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Subject
Assessment of Vaccination Program in Reduction of Morbidity, Mortality in Palestine between 2010-2020

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This thesis was submitted in partial fulfillment of the Requirements for the Master's degree in Health Informatics
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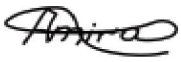
4. External Examiner: Dr. Amira Shaheen	

Declaration

This thesis was submitted in partial fulfillment of the requirement for the Master's degree in Heath Informatics.

I declare that the content of this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

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Date: 16/ 02 /2022

Dedication

I would like to dedicate this thesis to:

My God Allah, my Creator and my Master;

The prophet Mohammed (peace be upon him), who was the first teacher about life;

My husband and sons for their patience, support and encouragement throughout the study period;

My beloved mother whose support, encouragement and prayers enable my success;

My beloved brother and sisters who always wish me the best;

My beloved friends and colleagues who encouraged and have helped and facilitated my path in education;

To all the people in my life, and to precious Palestine, I dedicate this research.

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Abstract

Background

Vaccination is one of the most effective and safe ways of protecting from diseases on an individual level. The main goal of vaccination is to reduce and control the spread of diseases by achieving high immunity in the target groups during the vaccination period.

Preventive diseases are the diseases that we can avoid and limit their spread through the vaccination program followed in that region (diphtheria, tetanus, poliomyelitis, hepatitis, pertussis, measles, mumps, rubella, Tuberculosis)

in 1974 the WHO establish the Expanded Program on Immunization (EPI) with goal reach to high vaccination Coverage (VC) for children throughout the world to burden of preventable disease ;thePalestine has one of oldest VP in the world , vaccination program started in Palestine in 1969.

Objectives

Our study Assess the VP in the reduction of morbidity, mortality, in Palestine between (2010-2020), Investigate the percentages of vaccination coverage among the Palestinian population, Investigate the levels of failures in vaccination coverage among the Palestinian

population, Determine the reasons for failures in vaccination among the Palestinian population, through study data record in ministry of Health.

Methods:

A retrospective Data review of the cases registered in the Palestinian Ministry of Health preventable diseases and immunization monitoring system, The study utilized all data recorded by the Palestinian Ministry of Health/Preventive Medicine Department during the period 2010-2020 related to diseases that can be prevented with vaccinations and the unified national vaccination program in Palestine, The data was collected from the Central Preventive Medicine Department, which collects data associated with diseases and related vaccinations from all health service providers in Palestine, Telephone-based interview**,** A descriptive analysis approach was adopted to analyze the data based on age, gender, type of disease, and the incidence of disease according to geographical distribution, A percentage was used to calculate the prevalence\ incidence\ rate of disease. Ethical, approval from AAUP's committee and the Ministry of Health was obtained to acquire the patients' medical records

Results:

Our study view the result of the interviews that there is not a failure of vaccine efficacy, however a shortage of some vaccines occurred during the period of 2010-2020; Through the reports that were collected and analyzed by calculating the coverage rate for vaccines, it

was found that the coverage rate exceeded 90% in most vaccines; through analyzed disease incidence, found No cases register in some disease (Polio, Diphtheria), some outbreak (Mumps, Measles).

Conclusions:

Vaccination is one of the most widely used means to reduce, eliminate, and eradicate vaccine-preventable diseases, and the greater the coverage of vaccination, the greater the chance of eradication; Despite the shortage of some vaccines within the routine immunization program, the coverage rate nationally did not drop below 80%; Polio and diphtheria were eradicated in Palestine by vaccination; Tetanus and pertussis have been eliminated in Palestine by vaccination; Hepatitis B cases have been reduced to the point of reasonable control in Palestine by vaccination; Measles, Mumps, Rubella are diseases that can be eliminated but are not quite to that point; In Palestine, rubella under control as was measles before 2017 and was even in an elimination stage, however after 3 outbreaks, despite high vaccination coverage, measles no longer in control in Palestine. Mumps also has a high level of recorded cases despite high vaccination coverage.

Recommendation:

Our study recommended to improve the population register, Separate the reporting of cases and carriers of hepatitis b in the Gaza Strip (GS), Ensure the availability of lab testing for

pertussis, mumps in the Gaza Strip, investigate all confirmed cases of mumps, Assess the efficacy of the Measles, Mumps, Rubella (MMR)vaccine/vaccination process.

key words: Vaccination, Immunization, Preventable Disease, vaccination preventable Disease

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List of Abbreviations

AAFP	American Academy of Family Physicians
AAP	American Academy of Pediatrics
ACIP	Advisory Committee on Immunization Practices
AFP	Acute Flaccid Paralysis
BCG	Bacille Calmette-Guerin Vaccine
CDC	Center for Disease Control and Prevention
DPHCD	District Primary Health Care Directorate
DPT	Diphtheria, Pertussis (whooping cough), and Tetanus Vaccine
DT	Diphtheria and Tetanus toxoids vaccine (DT, pediatric)
EPI	Expanded Program on Immunization
GS	Gaza Strip
Hep.B	Hepatitis B Vaccine
IPV	Inactivated polio vaccine
MMR	measles, mumps, and rubella vaccine
MoH	Ministry of Health
OPV	Oral polio vaccine
PCV	pneumococcal vaccine
Penta	Pentavalent Vaccine
Rota vacc	Rotavirus vaccine
RuV	Rubella virus
Td	booster vaccine for tetanus and diphtheria
UNICEF	United Nations Children's Fund
UNRWA	*United Nations Relief and Works Agency*
US	United States

VPD	Vaccine preventive disease
WB	West Bank
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

Vaccination is defined as catalyzing the production of antibodies that are not harmful to the body to stimulate the immune system of children who have been vaccinated. The term immunization can be used instead of vaccination. Vaccination is one of the most effective and safe approaches of protection from diseases at the individual level(Miller et al., 1989) and protection of populations from the spread of infectious diseases that have caused the death of millions in the past(Home - Hong Kong Training Portal on Infection Control and Infectious Disease, 2021).Vaccination also protects people who move between countries from exposure to serious infections(World Health Organization, 2020a).

The main goal of vaccination is to reduce and control the spread of infectious and communicable diseases by achieving high immunity in the target groups during the vaccination period (Tholdcro, 2005).

Preventive diseases are the diseases that can be avoided and limited through the vaccination program implemented in that region (such as: diphtheria, tetanus, poliomyelitis, hepatitis, pertussis, measles, mumps, rubella, and meningitis.... ect ,). Vaccines are among the most successful preventive measures against diseases in the history of public health, the importance of vaccination includes; reduction of the mortality of infectious diseases,

eliminating certain diseases ,and reducing transmission of other diseases. (EhrethJ.2003; Duclos P, et al ,2009).

In 1974 the WHO established the Expanded Program on Immunization (EPI) with the goal of reaching to high vaccination coverage for children throughout the world to reduce the burden of preventable disease. (Kim-Farley RJ.1992)

The territories of the State of Palestine consist of two geographically separated areas: the West Bank (WB) and the Gaza Strip (GS). The WB is surrounded by the territories occupied in 1948 to the west, north, south, and the Jordan River to the east. The WB has a total area of 5661 sq km and is divided into eleven governorates: Jenin, Tubas, Tulkarm, Nablus, Qalqilya, Salfit, Ramallah and Al-Bireh, Jericho, Jerusalem (East Jerusalem), Bethlehem, and Hebron. The GS is a narrow zone of land bounded on the south by Egypt, on the west by the Mediterranean Sea, and on the east and north by the territories occupied in 1948. The GS has a total area of 365 sq km and constitutes 6.1% of the historical Palestine.

The mid-year population of the GS in the year 2020 was estimated at 5,101,152, which represents about 40% of the total population in the Palestinian territories with the remaining 60% in the WB. (PCPS, 2018).

