4 Effects of Socio-demographic characteristics on vaccination time:

2.5% of the children were not immunized, 35.5 % were immunized after a long time, and 62% were immunized on time.

Table4. 26: Immunization time in study sample.

		N	%
Immunization time	Not taken	10	2.5%
	After long time	144	35.5 %
	On time	251	62%
	Total	405	100 %

69.2 – 80% of the age groups under 8 months were significantly more vaccinated on time compared to 55.1 – 59.2% of children aged 9, 12, and +18 months (p = 0.035).

Table 4.27: Effects of age on vaccination time.

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Age	Less than 2 Months	18	4.4%	1	5.6%	4	22.2%	13	72.2%	P = 0.035 X^2 = 29.974
	2 – Less than 4 Month	48	11.9 %	1	2.1%	11	22.9%	36	75%	
	4 – Less than 6 Months	32	7.9%	2	6.3%	5	15.6%	25	78.1%	
	6 – Less than 8 Months	39	9.6%	2	5.1%	10	25.6%	27	69.2%	
	8 – Less than 9 Months	5	1.2%	0	0%	1	20%	4	80%	
	9 – Less than 12 Months	49	12.1 %	2	4.1%	18	36.7%	29	59.2%	
	12 – Less than 18 Months	47	11.6 %	1	2.1%	21	44.7%	25	53.2%	
	+18 Months	167	41.2 %	1	0.6%	74	44.3%	92	55.1%	
	Total	405	100 %	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

Most of these children aged 1.5, 3, and 4 years old were vaccinated on time (69.6%, 54.5%, and 54.1% respectively) while most of the children aged 3 years old were vaccinated after a long time. However, there was no statistically significant difference (p = 0.193)

Table 4.28: Effects of age in +18 months children on immunization status.

		Total		Vaccination Time					
				Not Taken		After Long Time		On Time	
		N	%*	N	%	N	%	N	%
Age of the child	1.5 – Less than 2 Years	46	27.5 %	0	0%	14	30.4 %	32	69.6%
	2 – Less than 3 Years	51	30.5 %	1	2%	28	54.9 %	22	43.1%
	3 – Less than 4 Years	33	19.8 %	0	0%	15	45.5 %	18	54.5%
	4 Years	37	22.2 %	0	0%	17	45.9 %	20	54.1%
	Total	167	100 %	1	0.6%	74	44.3 %	92	55.1%

* Column percentages; other are row percentages P = .193 X2 = 8.678

Most of both genders were vaccinated on time (62.3% of males, and 61.7% of females). No statistically significant difference was found (p = 0.945).

Table 4.29: Effects of gender on vaccination time.

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Sex	Male	183	45.2 %	4	2.2 %	65	35.5%	114	62.3%	P = .945 X^2 = .114
	Female	222	54.8 %	6	2.7 %	79	35.6%	137	61.7%	
	Total	405	100 %	10	2.5 %	144	35.5%	251	62%	

* Column percentages; other are row percentages

76.8% of the people answered the survey were mothers, 61.7% of their children were vaccinated on time. 21.5% of the of the people answered the survey were fathers, 62.1% of their children were vaccinated on time. And 1.7% were other relatives 71.4% of their children were vaccinated on time. However, no statistically significant difference was found (p = 0.053).

Table 4.30: Effects of the relationship with the child on vaccination time**.**

		Total		Vaccination Time						Sig.
		Total		Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Relationship with child	Father	87	21.5%	5	5.7%	28	32.2%	54	62.1%	P = .053 X^2 = 9.957
	Mother	311	76.8%	4	1.3%	115	37%	192	61.7%	
	Other relatives	7	1.7%	1	14.3%	1	14.3%	5	71.4%	
	Total	405	100%	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

100% of the children of mothers less than 20 years were vaccinated on time, 60.3% of the children of mothers aged 20 – 30 years were vaccinated on time, 35.6% were vaccinated after a long time, and 4% were not vaccinated, while the percentages in the children of mothers aged 30 – 40 years were 62.4%, 36.5%, and 1% respectively, and finally the percentages in the children of mothers aged above 40 years were 40%, 50%, and 10% respectively. However, there was no statistically significant difference (p = 0.160).

Table 4.31: Effects of the age of the mother on vaccination time**.**

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Age of the mother	Less than 20	4	1%	0	0%	0	0%	4	100%	P = .160 X^2 = 9.259
	20 to less than 30	174	45.2 %	7	4%	62	35.6%	105	60.3%	
	30 to less than 40	197	51.2 %	2	1%	72	36.5%	123	62.4%	
	Above 40	10	2.6%	1	10%	5	50%	4	40%	
	Total	405	100 %	10	2.5 %	144	35.5%	251	62%	

* Column percentages; other are row percentages

69.2% of the children of fathers aged 20 – 30 years were vaccinated on time, 35.9% were vaccinated after a long time, and 2.6% were not vaccinated, while the percentages in the children of fathers aged 30 – 40 years were 60.4%, 37.2%, and 2.4% respectively, and finally the percentages in the children of fathers aged above 40 years were 62.9%, 34.5%, and 2.6% respectively. However, no statistically significant difference was found (p = 0.865).

Table 4.32: Effects of the age of the father on vaccination time**.**

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Age of the father	20-30	39	9.6%	1	2.6%	11	28.2%	27	69.2%	P = .865 X^2 = 1.281
	31-40	250	61.7 %	6	2.4%	93	37.2%	151	60.4%	
	> 40	116	28.6 %	3	2.6%	40	34.5%	73	62.9%	
	Total	405	100 %	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

Most of the children were vaccinated on time regardless of their fathers' education level are graduated from university (64.3%). However, there was no statistically significant difference (p = 0.297)

Table 4.33: Effects of the education level of the father on vaccination time**.**

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Education of father	Preparatory School	41	10.1%	3	7.3%	13	31.7%	25	61%	P = .297 X^2 = 7.268
	High School	71	17.5%	2	2.8%	28	39.4%	41	57.7 %	
	University	235	58%	5	2.1%	79	33.6%	151	64.3 %	
	Postgraduate	58	14.3%	0	0%	24	41.4%	34	58.6 %	
	Total	405	100%	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

Most of the children were vaccinated on time regardless of their mothers' education level are High School (71%). However, there was no statistically significant difference (p = 0.507).

Table 4.34 : Effects of the education level of the mother on vaccination time**.**

		Total		Vaccination Time					
				Not Taken		After Long Time		On Time	
		N	%	N	%	N	%	N	%
Education of mother	Preparatory School	0	0%	0	0%	0	0%	0	0%
	High School	69	17.3 %	2	2.9%	18	26.1%	49	71%
	University	27 6	69.3 %	6	2.2%	104	37.7%	166	60.1%
	Postgraduate	53	13.3 %	1	1.9%	19	35.8%	33	62.3%
	Total	40 5	100 %	10	2.5%	144	35.5%	251	62%

* Column percentages; other are row percentages P = .507 X2 = 3.310

Most of the children were vaccinated on time regardless of their region are from Fezzan(70.4%) . However, there was no statistically significant difference (p = 0.083).

Table 4.35: Effects of children's region on vaccination time**.**

		Total		Vaccination Time					
				Not Taken		After Long Time		On Time	
		N	%*	N	%	N	%	N	%
Region	Cyreneica (east)	190	46.9 %	6	3.2%	75	39.5 %	10 9	57.4%
	Fezzan (south)	27	6.7%	2	7.4%	6	22.2 %	19	70.4%
	Tripolitania (west)	188	46.4 %	2	1.1%	63	33.5 %	12 3	65.4%
	Total	405	100 %	10	2.5%	14 4	35.5 %	25 1	62%

* Column percentages; other are row percentages P = .083 X2 = 8.246

Most of the children were vaccinated on time regardless of the marital status of their relatives are widow (66.7%). However, there was no statistically significant difference (p = 0.522).

Table 4.36: Effects of marital status of children's relatives on vaccination time**.**

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Marital status	Married	390	96.3%	9	2.3%	139	35.6%	242	62.1%	P = .522 X^2 = 3.015
	Widow	6	1.5%	0	0%	2	33.3%	4	66.7%	
	Divorced	9	2.2%	1	11.1%	3	33.3%	5	55.6%	
	Total	405	100%	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

Most of the children were vaccinated on time regardless of the economic status of their relatives. However, there was no statistically significant difference (p = 0.165).

Table 4.37: Effects of economic status of children's relatives on vaccination time.

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%	N	%	N	%	N	%	
Economic status	Poor	11	2.7%	0	0%	1	9.1%	10	90.9%	P = .165 X^2 = 6.502
	Average	217	53.6%	7	3.2%	84	38.7%	126	58.1%	
	Good	177	43.7%	3	1.7%	59	33.3%	115	65%	
	Total	405	100%	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

Most of the children in all groups of number of children in the family were vaccinated on time except of the families with 7 children where 33.3% were vaccinated on time and 66.7% were vaccinated after a long time. However, no statistically significant difference was found (p = 0.637).

Table 4. 38: Effects of the number of children in the family on vaccination time.

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Number of children	1	92	22.7%	4	4.3%	27	29.3%	61	66.3%	P = .637 X^2 = 9.758
	2	116	28.6%	3	2.6%	50	43.1%	63	54.3%	
	3	87	21.5%	1	1.1%	29	33.3%	57	65.5%	
	4	61	15.1%	1	1.6%	18	29.5%	42	68.9%	
	5	35	8.6%	1	2.9%	13	37.1%	21	60.0%	
	6	11	2.7%	0	0.0%	5	45.5%	6	54.5%	
	7	3	0.7%	0	0.0%	2	66.7%	1	33.3%	
	Total	405	100%	10	2.5%	183	45.2%	222	54.8%	

* Column percentages; other are row percentages

4.5. Effects of the access and quality of vaccination service on vaccination time:

Most of the children were vaccinated on time regardless of the existence of a nearby health facility. However, there was no statistically significant difference (p = 0.738).