Palestine has one of the oldest vaccination programs in the world, more than 130,000 child are vaccinated each year. Vaccination program started in Palestine in 1969, and has been developed more than one time through introduction of new vaccines and development of

new method for monitoring the effectiveness and efficiency of the vaccines including cold chain monitoring and surveillance system for communicable disease, to protect population health, and reducing the mortality of preventable diseases. (PMD,MoH,2021)

The study will focus on the assessment of the Palestinian vaccination program to limit and control the spread of diseases such as diphtheria, tetanus, poliomyelitis, hepatitis, pertussis, measles, mumps, and rubella, also to assess the impact of the vaccination program on these diseases between (2010-2020) by studying all recorded cases by the MoH, address the reasons behind recording new cases despite high vaccination coverage, focusing mainly on vaccine coverage methods

1.1 Significance of the Study

To date, according to a comprehensive literature review, no study has been conducted in Palestine to fully evaluate the national vaccination program and its effect on all communicable diseases in Palestine, Explanation of the methods for calculating vaccination coverage, studying the recorded disease cases and linking them to the vaccination history, this will give decision makers and stakeholders a perception of the health situation and highlight points that need to be improved. Moreover, it will give a clearer picture and better understanding of vaccination coverage and vaccination failures in Palestine, help health policymakers in evaluating the current procedures for vaccination coverage and planning for the future, evaluation of different products provided by different vaccine-producing

companies .The results and recommendations of our study will be added to the global results for comparison and a better understanding of vaccination coverage and failure in the globe.

1.2 Problem Statement

Immunization is a global health and development success story saving millions of lives every year. Vaccines reduce the risks of getting a disease by working with our body's natural defenses to provide protection against infectious and communicable disease. Preventive diseases are the diseases that can be avoided, and their spread can be limited through the vaccination program followed in that region, by reaching high vaccination coverage, we can reduce the rate of incidence of these diseases.

Despite high vaccination coverage in Palestine, many vaccines preventable diseases are still recorded according to the Ministry of Health (MoH) reports and health annual report Palestine 2019, hepatitis B (16 cases), measles(288 cases), Mumps (561 cases), Tuberculosis (17 cases), pertusis (22 cases). (Site.MOH.PS)

There are no studies that link the registered disease cases with vaccination history. In our study, we will determine and connect the vaccination history and the registered disease cases. Also, our study will investigate the registered cases of disease in either vaccine status. Furthermore, the study will review the surveillance system and the methods used by the MoH in data collection of vaccine coverage. The study will also cover the entire

population through comprehensive monitoring of vaccination coverage, thus ensuring that all targeted populations for the vaccine have received it on time to achieve herd immunity throughout the community. Therefore, we will show the possibility of limiting the spread of the disease and the emergence of new diseases through comprehensive vaccination coverage, noting that we are the first study conducted in Palestine to do so.

The study will focus on diseases such as diphtheria, tetanus, poliomyelitis, hepatitis, pertussis, measles, mumps, rubella, and meningitis that vaccines can limit their spread, also assess the vaccination program on these diseases between (2010-2020) by studying all recorded cases of these diseases by the MoH, address the reasons behind recording new cases despite high vaccination coverage, focusing mainly on vaccine coverage methods. Finally, the study will also determine the areas in which the disease is endemic to get rid of these diseases as recommended by the World Health Organization (WHO)

1.3 Objectives of the Study

The objectives of the study are:

- Assess the vaccination program in reduction of morbidity, mortality, in Palestine between (2010-2020).
- Investigate the percentages of vaccination coverage among the Palestinian population.
- Investigate the levels of failures in vaccination coverage among the Palestinian population.

- Determine the reasons for failures in vaccination among the Palestinian population

1.4 Thesis Outline

Chapter one: Introduction

This chapter includes Significance of the Study, Problem Statement, and objectives of the Study.

Chapter two: Literature Review

This chapter will include Introduction, Preventive diseases, Vaccination, Vaccine-preventable disease (VPD), Description of the Expanded Program on Immunization (EPI), Communicable Diseases, Vaccination in Palestine, and Previous Studies.

Chapter three: Methodology

This chapter will include Introduction, Study design, Study Population, Data Collection, Data analysis, Data management and analysis and Ethical.

Chapter four: Results

This chapter will include Introduction, Telephone-based interview, Vaccination Coverage and Communicable disease incidence,

Chapter five: Discussion

This chapter will include Introduction, Vaccination coverage and Preventable Disease.

Chapter six: Conclusion and Recommendation

This chapter will include Conclusion, Recommendation, Future work, Limitation and Appendix

CHAPTER TWO

LITERATURE REVIEW

This chapter includes previous studies, definitions and terms related to the subject of our study, as it includes (preventive disease, vaccination, vaccine preventive diseases, Description of the Expanded Program on Immunization (EPI), communicable diseases, and vaccination in Palestine.

2.1 Communicable diseases

are illnesses caused by viruses or bacteria that people spread to one another through contact with contaminated surfaces, bodily fluids, blood products, insect bites, or through the air, examples of communicable diseases, HIV, hepatitis A, B and C, measles, salmonella, food poisoning, insect bites.

2.2 Preventive diseases

Preventive diseases are diseases that we prevent and limit their spread through vaccination programs and include diphtheria, tetanus, poliomyelitis, hepatitis, pertussis, measles, mumps, rubella, and meningitis, among others. Vaccines are among the most successful preventive measures against disease in the history of public health. They can reduce the mortality and morbidity of infectious diseases, eliminate certain diseases, and reduce the transmission of others (WHO, 2019). MMR vaccine success story in Jordan, reduce measles cases from 120 cases in year 2013 to 48 cases in year 2019, and mumps cases

reduce from 162 cases to 11 cases between year 2010-2019, in Qater reduce measles cases from 295 cases to 5 cases between 2010-2019, in Israel reduce mumps cases from 4923 to zero case from 2010 to 2019, in Iraq reduce Rubella cases from 15 to 9 through 2010-2019. In Iraq Tetanus vaccine reduce cases from 11-6 cases through 2010-2019. Neonatal tetanus in Egypt reduces from 20 to Zero cases through years 2010-2019. (WHO.APPS) Other vaccine success story for OPV and IPV against poliomyelitis, Wild poliovirus cases have decreased by over 99% since 1988, from an estimated 350 000 cases in more than 125 endemic countries then, to 33 reported cases in 2018. (Poliomyelitis (who.int))

2.3 Vaccination

Vaccination is an easy, healthy, and efficient way to protect people from dangerous diseases before they become infected. It enhances human immune system by using body's natural defenses to create resistance to specific infections(WHO, 2021a)**. Vaccines** instruct the immune system to make antibodies in the same manner as when exposed to a disease. Unlike other exposures to a disease, vaccines do not cause illness and risk of complications because they contain viruses or bacteria that have been killed or weakened. Vaccines interact with body's natural defenses to create immunity, lowering the risk of contracting a disease. By receiving a vaccine, the immune system reacts by detecting the invasive germ, such as a virus or bacteria. It produces antibodies (proteins that the immune system produces naturally to combat disease).These antibodies then recall the virus or bacteria and

how to combat it; thus, if you are later exposed, the immune system will easily kill it, preventing human body from becoming ill(WHO, 2020).

If vaccination programs are not effectively implemented, the general population is at risk of severe illness and disability from diseases such as measles, meningitis, tuberculosis, tetanus, and polio, especially when considering that many of these illnesses are potentially deadly. Being vaccinated serves two purposes: protecting ourselves and protecting those around us. Since some people cannot be vaccinated such as very young infants, chronically ill, or others who have specific allergies. The majority of vaccines are administered by injection, but others are administered orally or by nasal spray. At least 20 illnesses, including diphtheria, tetanus, pertussis, influenza, and measles, are now protected by vaccines. Every year, these vaccines help to save the lives of up to 3 million people(WHO, 2021a).