Table 4.39: Effects of the existence of a nearby health facility on vaccination time.

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Nearby health facility	No	54	13.3%	1	1.9%	17	31.5%	36	66.7%	P = .738 X^2 = .608
	Yes	351	86.7%	9	2.6%	127	36.2%	215	61.3%	
	Total	405	100%	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

Most of the children were vaccinated on time regardless of the mean of transportation to the health facility. However, there was no statistically significant difference (p = 0.675).

Table 4.40: Effects of the mean of transportation to the health facility on vaccination time.

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Mean of Transportation	On foot	19	4.7%	10	2.6%	136	35.2 %	240	62.2 %	P = .675 X^2 = .786
	Any mean	386	95.3 %	0	0%	8	42.1 %	11	57.9 %	
	Total	405	100 %	10	2.5%	144	35.5 %	251	62%	

* Column percentages; other are row percentages

Most of the children were vaccinated on time regardless of the time to reach the health facility. However, there was no statistically significant difference (p = 0.978 , X^2 = 1.182).

Table 41: Effects of the time to reach the health facility on vaccination time.

		Total		Vaccination Time					
				Not Taken		After Long Time		On Time	
		N	%*	N	%	N	%	N	%
Time to reach the health facility (min)	Less than 15 minutes	188	46.4 %	5	2.7%	70	37.2 %	113	60.1%
	15-30 minutes	173	42.7 %	4	2.3%	60	34.7 %	109	63%
	1 hour	30	7.4%	1	3.3%	9	30%	20	66.7%
	> 1 hour	14	3.5%	0	0%	5	35.7 %	9	64.3%
	Total	405	100 %	10	2.5%	144	35.5 %	251	62%

* Column percentages; other are row percentages P = .978 X2 = 1.182

Most of the children were vaccinated on time regardless of getting advice about vaccination by the health workers. However, there was no statistically significant difference (p = 0.575).

Table 4.42: Effects of getting advice about vaccination by the health workers on vaccination time.

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%	N	%	N	%	N	%	
Advice by health workers	No	100	24.7 %	4	4%	35	35%	61	61%	P = .575 X^2 = 2.897
	Sometimes	185	45.7 %	4	2.2%	71	38.4%	110	59.5%	
	Yes	120	29.6 %	2	1.7%	38	31.7%	80	66.7%	
	Total	405	100 %	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

Most of the children were vaccinated on time regardless of the advice given by the health workers. However, there was no statistically significant difference (p = 0.627).

Table 4.43: Effects of the advice given by the health workers on vaccination time.

		Total		Vaccination Time					
				Not Taken		After Long Time		On Time	
		N	%*	N	%	N	%	N	%
Advice	Side effects of the vaccine	1	0.3%	0	0%	1	100%	0	0%
	Age in which you should finish routine vaccination	30	9.8%	0	0%	8	26.7%	22	73.3%
	Care for my Child after Vaccinations	1	0.3%	0	0%	1	100%	0	0%
	Importance of breastfeeding after vaccination	1	0.3%	0	0%	0	0%	1	100%
	Importance of complete vaccination	39	12.8 %	2	5.1%	17	43.6%	20	51.3%
	Importance of routine vaccination	37	12.1 %	1	2.7%	10	27%	26	70.3%
	Information about the next doses of the routine vaccination	196	64.3 %	3	1.5%	72	36.7%	12 1	61.7%
	Total	305	100 %	6	2%	10 9	35.7%	19 0	62.3%

* Column percentages; other are row percentages   P = .627 X2 = 11.351

Most of the children were vaccinated on time regardless of having a long waiting line. However, there was no statistically significant difference (p = 0.319).

Table 4.44: Effects of having a long waiting line on vaccination time**.**

				Vaccination Time						
		Total		**Not Taken**		**After Long Time**		**On Time**		**Sig.**
		N	**%***	**N**	**%**	**N**	**%**	**N**	**%**	
Long waiting line	No	75	18.5%	1	1.3%	22	29.3%	52	69.3%	P = .319 X^2 = 2.287
	Yes	330	81.5%	9	2.7%	122	37%	199	60.3%	
	Total	405	100%	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

The percentages of the vaccinated on time children of the very unsatisfied, unsatisfied, moderately satisfied, and satisfied children's relatives were (60.6%, 52.2%, 64.4%, and 66.7% respectively), while the percentage in the very satisfied children's relatives increased significantly to 89.5% (p = 0.003).

Table 4.45: Effects of the satisfaction regarding the vaccination service on vaccination time.

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%	N	%	N	%	N	%	
Satisfaction regarding the vaccination service	Very unsatisfied	66	16.3 %	5	7.6%	21	31.8%	40	60.6 %	P = .003 X^2 = 23.215
	Unsatisfied	113	27.9 %	2	1.8%	52	46%	59	52.2 %	
	Moderately satisfied	144	35.6 %	1	0.7%	50	34.7%	93	64.6 %	
	Satisfied	63	15.6 %	1	1.6%	20	31.7%	42	66.7 %	
	Very satisfied	19	4.7%	1	5.3%	1	5.3%	17	89.5 %	
	Total	405	100 %	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

Most of the children were vaccinated on time regardless of being refused to get the vaccination or not. However, there was no statistically significant difference (p = 0.320).

Table4 46: Effects of being refused to get the vaccination on time**.**

		Total		Vaccination Time						Sig.
				Not Taken		After Long Time		On Time		
		N	%*	N	%	N	%	N	%	
Refused to give vaccination	No	8	2%	0	0%	1	12.5%	7	87.5%	P = .320 X^2 = 2.280
	Yes	397	9%	10	2.5 %	143	36%	244	61.5%	
	Total	405	100 %	10	2.5 %	144	35.5%	251	62%	

* Column percentages; other are row percentages

Out of the children which faced the lack of syringes or some other supply needed for vaccination 64.8% were vaccinated on time, 33.3% were vaccinated after a long time, and 1.9% were not vaccinated. Out of the children which faced the lack of vaccine 59.6% were vaccinated on time, 37.7% were vaccinated after a long time, and 2.7% were not vaccinated. Out of the children which were sick 64.3% were vaccinated on time, 35.7% were vaccinated after a long time. Out of the children which faced long waiting line 86.7% were vaccinated on time, 13.3% were vaccinated after a long time. Children with no vaccination problems or whom faced long waiting line were significantly more vaccinated on time (p < 0.001).

Table 47: Effects of vaccination problems on vaccination time.

		Total		Vaccination Time: Not Taken		Vaccination Time: After Long Time		Vaccination Time: On Time		Sig.
		N	**%***	**N**	**%**	**N**	**%**	**N**	**%**	
Vaccination problems	Coronavirus Pandemic	1	0.2%	0	0%	0	0%	1	100%	P < .001 * r = .248 X^2 = 49.754
	Migration	1	0.2%	0	0%	1	100%	0	0%	
	Father neglect	1	0.2%	1	100 %	0	0%	0	0%	
	No problems	8	2%	0	0%	1	12.5%	7	87.5%	
	Child was sick	28	6.9%	0	0%	10	35.7%	18	64.3%	
	Long waiting line	15	3.7%	0	0%	2	13.3%	13	86.7%	
	No syringes or some other supply needed for vaccination	54	13.3 %	1	1.9 %	18	33.3%	35	64.8%	
	No vaccines	297	73.3 %	8	2.7 %	112	37.7%	177	59.6%	
	Total	405	100 %	10	2.5 %	144	35.5%	251	62%	

* Column percentages; other are row percentages

47.1% of children which hadn't a vaccine during a vaccination campaign were vaccinated on time, 47.1% were vaccinated after a long time, and 5.9% were not vaccinated, while 63.3% of children which had a vaccine during a vaccination campaign were vaccinated on time, 34.5% were vaccinated after a long time, and 2.2% were not vaccinated. However, there was no statistically significant difference (p = 0.107).

Table 4.48: Effects of having a vaccine during a vaccination campaign on vaccination time.

				Vaccination Time						
		Total		Not Taken		After Long Time		On Time		Sig.
		N	%*	N	%	N	%	N	%	
Vaccination Campaign	No	34	8.4%	2	5.9%	16	47.1%	16	47.1%	P = .107 X^2 = 4.465
	Yes	371	91.6 %	8	2.2%	128	34.5%	235	63.3%	
	Total	405	100 %	10	2.5%	144	35.5%	251	62%	

* Column percentages; other are row percentages

5. DISCUSSION

This study was conducted in three Libyan regions (east, west, south) to evaluate the vaccination status of Libyan children under 5 years old, From 405 children included in the study 46.4% were completely immunized 62% were immunized on time according to schedule for routine vaccination , the percentage of complete vaccination is less than other two cross sectional Libyan study in Parental Factors Affecting Child's Immunization Status in Benghazi, Libya which done in 2017, 86% of the children were completely immunized for their age and in Al-Beida City study we found 81% of children were completely immunized in the same time they did not observe unimmunized children [53-54] in contrast to our study 2.5% of the children were not immunized, the mothers were the most participants in this study with 76.8% percentage we found the same thing in Poland , Saudi[94-95] and Libya studies[53] .