2.4 Vaccine-preventable disease (VPD)

VPD is an infectious disease for which an effective preventive vaccine exists. The most common and serious vaccine-preventable diseases tracked by the World Health Organization (WHO) are: diphtheria, haemophilus influenza serotype B infection, hepatitis B, measles, meningitis, mumps, pertussis, poliomyelitis, rubella, tetanus, tuberculosis, and yellow fever (WHO, 2021b).

In addition, the WHO reports licensed vaccines as those being available to prevent or contribute to the prevention and control of the 27 vaccine-preventable infections (MacDonald et al., 2020).

The WHO estimates that vaccination prevents 2.5 million deaths each year (MacDonald et al., 2020). With 100% immunization, and 100% efficacy of the vaccines, one out of seven deaths among young children could be prevented, mostly in developing countries, making this a significant global health issue (WHO, 2021b). As of 2021, four diseases were responsible for 98% of vaccine-preventable deaths: measles, haemophilus influenzae serotype B, pertussis, and neonatal tetanus (WHO, 2021b).

Vaccine-preventable deaths are usually caused by a failure to obtain the vaccine promptly. This may be due to financial constraints or to a lack of access to the vaccine. Also, a generally recommended vaccine may be medically inappropriate for a small number of people due to severe allergies or a damaged immune system. In addition, vaccines against specific diseases may not be recommended for general use in a given country, or maybe recommended only to specific populations, such as young children or older adults. (International Travel and Health, 2019)

Every country has its own immunization recommendations based on the common diseases in the area and its healthcare priorities. If a vaccine-preventable disease is uncommon in a country, then residents are unlikely to receive a vaccine against it. For example, residents of

Canada and the United States do not routinely receive vaccines against yellow fever, which leaves them vulnerable to infection if travelling to areas where risk of yellow fever is highest (endemic or transitional regions) (That is why one of the visa requirement to visit these countries is to have a vaccine, if you do not). ((PHAC), 2018; Vaccine-Preventable Diseases - Yellow Fever, n.d.).

It is not necessary that the vaccination program within one country includes all the global vaccines but rather can be based on risk of exposure, with additional vaccinations given before travel to countries with higher risk areas.

Since infants and young children are more vulnerable to disease because their immune systems have not entirely evolved. They cannot combat infections, the World Health Organization's prescribed vaccine schedule must be followed at the recommended time to protect them from disease(Ventola,2016).

Timely vaccination throughout childhood is essential because it helps provide immunity before children are exposed to potentially life-threatening diseases. In addition, vaccines are tested to ensure that they are safe and effective for children to receive at the recommended ages(CDC, 2019).

Table (2-1) shows the schedule for vaccination program as recommended by the Advisory Committee on Immunization Practices (ACIP), and approved by American Academy of

Pediatrics (AAP), the Centers for Disease Control and Prevention (CDC), and American Academy of Family Physicians (AAFP)(CDC,2020).

Table (2-1): Vaccine-Preventable Diseases Program:

Disease	Vaccine	Disease spread by	Disease symptoms	Disease complications
Chickenpox	**Varicella vaccine** protects against chickenpox.	Air, direct contact	Rash, tiredness, headache, fever	Infected blisters, bleeding disorders, encephalitis (brain swelling), pneumonia (infection in the lungs)
Diphtheria	**DTaP*** vaccine protects against diphtheria.	Air, direct contact	Sore throat, mild fever, weakness, swollen glands in neck	Swelling of the heart muscle, heart failure, coma, paralysis, death
Hib	**Hib** vaccine protects against *Haemophilus influenzae* type b.	Air, direct contact	May be no symptoms unless bacteria enter the blood	Meningitis (infection of the covering around the brain and spinal cord), intellectual disability, epiglottitis (life-threatening infection that can block the windpipe and lead to serious breathing problems), pneumonia (infection in the lungs), death
Hepatitis A	**HepA** vaccine protects against hepatitis A.	Direct contact, contaminated food or water	May be no symptoms, fever, stomach pain, loss of appetite, fatigue, vomiting, jaundice (yellowing of skin and eyes), dark urine	Liver failure, arthralgia (joint pain), kidney, pancreatic, and blood disorders
Hepatitis B	**HepB** vaccine protects against hepatitis B.	Contact with blood or body fluids	May be no symptoms, fever, headache, weakness, vomiting, jaundice (yellowing of skin and eyes), joint pain	Chronic liver infection, liver failure, liver cancer
Influenza (Flu)	**Flu vaccine** protects against influenza.	Air, direct contact	Fever, muscle pain, sore throat, cough, extreme fatigue	Pneumonia (infection in the lungs)
Measles	**MMR**** vaccine protects against measles.	Air, direct contact	Rash, fever, cough, runny nose, pink eye	Encephalitis (brain swelling), pneumonia (infection in the lungs), death
Mumps	**MMR****vaccine protects against mumps.	Air, direct contact	Swollen salivary glands (under the jaw), fever, headache, tiredness, muscle pain	Meningitis (infection of the covering around the brain and spinal cord), encephalitis (brain swelling), inflammation of testicles or ovaries, deafness
Pertussis	**DTaP*** vaccine protects against pertussis (whooping cough).	Air, direct contact	Severe cough, runny nose, apnea (a pause in breathing in infants)	Pneumonia (infection in the lungs), death
Polio	**IPV** vaccine protects against polio.	Air, direct contact, through the mouth	May be no symptoms, sore throat, fever, nausea, headache	Paralysis, death
Pneumococcal	**PCV13** vaccine protects against pneumococcus.	Air, direct contact	May be no symptoms, pneumonia (infection in the lungs)	Bacteremia (blood infection), meningitis (infection of the covering around the brain and spinal cord), death
Rotavirus	**RV** vaccine protects against rotavirus.	Through the mouth	Diarrhea, fever, vomiting	Severe diarrhea, dehydration
Rubella	**MMR**** vaccine protects against rubella.	Air, direct contact	Sometimes rash, fever, swollen lymph nodes	Very serious in pregnant women—can lead to miscarriage, stillbirth, premature delivery, birth defects
Tetanus	**DTaP*** vaccine protects against tetanus.	Exposure through cuts in skin	Stiffness in neck and abdominal muscles, difficulty swallowing, muscle spasms, fever	Broken bones, breathing difficulty, death

2.5Description of the Expanded Program on Immunization (EPI):

The childhood immunization program for Palestine is in accordance with the recommendations by the WHO, and all children in Palestine are offered the recommended vaccine doses free of charge.

Table (2-2) below shows the schedule of the vaccination program approved by the Ministry of Health in Palestine; the last update was 2018.

Table (2-2): immunization schedule for Palestine last version was 2018.(MoH, 2020)

dT	DT	DPT	M.M.R	PCV10	Rota vacc	Penta	OPV	IPV	Hep. B	B.C.G	Vaccine Age
									*	*	One day
								*			Month 1
				*	*	*	*	*			Month 2
				*	*	*	*				Month 4
					*	*	*				Month 6
			*	*							12 Month
		*	*				*				18 Month
	*						*				Years 6
*											Years 15

BCG (Bacille Calmette-Guerin Vaccine), Hep.B(Hepatitis B vaccine), IPV (Inactivated polio vaccine), OPV (Oral polio vaccine), Penta (Pentavalent Vaccine), Rota vacc (Rotavirus vaccine), PCV10 (pneumococcal vaccine), MMR (measles, mumps, and rubella vaccine), DPT (diphtheria, pertussis (whooping cough), and tetanus Vaccine), DT (diphtheria and tetanus toxoids vaccine (DT, pediatric)), Td tetanus and diphtheria (booster vaccine for tetanus and diphtheria)

Each healthcare facility that provides vaccinations in the EPI program counts the number of doses given for each vaccine and reports monthly to the District Primary Health Care Directorate (DPHCD).