In our study 58% of the fathers' and 69.3% of the mothers' education level were university, but there was not statistically significant difference like Knowledge, attitude and practices of mothers regarding immunization of infants and preschool children at Al-Beida City, Libya 2008 study[54] , counter to other studies there was a strong positive association between maternal education and full immunization, Children of more educated mothers are more likely to be fully immunized, mothers always were aware of the national compulsory vaccination program regarding timing and its benefits, it is clear in Indonesia, Philippines, Ethiopia[96-97-98] studies the explanation is educated mothers are more aware of the value of accessible health and vaccination programs, have better communication skills, and likely to use available services more effectively. On other hand in Western Pacific and China studies found that the children of more or highly educator fathers are more likely to be immunized[99-100] ,further more age of caregivers are not associated with immunization uptake in this study , same thing we found it in cross sectional Mozambique study[101] but in other studies has been reported to be associated with incomplete vaccination with caregivers age like Australian ,and other studies[102-103] , however the differences in socio-cultural characteristics play main role in this factor.

45.2% of sample's children were males and 54.8% were children No statistically significant difference was found in immunization status between gender groups, but in other societies we found female was less likely to be immunized than male like India, China and Bangladesh [104-105-106] studies.

Most of the sample were +18 months (41.2%) were significantly more completely immunized, like China study the likelihood of being fully immunized appears to increase with age, most likely due to older children having more access to immunization.[107].

The study showed that there are not significant regional differences in immunization coverage, but in other studies we found differences, in some regions in countries like Senegal and Congo, cultural beliefs, health service capacity, vaccine procurement, supply, cold-chain management, and long-term armed conflict are identified as determinants of immunization coverage[108-109-110].

Furthermore, no statistically significant difference was found regarding economic status and immunization status in this study, counter to other studies where the positive correlation between economic status and immunization they explain that wealthier people tend to make better use of health services and thus regularly receive information about the benefit of child immunization[111] determinants of full vaccination among children aged 12–59 months in Nyanza province, Kenya, Coverage, timeliness, and determinants of immunization completion in Pakistan , Identifying the determinants of childhood immunization in the Philippines and Factors influencing full immunization coverage among 12–23 months of age children in Ethiopia , Maternal characteristics associated with vaccination of young Children. 2008 in China and Factors influencing the use of maternal healthcare services and childhood immunization in Swaziland in these studies showed a positive relationship between economic status of households and immunization coverge[112-113-114 -115-116-117.]

In this study 96.3% of the children's parents were married and median number of children in the families was 2 children, there was not a statistically significant correlation between the number of children and immunization status due to vaccines were free of charge, but in other studies families with more than five children were less likely to immunize their children; the large number of children in the family reduced the likelihood of children receiving complete immunization. furthermore, children in larger families have a lower likelihood of receiving full immunization, and as the number of children in a family grows, the mother becomes busier meeting the needs of her children. Furthermore, if a mother has a large number of children, her attention is divided among them[98-118-119]

In this study 4.7% of sample's children were going to the health facility on foot and 95.3% were going by any means of transportation 46.4% of the children needed less than 15 minutes to reach the health facility, 42.7% needed 15-30 minutes, 7.4% needed 1 hour, and 3.5% needed more than an hour , 13.3% of sample's children had a nearby health facility and 86.7% hadn't. Children with a nearby health facility were more significantly more immunized than children with no nearby one ,an earlier study from a developing country found that walking or traveling time, transportation facility, and distance are the key factors that influence the utilization of healthcare services, and walking distance greater than 30 minutes reduces vaccine uptake by one-third[120] and In other studies, we noticed that shorter travel times to the nearest vaccination site (30 minutes) were negatively associated with child vaccination status[121-122].

The health education has important role to increase awareness about the importance of vaccination for children, in this study 45.7% of the children's relatives were sometimes given advice about vaccination by the health workers, 29.6% were always given advice, and 24.7% were not given advice. Children which were given advice about vaccination were significantly more immunized than others, the advices were about information about the next doses of the routine vaccination, the importance of complete vaccination, the importance of routine vaccination, the age in which the child should finish routine vaccination, about each of the side effects of the vaccine, caring of the child after vaccinations, and about the importance of breastfeeding after vaccination , in many studies that households who are given advices from healthcare professionals, other persons, or the media–showed higher odds of completing basic immunization than those who did not[123-124-125-126], furthermore Contact with health facilities is a proxy for interactions with healthcare professionals, which provides an opportunity to receive information about immunization we showed positively associated with full immunization in Kenya, Pakistan and Italy studies .[127-128]

81.5% of the children had a long waiting line during last vaccination session, 35.6% of the children's relatives were moderately satisfied regarding the vaccination service, 27.9% were unsatisfied, 16.3% were very unsatisfied, 15.6% were satisfied, and 4.7% were very satisfied. Unsatisfied and very unsatisfied children were significantly less immunized then satisfied ones because they were having problems to receive the vaccination to their children. The biggest vaccination problem was the lack of vaccine (73.3%), then the lack of syringes or some other supply needed for vaccination (13.3%), the child was sick (6.9%), the long waiting line (3.7%), and finally the migration, the coronavirus pandemic, and father neglection (0.2%), Unavailability of vaccination was caused by vaccine stockouts and/or cold chain issues. When parents miss work, travel long distances, wait for long periods of time, and then are denied service, they are less likely to return for vaccination ,vaccine stock-outs are caused by a lack of funding or storage capacity, as well as insufficient ordering and distribution skills and systems for example Because health facilities frequently ran out of medicines or failed to provide curative and other services at the time and place of vaccination[129-130-131], Kenyans became less likely to seek vaccination[132].

It is critical to get vaccinated on time in order to get the most out of the vaccine. because the health system is primarily concerned with vaccine completion, timely completion of recommended vaccines is critical for assessing the effectiveness of immunization programs in Libya Childhood immunization timing is critical because immunizations given to children too early or too close together can significantly reduce the duration of protection or interfere with the immune response. Delayed immunizations result in a longer period of potential exposure to vaccine-preventable disease. Vulnerable children are protected in communities with herd immunity, which is achieved through adequate immunization coverage of the population, because the majority of people with whom they come into contact are immune and thus incapable of spreading communicable disease.

The example of importance of timeliness of vaccination, the failure to provide timely vaccination caused the US measles epidemic from 1989 to 1991, and the Centers for Disease

Control and Prevention states that "only a sustained effort to provide age-appropriate vaccination will prevent another resurgence of measles." Another example of the importance of timely vaccination is pertussis. During2003[133-134]

We did not find any study done about timeliness of vaccination in Libya, in our study 51.1% have delayed immunization were immunized after a long time, and 62% were immunized on time this means that a strategy for improving the situation must be devised. Because the continued delay in vaccine uptake results in a cohort of children with incomplete or no immunization. This group of vulnerable children becomes vulnerable to outbreaks of vaccine-preventable diseases. When the epidemic threshold is reached, outbreaks occur, resulting in increased morbidity and mortality among unprotected children. age groups under 8 months were significantly more vaccinated on time compared to 55.1 – 59.2% of children aged 9, 12, and +18 months, most of both genders were vaccinated on time.

Compared with other studied we did not find significant between Socio-demographic characteristics, quality of health services and timeliness of vaccination except the Children with no vaccination problems or whom faced long waiting line were significantly more vaccinated on time, that is mean caregivers who are most patiently during waiting in long line are more likely their children get the vaccination on time., on other studies we found Parents of approximately 60% of children who received delayed vaccinations reported illness and mild fever as the reason for the delay[135]. There are no guidelines displayed in primary health care's PHCs to show contraindications of such mild diseases to vaccination issues with transportation, better vaccination knowledge, and time management. Parental university education had a similar effect on vaccination timeliness. The majority of studies have found that maternal education is associated with increased utilization of child vaccination services. Children with multiple siblings were more likely to have their vaccinations delayed. A birth order of more than two was associated with increased delay. There was also a highly significant relationship between the timeliness of vaccination uptake and the ages of the child and the mother[135-136-137-138-139] furthermore Transportation costs, vaccine fears, insufficient information on vaccine safety, a lack of communication with healthcare workers, and unpleasant experiences in health facilities were among the reasons of delay vaccination in magnolia and India studies[140-141].

This study has some limitations, problem in electricity in Libya effect in internet connection and effect in sample size in our study in addition limited sources regarding childhood vaccination in Libya was effected too , data was collected using a convenience sampling approach via an online tool, which limited the representativeness of our study. When compared to the general population, our sample contains a higher proportion of highly educated caregivers, which could lead to selection bias. Nonetheless, the overrepresentation of such characteristics may reflect increased health awareness and interest in science. Furthermore, while the use of online methods is the best solution for data collection during periods of social distancing due to the COVID-19 pandemic, the response rate for our online survey could not be calculated because there is no way to know how many individuals may have seen the survey or its links but declined to participate. You may have seen the survey or its links but chose not to participate.

6. CONCLUSION

The result of this study has clearly indicated that there is no difference between Libyan regions in vaccination coverage and timelines of vaccination, and the mean reason of unvaccinated and delay of children vaccination was unavailability of vaccine, more emphasis on the local health authority is needed and increase quality and number of the health centers to ensure continuous vaccines supply to all MCH clinics and health centers in Libya to avoid vaccine preventable diseases specially after illegal migration.