2.6 Communicable Diseases:

All doctors who detect or suspect a notifiable communicable disease have to fill out a communicable disease notification form and report it to the DPHCD. The diseases covered by the EPI program have to be reported immediately, weekly or monthly depending on the disease (category A, B, C) show in table (2-3). The diagnosis depends on clinical, epidemiological, and microbiological findings and there are published case definition for the disease in the communicable disease registry. These cases are often classified into suspected and confirmed cases depending on the certainty of the diagnosis. Since the registry only covers reported cases, patients with a notifiable communicable disease who does not seek health services or if the health service providers do not recognize or diagnose the case, it will not be reported in the registry system.

Table (2-3): Epidemiology Disease Category (A, B, C) in Palestine.(MoH, 2020)

A.	Immediately(Daily) Notified Diseases	B.	Weekly Notified Diseases	C.	Weekly or Monthly Notified Diseases
1	Acute Flaccid Paralysis	1	Brucellosis	1	Bites
2	Poliomylitis	2	Chemical Poisoning	1.1	Snake
3	Aids	3	Encephalitis	1.2	Scorpion Sting
3.1	Case	4	Viral Meningitis	1.3	Animal Bite
3.2	HIV infection	5	Hepatitis	2	Chicken Pox
4	Cholera	5.1	Hepatitis A	3	Herpes
5	Diphtheria	5.2	Hepatitis B	3.1	Zoster
6	Food Poisoning	5.2.1	Case	3.2	Simplex
7	Measles	5.2.2	Carrier	4	Hydated Cyst
8	Meningitis	5.3.	Hepatitis C	5	Intestinal Parasitic Diseases
8.1.1	Meningococcal Meningitis	5.3.1	Case	5.1	Ascariasis (Round Worm)
8.1.2	Hemophillus Influenza	5.3.2	Carrier	5.2	Oxyuriasis
8.1.3	Other Bacterial	6	Leprosy	5.3	Strongyloidiasis
9	Plague	7	Leishmaniasis	5.4	Taeniasis
10	H. Fever	7.1	Cutaneous	5.4.1	T. Solium (Pork Worm)
11	Rabies	7.2	Visceral(Kalazar)	5.4.2	T. Saginata (Beef Worm)
12	Tetanus	8	Malaria	5.5	Amebiasis
12.1	Neonatal	9	Pertusis (Whooping Cough)	5.5.1	Trophozoite
12.2	Other	10	Susp. Rickettsial Disease	6	Giardiasis
13	Yellow Fever	11	Rubella	7	Scabies
14	West Nile Fever	12	Mumps	8	Scarlet Fever
15	SARI Cases	13	S.T.D.s	9	Septicemia
15-1	pos. H1N1	13.1	Gonorrhea	10	Shigellosis
15-2	Pos. H3N2	13.2	Syphilis	11	Toxoplasmosis
15-3	Pos. Flu B	13.3	Other		
		14	Tuberculosis		
		14.1	Pulmonary		
		14.2	Extrapulmonary		
		15	Typhoid & Paratyphoid		
		16	Other Salmonella		

Hepatitis B:

Hepatitis B is a contagious liver disease caused by the hepatitis B virus. Acute hepatitis B refers to the first 6 months after someone is infected with the virus. As the infection continues, it is referred to as "chronic" or "lifelong."In the caseof chronic hepatitis B, the

infection can lead to serious health problems over time, including liver cancer. Hepatitis B is transmitted by coming into contact with an infected person's blood (even if they show no symptoms), at the time of birth, though cuts or sores that are open, or sharing toothbrushes or other personal items. For an infant, the virus may be transmitted by any infected family member or caregiver who chews food for them (American Academy of Pediatrics, 2021a).

Symptoms of hepatitis B infection include loss of appetite, fever, exhaustion, muscle, joint, and stomach pain, nausea, diarrhea, and vomiting, which are all also symptoms of a stomach bug. Symptoms also include dark urine and these symptoms usually appear three to four months after a person contracts the virus(American Academy of Pediatrics, 2021a).Hepatitis B vaccine is usually given as 2, 3, or 4 doses. Infants should receive their first dose of the vaccine at birth and will usually complete the vaccination series at six months, though it sometimes takes longer. In addition, a booster dose is recommended for all health workers(doctors, nurses, laboratory technicians, etc.) and university students who have direct contact with patients(American Academy of Pediatrics, 2021a).

Haemophilus Influenzae type B:

The bacteria *Haemophilus influenzae* type because Hib disease, which can be a severe illness (Hib). Hib disease is most common in babies and children under the age of 5 and can leave the child disabled for the remainder of his or her life, and in some cases, is fatal. Hib disease causes different symptoms depending on which part of the body it affects.

Symptoms include fever, headaches, and joint and skin infections. Three or four doses of the Hib vaccine are recommended as the best way to protect against Hib disease(American Academy of Pediatrics, 2021a).

Measles:

Measles is a viral infection of the respiratory tract caused by measles virus, including the lungs and breathing tubes. The virus can be transmitted through the air when an infected person coughs or sneezes. It can last as long as two hours on something that has been touched by an infected person. 90% of unvaccinated people are exposed to infection if they are close to an infected person, Measles can cause pneumonia, brain swelling, and death.(American Academy of Pediatrics, 2021a)

Mumps:

Mumps is a disease caused by mumps virus. That causes swollen salivary glands, fever, headache, and muscle aches, all of which contribute to general fatigue. It is transmitted through the air and transmitted to others through breathing or coughing. Mumps can cause long-term problems, including infertility in men(American Academy of Pediatrics, 2021a).

Rubella:

Rubella virus (RuV)or German measles, is transmitted through the respiratory system and is caused by a viral agent of Rubella(American Academy of Pediatrics, 2021a).

Two doses of the Measles, Mumps, Rubella (MMR) vaccine are recommended by healthcare providers at 12 and 18 months for children as the best way to protect against measles, mumps, and rubella (CDC,2021).

Diphtheria:

Diphtheria is a serious infection caused by bacteria called *Corynebacterium diphtheria*. It causes severe illness and a thick covering at the back of the nose or throat that makes it difficult to breathe or swallow. In serious cases it can lead to heart failure and paralysis or even death. The bacteria is spread through the respiratory system (through sneezing and coughing) or contact with infected wounds(American Academy of Pediatrics, 2021a).

According to the estimates of the WHO, the death rate among children less than 5 years of age is 1 for every 5 children infected with the disease, so it is recommended that children receive at least 3 doses of the vaccine to protect against the disease(American Academy of Pediatrics, 2021a).

Poliomyelitis:

Poliomyelitis is caused by **poliovirus which** primarily transmitted by ingestion of contaminated water and can cause an acute gastrointestinal infection. Polio, as it is often called, is a crippling and potentially deadly infectious disease that is caused by the poliovirus. The virus spreads from person to person and can invade an infect person's brain and spinal cord. In a minority of cases, the disease will progress to meningitis and myelitis and cause Acute Flaccid Paralysis (AFP).Ensuring that infants and children are vaccinated

is the best way to prevent polio from returning, and it is recommend that children get two doses from polio vaccine (Two types of vaccines protect against polio, or poliomyelitis, Inactivated poliovirus vaccine (IPV), Oral poliovirus vaccine (OPV)at the age of 2 and 4months(CDC, 2020).