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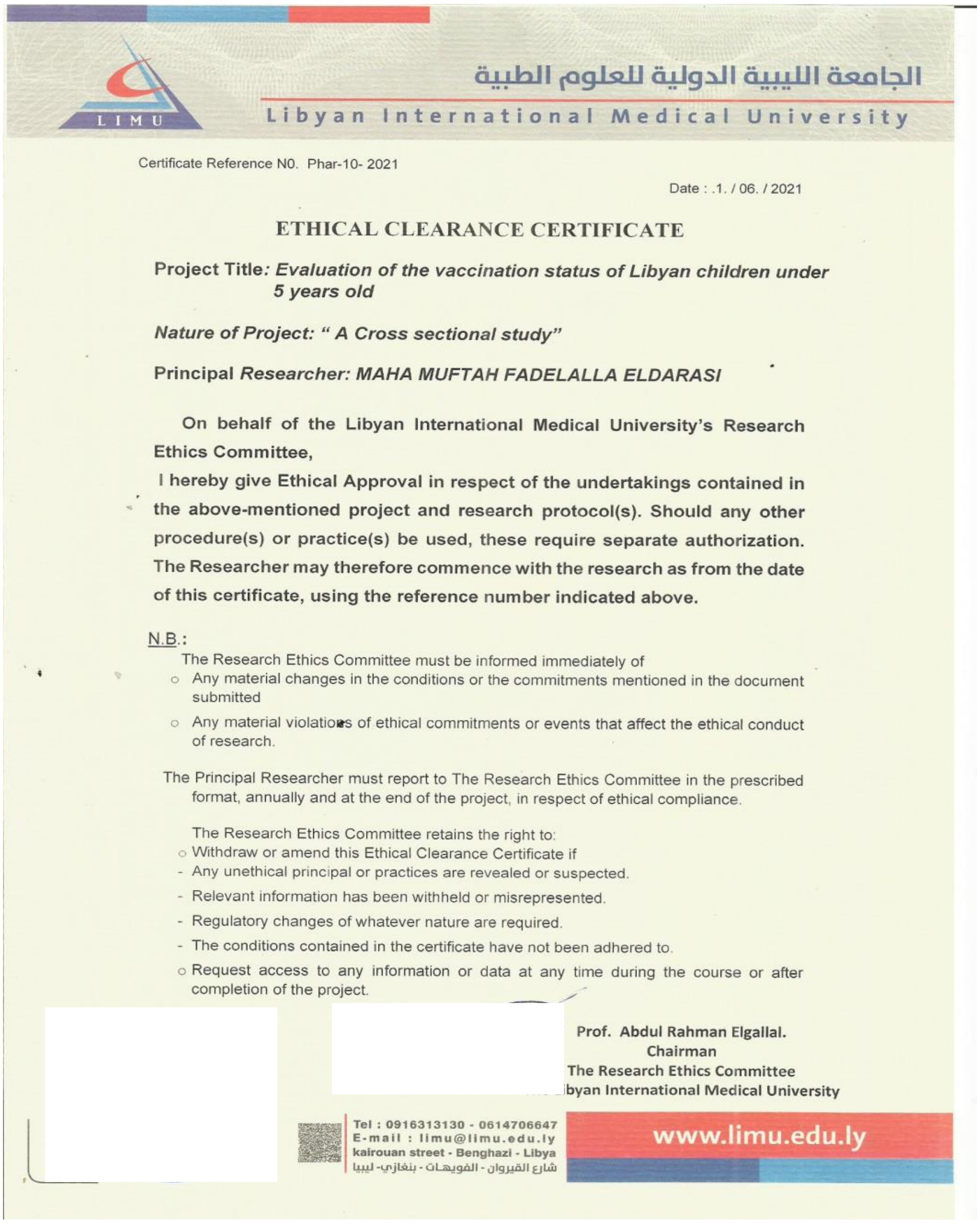
8. APPENDICES

8.1. Ethical Committee Declaration.



الجامعة الليبية الدولية للعلوم الطبية

Libyan International Medical University

Certificate Reference N0. Phar-10- 2021

Date : .1. / 06. / 2021

ETHICAL CLEARANCE CERTIFICATE

Project Title*: Evaluation of the vaccination status of Libyan children under 5 years old*

Nature of Project: " A Cross sectional study"

Principal *Researcher: MAHA MUFTAH FADELALLA ELDARASI*

On behalf of the Libyan International Medical University's Research Ethics Committee,

I hereby give Ethical Approval in respect of the undertakings contained in the above-mentioned project and research protocol(s). Should any other procedure(s) or practice(s) be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

N.B.:

The Research Ethics Committee must be informed immediately of

- Any material changes in the conditions or the commitments mentioned in the document submitted
- Any material violations of ethical commitments or events that affect the ethical conduct of research.

The Principal Researcher must report to The Research Ethics Committee in the prescribed format, annually and at the end of the project, in respect of ethical compliance.

The Research Ethics Committee retains the right to:

- Withdraw or amend this Ethical Clearance Certificate if
  - Any unethical principal or practices are revealed or suspected.
  - Relevant information has been withheld or misrepresented.
  - Regulatory changes of whatever nature are required.
  - The conditions contained in the certificate have not been adhered to.
- Request access to any information or data at any time during the course or after completion of the project.