Rotavirus:

Rotavirus one of the most critical symptoms of rotavirus is severe diarrhea and vomiting. Infants and young children are the most vulnerable group to infections. If left untreated, it leads to a significant loss of fluids and electrolytes. The virus can live for an extended period on household objects. Hand washing and sterilization are not enough to prevent the virus but should be used with the vaccine. The WHO recommends three doses of the vaccine to protect children aged from two to six months from the virus(CDC, 2020).

Pneumococcal Disease:

Pneumococcal Disease is caused by *Streptococcus pneumoniae* and leads to several diseases including otitis media and meningitis. To protect children from these diseases, the WHO recommends a vaccine at 2 months, 4 months, and 6 months. The pneumococcal vaccine was introduced into the childhood immunization program in Palestine in 2011. (CDC, 2020)

Tetanus

Tetanus is caused by toxins from a bacterium *Clostridium tetani* that is present in the soil and the large intestines of many animals. Bacterial spores enter the body via contaminated wounds and grow well under anaerobic conditions in the lacerated tissue. The disease manifests itself with muscular stiffness of the jaw progressing to more generalized painful muscular spasms. Neonatal tetanus is of particular concern as the mortality is high. Unfortunately, in terms of diagnosis, microbiological test are of little value as they often are negative; thus, in many countries, there is a tendency of underreporting of this disease as the registry relies on the clinician remembering to report(American Academy of Pediatrics, 2021b).

The tetanus vaccine is usually given combined with vaccines against diphtheria, pertussis (whooping cough), and Hib. After the primary3 doses, almost all vaccinated people are protected against the disease. After that, however, immunity wanes gradually, and boosters are recommended every ten years to maintain complete protection(American Academy of Pediatrics, 2021b).

Whooping Cough:

Whooping Cough (Pertussis) is a droplet-borne disease caused by the bacterium *Bordetella pertussis*. The disease is characterized by prolonged paroxysms of coughing lasting for periods up to several months after an initial period of cold-like symptoms. The disease can be fatal for

children under 2 years and especially for infants. Partially immunized people can have less characteristic symptoms and diagnosis is based on typical clinical symptoms, antibodies in blood test, and microbiological examinations (culture and PCR). The vaccine is usually given in combination with the vaccine against diphtheria, tetanus, and Hib(WebMD, 2011).

2.7 Vaccination in Palestine

Preventive Medicine is a branch of medicine concerned with studying, discovering, and applying ways to prevent diseases. Preventive medicine belongs under the umbrella of community medicine as one of the primary branches of medicine. It aims to predict and prevent diseases before they occur and is primarily concerned with the general health of groups rather than individuals. The most important tasks assigned to preventive medicine are as follows:

1. Prevention of the disease epidemics and the facilitation of rapid intervention when they occur to prevent further spread and reduce damage
2. Improve the general health of a population
3. Maintain quality of life for healthy and sick people (MoH, 2011).

Vaccination strengthens the human body's immune system by injecting a tiny amount of the dead or weakened bacteria or viruses that cause a disease. The importance of vaccination can be summarized as follows as it:

1. Reduces mortality and morbidity for infectious diseases

2. Eliminates certain diseases such as smallpox, poliomyelitis, neonatal tetanus, and measles
3. Reduces the transmission of other diseases such as pertussis, rubella, and viral hepatitis B
4. Protects the stability of the national economy, by reducing the costs of healthcare for sick children and reducing the time that parents are out of work to care for their children (WHO,2020).

The expanded vaccination program for children is considered as one of the most successful public health programs in Palestine due to the eradication of some diseases such as polio (1988) and smallpox (1978). The control of others such as measles, rubella, and tetanus, and the limitation of spread in the case of meningitis (Ramlawi A, 2014).

This program includes 11 different vaccines (BCG, IPV, OPV, DPT, MMR, Hepatitis B, HIP, PCV, Penta, Rota and covid-19) that covers children from birth until the age of 15 years old. According to the statistics issued by the MoH and the WHO, the annual vaccination rate exceeds 99% for all vaccines (PMD, MoH).

The vaccination program, which began in 1969, initially included vaccinations against smallpox, the OPV vaccine against polio, the DPT vaccine against diphtheria, tetanus and pertussis, and the vaccine measles. Between 1978 and 1985 the vaccination program included the tetra vaccine and in 1988 the program added the IPV vaccine against polio and the MMR vaccine against measles, mumps and rubella. In 1992, the hepatitis B vaccine was added followed by the BCG vaccine against tuberculosis in 1999 and the PCV vaccine in 2012which protects against pneumococcal disease. The PENTA vaccine against

diphtheria, tetanus, pertussis, Hib infection, and Hep.B and a Rota vaccine were added in 2017 (MoH, 2011). And in 2021, vaccination against corona virus (covid-19) was introduced.

Except the covid-19 vaccination, all vaccines mentioned above are given to children from birth until the age of 18 months which is considered the essential stage of vaccination. In addition, booster doses are given for some vaccines such as polio, diphtheria, and tetanus in the first grade of primary school and another booster dose at the age of 15-year-old of diphtheria and tetanus. These vaccines aim to immunize all children in Palestine, even those coming from abroad, and the vaccination schedule is completed according to the age of the child or newborn (MoH, 2011).

The vaccination program has been highly successful, as indicated by precise results demonstrating the eradication or reduction in the prevalence of these diseases to levels that make prevention and control feasible. This includes the eradication of polio from Palestine, which is confirmed by the WHO, which has issued a certificate stating that Palestine is free from this disease and the eradication of smallpox (MoH, 2011) like the countries of the world.

Through the vaccination program, tetanus was controlled along with measles and rubella. Palestine also has a low prevalence of some vaccine-targeted diseases such as hemorrhagic meningitis, one of the causes of bacterial meningitis, diphtheria, pertussis, and mumps (PMD, MoH).

The Ministry of Health is continuously carrying out educational and awareness campaigns about the vaccination program and its importance for children in the health centers that administer these vaccines, organizing media meetings, and distributing an expanded vaccination guide booklet. Additionally, the Ministry participates in awareness campaigns throughout the first week of April of each year as a part the activities of the World Vaccination Week. The Palestinian community is one of the most committed and understanding communities of the vaccination program. This fact is evidenced by the over 99% rate of vaccination coverage that is achieved annually.

Vaccines currently included in the unified national program for vaccination in Palestine are:

Oral polio vaccine (OPV) protects against polio. The vaccine contains live attenuated virus. It is given as follows: dose one at the age of two months, dose two at the age of 4 months, dose three at the age of 6 months, dose four (booster) at the age of 18 months and does five (booster) at the age of 6 years. It is administered orally and was included in the national immunization schedule in 1969 (MoH, 2011; Haber & Schillie, 2021).

IPV vaccine protects against polio. The first dose is given at the age of one month and the second at two months. It is given before OPV to protect children from potential paralysis resulting from the live vaccine in OPV. Fortunately, there have been no cases of polio in Palestine since 1988. It was included in the national immunization schedule in 1988 (MoH, 2011; Haber & Schillie, 2021).

DTP Triple vaccine protects against diphtheria, tetanus, and whooping cough. It is given as follows: dose one at the age of two months, dose two at the age of 4 months, dose three at the age of 6 months, and dose four (booster) at the age of 18 months. It was included in the national immunization schedule in 1979(MoH, 2011; Haber & Schillie, 2021).

Measles, rubella, and mumps M.M.R protects against measles, rubella, and mumps which are viral diseases. The M.M.R vaccine is given at the age of 12 months, and another dose at the age of 18 months. It was included in the national immunization schedule in 1988 (MoH, 2011; Haber & Schillie, 2021).

Hepatitis B Vaccine protects against hepatitis B infection but does not protect from other types of hepatitis, that is, A, C, and D. A total of three doses are required. The first dose is given immediately after birth, with two months separating the first two doses, and the third and fourth dose are given at the age of 4 and 6 months, respectively. It was included in the national immunization schedule in 1991 (MoH, 2011; Haber & Schillie, 2021).

Haemophilus (B) vaccine (Hib) B Haemophilus Influenza protects against *Haemophilus influenza* (Class B) infection, which is one of the most severe bacterial infections and is common among children under the age of five. The vaccine is most effective when administered before the peak risk period 6-36 months of age, that is, from the age of two months. Three doses are administered with the DTP vaccine. The dose is given one at the age of two months, dose two at the age of 4 months, and dose three at the age of 6 months.

It is not in the form of a live virus but rather is part of a bacterial capsule to which the immune system responds(MoH, 2011; Haber & Schillie, 2021).

B.C.G vaccine protects against meningococcal tuberculosis; it primarily reduces pulmonary and extra-pulmonary tuberculosis in children and is given in the first days after birth. It was included into the national immunization schedule in 1999 (MOH, 2011),(Haber & Schillie, 2021).

Pneumococcal Vaccine protects against infection from the most common types of streptococcus pneumonia. The vaccine for infants should be given at two or four months, with a booster dose given at one year. The pneumococcal vaccine for children and adults should be given to high-risk individuals (those over 50 or with chronic obstructive pulmonary disease, diabetes, spleen loss, or liver disease) and is usually given as a single dose and a booster dose at the age 65 years old. It was included in the national immunization schedule in 2012(PMD, MoH,2020).

Tetanus toxin analog dT vaccine for pregnant women protects against tetanus in the newborn baby. The main goal of this vaccine is to increase the level of antibodies to tetanus in the mother's body, which is passively passed on to the fetus. If the mother has not received a tetanus vaccination at all, she must receive at least two doses (0.5 milliliters of tetanus toxin analog) during pregnancy, with subsequent doses after delivery. If she has received tetanus vaccines in the past, the pregnant woman's immune status will be evaluated. A tetanus booster dose is given every ten years. No side effects were reported on

the developing fetus from the isotonic tetanus vaccine(MoH, 2011; Haber & Schillie, 2021).

Meningitis (Meningococcal ACYW135 Polysaccharide) protects against the most common form of meningitis, caused by *Neisseria meningitides*, which is spread by picking up droplets in the air. The vaccine is administer as a part of bacterial capsules to which the immune system responds (MoH, 2011; Haber & Schillie, 2021).

A single dose (0.5ml subcutaneously) protects against the 4 most common types of meningitis. Immunity lasts for at least 3 years and then decreases. It is currently given to Hajj and Umrah pilgrims by the Palestinian MoH, and travelers to areas affected by this disease. Side effects include mild local pain and swelling at the site of injection though fever is rare (MoH, 2011; Haber & Schillie, 2021).

Rabies Vaccine protects against rabies. The first dose should be given as soon as possible after potential exposure. The second dose is given after 3 days and the third dose after 7 days. The situation is then evaluated on the tenth day. If person remains alive and asymptomatic, the vaccinations will be stopped. Otherwise, a fourth dose is given on the 14th day (MoH, 2011; Haber & Schillie, 2021).

The flu vaccine protects against the currently dominant type of influenza A, Swine, or B and consists of a deadly virus. Because the type of influenza changes yearly, the vaccine must be reworked every year based on the best effort to predict the possible types of

influenza. Every year, it is given in one dose to patients at high risk of influenza complications (those >65 years old or who have low immunity, HIV, chronic obstructive pulmonary disease, diabetes, and/or chronic heart disease). To obtain maximum immunity, infants and children between the ages 6 and35 months need two doses of 0.25 ml each, separated by about 30 days (MoH, 2011; Haber & Schillie, 2021).

Yellow Fever vaccine protects against infection with the yellow fever virus. It is given in the form of a weakened live virus by injection in 0.5 ml. It is often administered to travelers to endemic areas. It is safe, and its side effects are rare but include headache and a slightly elevated temperature that may last for a few days after the vaccine (MoH, 2011; Haber & Schillie, 2021).

Vaccination of school students is carried out as follows Grade 1 (aged 6 years): OPV, D.T. (POLIO, diphtheria, and tetanus), grade 9 (15 years old): d.T (diphtheria and tetanus) (MoH, 2011; Haber & Schillie, 2021).

Corona (covid-19) vaccines since Covid -19 pandemic hit the world in 2019, allot of efforts were paid to introduce the vaccine to Palestine, in 2021 MOH introduce the Covid -19 vaccine targeted population over 12 years old, up to date (1,589,351) vaccinated using different type of vaccine type.

According to the ministry of health published goal it aims to vaccinate 90 percent's of the total population. (PMD, MoH,2021)

Table (2-4) shows the schedule of the routine vaccination program up to date by the Ministry of Health in Palestine; 1969-2020(PMD, MoH, 2021).

Table (2-4): Routine Child Immunization Program in Palestine 1969-2009. (PMD, MoH, 2021)

	Small pox		OPV					IPV			DPT				Tetra cok				MMR		Hepatitis B			Hib			BCG	PCV		
Year	I	II	I	II	III	IV	V	I	II	III	I	II	III	Boosters	I	II	III	Measles	I	II	I	II	III	I	II	III		I	II	III
1969	1	one wk	3	4	5	17					6	7	8	20				12												
1970	1	one wk	3	4	5	17					6	7	8	20				12												
1971	13	one wk	3	4.5	6	12					3	4.5	6	12				14												
1972	13	one wk	3	4.5	6	12					3	4.5	6	12				14												
1973	13	one wk	3	4.5	6	12					3	4.5	6	12				14												
1974	13	one wk	3	4.5	6	12					3	4.5	6	12				13												
1975	14.5	one wk	3	4.5	6	12-18					3	4.5	6	12-18				13												
1976	14.5	one wk	3	4.5	6	12-18					3	4.5	6	12-18				13												
1977	14.5	one wk	3	4.5	6	12-18					3	4.5	6	12-18				13												
1978	4	one wk	2	3.5	5	6.5	12				6.5	12			3.5	5		13												
1979			2	3.5	5	6.5	12				6.5	12			3.5	5		13												
1980			2	3.5	5	6.5	12				6.5	12			3.5	5		13												
1981			2	3.5	5	6.5	12				6.5	12			3.5	5		13												
1982			2	3.5	5	6.5	12				6.5	12			3.5	5		13												
1983			2	3.5	5	6.5	12				6.5	12			3.5	5		13												
1984			2	3.5	5	6.5	12				6.5	12			3.5	5		13												
1985			2	3.5	5	6.5	12				6.5	12			3.5	5		13												
1986			2	3.5	5	6.5	13				3.5	5	6.5	13				12												
1987			2	3.5	5	6.5	13				3.5	5	6.5	13				12												
1988			2	3.5	5	6.5	12	3.5	5		3.5	5	6.5	12					15											
1989			2	3.5	5	6.5	12				3.5	5	6.5	12					15											
1990			3.5	5	6.5	12		2	3.5		2	3.5	5	12					15											
1991			4	6	12			2	4	12	2	4	6	12					12											
1992			4	6	12			2	4	12	2	4	6	12					15		0	1	6							
1993			4	6	12			2	4	12	2	4	6	12					12		0	1	6							
1994			4	6	12			2	4	12	2	4	6	12					12		0	1	6	2	4	12				
1995			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6							
1996			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6							
1997			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6							
1998			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6				0-1			
1999			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6				0-1			
2000			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6				0-1			
2001			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6				0-1			
2002			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6				0-1			
2003			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6				0-1			
2004			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6				0-1			
2005			2	4	6	12		1	2		2	4	6	12				9	15		0	1	6				0-1			
2006			2	4	6	12		1	2					12	*2	4	6	9	15		0	1	6				0-1			
2007			2	4	6	12		1	2					12	2	4	6	9	15		0	1	6				0-1			
2008			2	4	6	12		1	2					12	2	4	6	9	15		0	1	6				0-1			
2009			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-1			
2010			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-1			
2011			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-2			
2012			2	4	6	12		1	2					18	**2	4	6	9	12	15	0	1	6				0-3	2	4	6
2013			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-4	2	4	6
2014			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-5	2	4	6
2015			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-6	2	4	6
2016			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-7	2	4	6
2017			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-8	2	4	6
2018			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-9	2	4	6
2019			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-10	2	4	6
2020			2	4	6	12		1	2					18	2	4	6	9	12	15	0	1	6				0-11	2	4	6

* In year 2006 the vaccine changes to DPT-HEP.