Prof. Abdul Rahman Elgallal.
Chairman
The Research Ethics Committee
ibyan International Medical University

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KARAR

BAŞVURU NUMARASI: 202104014

2.09.2021

☒ KABUL	☐ RET
	☐ KAPSAM DIŞI (GİRİŞİMSEL) ☐ BİLİMSEL VE/VEYA ETİK KURALLARA AYKIRI ☐ BİR SORUMLU ARAŞTIRMACININ (TEZ İSE TEZ DANIŞMANI), BİR TOPLANTIYA **İKİ (2) ADETTEN FAZLA ÇALIŞMA BAŞVURUSUNDA** BULUNMASI ☐ KURUM İÇİ BAŞVURULARINDA **YEDİTEPE UZANTILI E-POSTA HESABI** İLE GİRİŞ YAPILMAMIŞ OLMASI ☐ ŞARTLI KABULDE BELİRTİLEN REVİZYONLARIN ZAMANINDA VE/VEYA İSTENİLDİĞİ ŞEKİLDE YAPILMAMIŞ OLMASI

T.C. Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu adına
Prof. Dr. Didem ÖZDEMİR ÖZENEN
Başkan

Araştırmanın Başlığı: **5 yaşından küçük Libyalı çocukların aşılanma durumunun değerlendirilmesi: Kesitsel bir çalışma**

Araştırmacılar: Doç. Dr. Güldal İzbırak, Maha Muftah ELdarasi

8.2 QUESTIONER

Questionnaire

PART 1: Socio-demographic characteristics	
QUESTİONS	RESPONSES
1. Age of child	……………………………………
2. Sex	a- Male b- Female
3. City	………………………………………………
4. What is your relationship with child	a. Mother b. Father c. Other (specify…………………………
5. Age of mother	a. Less than 20 b. 20- 30 c. 30-40 d. above 40
6. Age of father	a. 20- 30 b. 30-40 c. > 40
7. Level education of the father	a- Primary school b- Secondary school c- Bachelor degree d- Higher education

8. Level of education of the mother	a. Primary school b. Secondary school c. Bachelor degree b. Higher education
9. What is your marital status?	a. Married b. Widow/Widower c. Divorced
10. How do you evaluate your economic status?	a. Good b. Average c. Poor
11. How many children do you have	…………………………………………………………

PART TWO : - ACCESS AND QUALITY OF VACCINATION SERVICE	
Questions	**Responses**
12. Is there any nearby health facility that provides vaccination services?	1-YES 2- NO
13. What means of transportation do you usually use to come to this facility?	1-On foot 2- By any means of transportation
14. How long does it take to you to reach nearby health facility in minutes?	1- Less than 15 minutes 2-15-30 minutes 3-30 minutes

	4-1 hour 5-> 1 hour
15. Did the health worker give you advice about vaccination?	1=yes 2=no
16. .. if you choose the answer "yes" to the above question, what would be the content of the advice?	1. importance of routine vaccination 2. importance of complete vaccination 3. age in which you should finish routine vaccination 4. information about the next doses of the routine vaccination 5. information about new vaccines 6. other, specify ________________
17. Was there long waiting line during last vaccination session?	1. Yes 2. No 3. other, specify ________________
18. How do you rate your satisfaction regarding the vaccination service you get?	1= Very satisfied 2= Satisfied 3= Moderately satisfied 4 =Unsatisfied 5-=Very unsatisfied
19. Have you ever requested vaccination for your child or any of your children and been refused?	1. Yes 2. No
20. .. if you choose the answer "no" to the above question, why did they not vaccinate your child?	1=The doctor or nurse said it couldn't be done because the child was sick 2= There were no vaccines,

	3= There were no syringes or some other supply needed for vaccination 3= It was not the programmed day for vaccination 4=The person in charge of vaccination was not available 5= We couldn't offer the vaccination card 6=. 7= there was long waiting line 8= Other Specify…………………………………
21. Has your child ever received any vaccination which prevents him/her from getting specific diseases, including vaccinations received in a campaign, immunization day or Child Health Day?	1. Yes 2. No

PART THREE - CHILD VACCINATION	
QUESTİONS	RESPONSES
24.Do you have vaccination card ?	1=yes 2=no

Age	**Vaccine**			
	Types of vaccination	taken on time	Do not taken	Taken after long time* *(length of the time is not specified)
At birth	BCG,			√
	O.P.V		√	
	Hep B	√		
Two months	HEXA (IPV, DTP, HepB, HİB),			
	ROTA			
	PCV			
4 months	HEXA			
	ROTA			
	PCV			
6 months	HEXA	√		
	ROTA			
9 months	O.P.V			
	Meningococcal v A+C+Y+W135+Conjugate			√
12 months	MMR			
	, Meningococcal v A+C+Y+W135+Conjugate ,			
	PCV			
18 months	O.P.V,			
	DTAP,	√		
	MMR			

*Put(√)in right answer