** in year 2012 the vaccine changes to Penta vaccine.

Number in table: (I, II, III, IV, V) number of vaccine dose, 1,2,3 .... child age.

The table update by researcher from 2009 to 2020 through Preventive medicine Department in Ministry of Health.

Vaccination has been one of the most successful and cost-effective public health interventions in the last century and has saved millions of people from various diseases(Ehreth, 2003). The benefits of vaccination include the global eradication of one deadly disease, smallpox, and the near eradication of another, poliomyelitis(Pan et al., 2021). In 1974, the WHO established the Expanded Program on Immunization (EPI) with the goal of increasing immunization coverage among children throughout the world(Muloiwa et al., 2020). The EPI has significantly contributed to the overall global reduction of burden of vaccine-preventable diseases (VPDs) since its inception(Muloiwa et al., 2020). Within Palestine, the National Committee for Expanded Immunization works continuously to follow vaccinations and epidemic diseases in the region and globally and to introduce new vaccines for diseases that pose a threat at the national level.

2.8 Previous Studies

Since 1986, according to the Palestine Immunization Program, children have received two doses of the measles, mumps, and rubella vaccine - the first dose at the age of 12 months, and the second dose at the age of 18 months. According to reports, since 1986, no incidences of these diseases have been reported. There were no cases of measles in the Gaza Strip except one case in the year 2000, however, in 2018, 124 confirmed cases of measles were reported in the Gaza Strip and a study indicated that 57 (46%) of these 124 cases did not receive the vaccine, including 28 (23%) children aged from 6 months to 1 year and 29 (23%) adults aged≥30 years old. Still, the coverage of the second dose of measles vaccination (MCV2) in the region was 97%. The West Bank has also reported several measles cases recently; the first case of measles in the West Bank since 2009 was reported in 2017, and the total number of cases was 64 that year. There were no cases in 2018, but again in 2019, 37 cases were reported. As of the beginning of 2020, there were five confirmed measles cases in the Jenin district (Bagcchi, 2020).

Communicable diseases have low incidence rates in Palestine, although viral hepatitis A, B, and C are endemic. In 2011, hepatitis A had an incidence rate of 23.1 per 100,000 populations. The incidence rate for bacterial meningitis in Palestine as a whole was 13.8 and for viral meningitis was 24.3 per 100,000 populations. However, incidence rates were much higher in the Gaza Strip (31.1 and 50.3 respectively) than in the West Bank (3.14 and

8.4 respectively). The incidence rate for pulmonary tuberculosis was 0.5 per 100 000 populations(World Health Organization, 2020b).

A study conducted by Dr.Ramlawi in 2000 reveals that the prevalence of hepatitis B is about 3.4 ranging from 0.0 to 6.3 for all population over 8 years assuming that children under 8 years are immune against viral hepatitis B due to vaccination . As vaccine for hepatitis B was introduced in the national routine expanded immunization program (EPI) in Palestine in the early 1992. (Ramalawi.2000)

India adopted a comprehensive program of immunization in 1985. As a result, they records the largest number of births annually (Lahariya, 2014). Through the process of adopting the vaccination program in, it has avoided large numbers of childhood deaths. However, measles is still one of the leading causes of childhood deaths in India (Lahariya, 2014). Although India's national routine vaccination coverage against measles reached 81% in 2015 (National Family Health Survey, 2015), 83,026 cases of measles and 3,265 cases of rubella were recorded (Béraud et al., 2018).

In the year 2000, the United States of America declared the elimination of measles, after which the number of reported cases was limited(McLean et al., 2013). In 2019, 1249 cases of measles were reported; 89% of these cases were in people who were unvaccinated or had an unknown vaccination status. 31% of the total recorded cases were between 1-4 years old, and 13% were infants aged <12 months (for whom the MMR vaccine is not routinely recommended). The US government indicated that one of the factors influencing disease occurrence is low vaccination coverage which is compounded by high population density or

imported cases due to travel to endemic areas. The US has worked to increase vaccination efforts in areas where the disease has spread and hasadministered60,000 doses of the MMR vaccine through specialized vaccination campaigns (Patel, 2019).

A study conducted in Israel on cases of meningococcal disease infection was conducted during the period of 2007-2017. The study indicated that 65% of the cases of meningococcal were in children of less than four years. The study also showed that 7% of the cases were fatal. Most of the cases and fatalities were in children less than one year old. The disease is endemic in a geographical area (Tel Aviv); the incidence rates ranged from 0.4 to 1.4 cases per 100,000. The results of the study also indicate that the disease can be prevented through vaccination. Therefore it is recommended to introduce the vaccine into the routine vaccination program(Salama M,2019).

In 2002, Israel was designated as a polio-free country according to the WHO protocols. Thus, the national vaccination program began to include only the inactivated polio vaccine, IPV, and ceased the administration of the oral polio vaccine (OPV). However, 11 years later, paralysis cases were discovered in the southern region (Rahat), detected through environmental surveillance of the sewage system. Consequently, in 2013, the Israeli Ministry of Health intensified efforts to reintroduce the oral polio vaccine (OPV) into the national vaccination program and improve the case investigation/ surveillance system (Brouwer et al., 2018). In addition, implementing a vaccination campaign that includes all children between 0-9 years who have not received the OPV (Kaliner et al., 2014).

Vaccination coverage against measles, mumps, and rubella is high in Sweden, but there are still outbreaks of associated diseases. After conducting a study of outbreak areas in 2018, it was found that most of its residents are Somali immigrants. Furthermore, it was found that the cause in the delay in vaccination or lack of vaccination by the parents is the fear of the vaccine's negative impact on the growth of their children (A et al., 2018).

From 2010 to 2015, the WHO made a concerted effort to eliminate measles and rubella in Europe, However, it could not achieve this goal, as the region recorded more than 30,000 cases in 2010, half of which were in France. Outbreaks of the disease increased after that, with studies finding that the main reason for the outbreaks was poor vaccine coverage (though some cases were previously vaccinated), which raises debate over the level of immunity achieved by the vaccine. Because the vaccine is a combination of vaccines against measles, rubella and mumps, lowered immunity rates could lead to the outbreak of any of the three diseases (Béraud et al., 2018).

In a study conducted on pertussis cases in the Vallès region of Catalonia, Spain, 421 confirmed pertussis cases were reported despite the commitment to the national vaccination schedule and reaching 90% or more coverage, which raised question about the effectiveness of the vaccination program(MR et al., 2015).

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter included the research methodology, study design, study population, data collection, data analysis, and data management.

3.2 Study Design

A cross-sectional study design was utilized to analyze the cases of preventable disease registered by the Palestinian Ministry of Health which were included in the epidemiological and immunization monitoring system.

Cases were viewed in order to obtain information (age and vaccination status), location (geographical distribution of cases), and national routine vaccination coverage (schedule immunization) for Hep.B, BCG, OPV, IPV, DPT, MMR and DPT by doses.

Moreover, Telephone-based interview were done to gain insight from vaccine providers in the primary healthcare units in the West Bank and Gaza Strip, and with the directors of the preventive medicine departments in each governorate to ask them the following questions:

1. Have you reported a failure in any of the given vaccines?
2. If yes, what is that vaccine?
3. What are the possible causes of that particular failure?

3.3 Study Population

The study utilized all data recorded by the Palestinian Ministry of Health/Preventive Medicine Department during the period 2010-2020 related to diseases that can be prevented with vaccinations and the unified national vaccination program in Palestine. (Hepatitis B, Measles, Mumps, Rubella, Polio, Diphtheria, Tetanus, pertussis, Rota virus, Pneumococcal and tuberculosis (TB) disease. In addition to vaccine providers in the primary healthcare units and the directors of the preventive medicine departments in each governorate through telephone-based interview.

3.4 Data Collection

The data was collected from the Central Preventive Medicine Department, which collects data associated with diseases and related vaccinations from all health service providers in Palestine. Therefore, the data was collected from the Palestinian Ministry of Health in the West Bank and Gaza Strip, government centers, centers affiliated with UNRWA, medical relief, military medical services, government and private hospitals, and all specialist doctors. In addition, it collects records of communicable and infectious diseases and vaccinations. Period study (2010-2020) was chosen because it is the beginning of when data collectors utilized the computerized electronic system and obtained the necessary data. Data were extracted from databases by age, gender, geographic distribution, disease status and vaccination status for confirmed and registered disease cases.

Telephone-based interview with vaccine providers in the primary healthcare units in the West Bank and Gaza Strip, and with the directors of the preventive medicine departments in each governorate were done as mentioned above.

3.5 Data Analysis

A descriptive analysis approach was adopted to analyze the data based on age, gender, type of disease, and the incidence of disease according to geographical distribution.

Statistical analysis was performed using Statistical Package for Social Science (SPSS) version 15 software package. A percentage was used to calculate the prevalence\ incidence\ rate of disease.

The data was analyzed by describing the disease according to type, location, gender, vaccination status and its relationship to the disease (whether the lack of vaccination affects the increase in cases of disease). We also compared the disease incidences at different time periods, different locations, and different population groups.

The results of the Telephone-based interview were entered and analyzed through the SPSS program.

3.6 Data management and analysis

Coverage rates for the vaccines included in the national immunization program were estimated for 2010-2020, a period which was chosen after more than one session with the Director of the Preventive Medicine Department, where he stated that 2010 marked the

implementation of the computerized electronic system and the possibility of obtaining available data.

The coverage percentage of the vaccines was calculated for each year based on the number of births compared to the number of vaccines administered for each disease according to the consumed vaccination doses. This is the method used by the Palestinian Ministry of Health to calculate the coverage percentage in accordance with the recommendations of the WHO.(WHO,2015)

Number of children vaccinated according to the type of vaccine Dose / number of children born alive during the year X 100

The incidence rate; incidence refers to the occurrence of new cases of disease or injury in a population over a specified period of time according to CDC(Centers for Disease Control and Prevention, 2012b).The incidence rate registered within the communicable diseases program was calculated according to the recommendations of the WHO.

Number of new cases of disease or injury during specified period/Time each person was observed, totaled for all persons

Prevalence rate is the proportion of persons in a population who have a particular disease or attribute at a specified point in time or over a specified period of time according to the CDC (Centers for Disease Control and Prevention, 2012b). The Prevalence rate of diseases was calculated as follows

All new and pre-existing cases during a given time period / Population during the same time period× 10 n

The data was analyzed by studying the registered cases of all diseases related to vaccinations in terms of counts of cases or health events, time, place, and person and studying the vaccination status of the registered patients and linking them to the vaccination history of the case according to CDC guidelines(Centers for Disease Control and Prevention, 2012a).

3.7 Ethical

First, approval from AAUP's committee and the Ministry of Health was obtained to acquire the patients' medical records.

Privacy and confidentially were completely protected. No identifiers or personal information was stored including an individual's name or ID. Each case was given a unique ID in the study and all private or sensitive information was hidden during the analysis and during the visualization of the results.

CHAPTER FOUR

RESULT

This chapter includes the results of the data analysis of the interviews and vaccination coverage in Palestine. The data needed for this study was made available by the Palestinian MoH in their computerized data bases.

4.2 Vaccination Coverage

Reported data for routine immunization coverage was collected from the Preventive Medicine Department within the Ministry of Health. Being the only department responsible for the vaccination process, its task is focused on determining the annual needs for vaccines and providing and distributing them to the centers where the vaccines are administered, all of which are subject to the guidelines and protocols of the WHO. The process of vaccine distribution, storage and method of administration are managed by the department and therefore all reports are centrally collected in the Central Preventive Medicine Department databases. The reports come from all centers providing vaccines in the West Bank and Gaza including from the government and UNRWA. Through the reports that were collected and analyzed by calculating the coverage rate for vaccines, it was found that the coverage rate exceeded 90% in most vaccines.

For the **BCG vaccine** during the period 2010-2020, the coverage rate reached 100% in all years except for the years 2011 and 2012, which each had a national coverage rate of 98%,

in the WB the coverage rate reaches 100% in all year except for the years 2011, 2012 and 2013, which each coverage rate 98%, in GS the coverage rate reaches 100% in all year except for year 2011, 2012 and 2020, which each coverage rate 98%.

For the **HIB-DPT Vaccine** during the period 2010-2012, the coverage rate reached more than 99% at the national level, however in 2012 the program transitioned to a **new vaccine (Penta)**, and consequently the coverage rate for Penta vaccine was less than 50% during the transition period.

For the **DPT vaccine** during period of analysis, the coverage rate reached more than 95% in all years except for 2010, 2013 and 2016 which all had a coverage rate between 90%-94%, and the year 2018 where the coverage rate was 80-89% at national level. In the West Bank specifically, the coverage rate was between 90%-94% in the years 2012, 2013, 2015, and 2017, and between 80%-89% in 2018. In GS, the coverage rate reached more than 95% in all years except for 2010, 2011 the coverage rate was between 90%-94%.

The **OPV vaccine** coverage rate reached more than 95% in all year during the period of analysis except for 2016 and 2017 when the coverage rate was between 90%-94% at national level. In WB the coverage rate reach more than 95% in all years except for 2012 and 2017 the coverage rate was between 90%-94%. In GS the coverage rate reaches more than 95% in all years.

The coverage rate of the **HB vaccine** during the period of analysis reached more than 95% in all years at national level except for2012 when the coverage rate was between 90%-94%. In WB the coverage rate reached more than 95% in all year except for 2012, the coverage rate was between 90%-94%. In GS the coverage rate reached more than 95% in all year.

For the **IPV vaccine** during the period of analysis, the coverage rate reached more than 95% in all years at national level except for2014 and 2015. In2014, the national coverage rate was 90%-94% and the rate in 2015 was 80%-89% at national level. In West Bank the coverage rate reached more than 95% in all years except 2010 the coverage rate was between 90%-94% and 2014, the coverage rate was 80%-89%. In GS the coverage rate reached more than 95% in all years.

The **measles vaccine** coverage rate reached more than 95% at national level and sup national level (WB & GS) in 2010 and 2011 after which the program transitioned to administering the MMR vaccine.

The **MMR vaccine** during the period of analysis, had a coverage rate of more than 95% at national level except for2010,2011,2016, and 2017 when the rate was 90%-94%. In the West Bank the coverage rate reached more than 95% except for 2012, 2015,2017, and 2018, the coverage rate was between 90%-94%. In GS the coverage rate reached more than 95% in all years except for 2010 and 2011 the coverage rate was between 90%-94%.

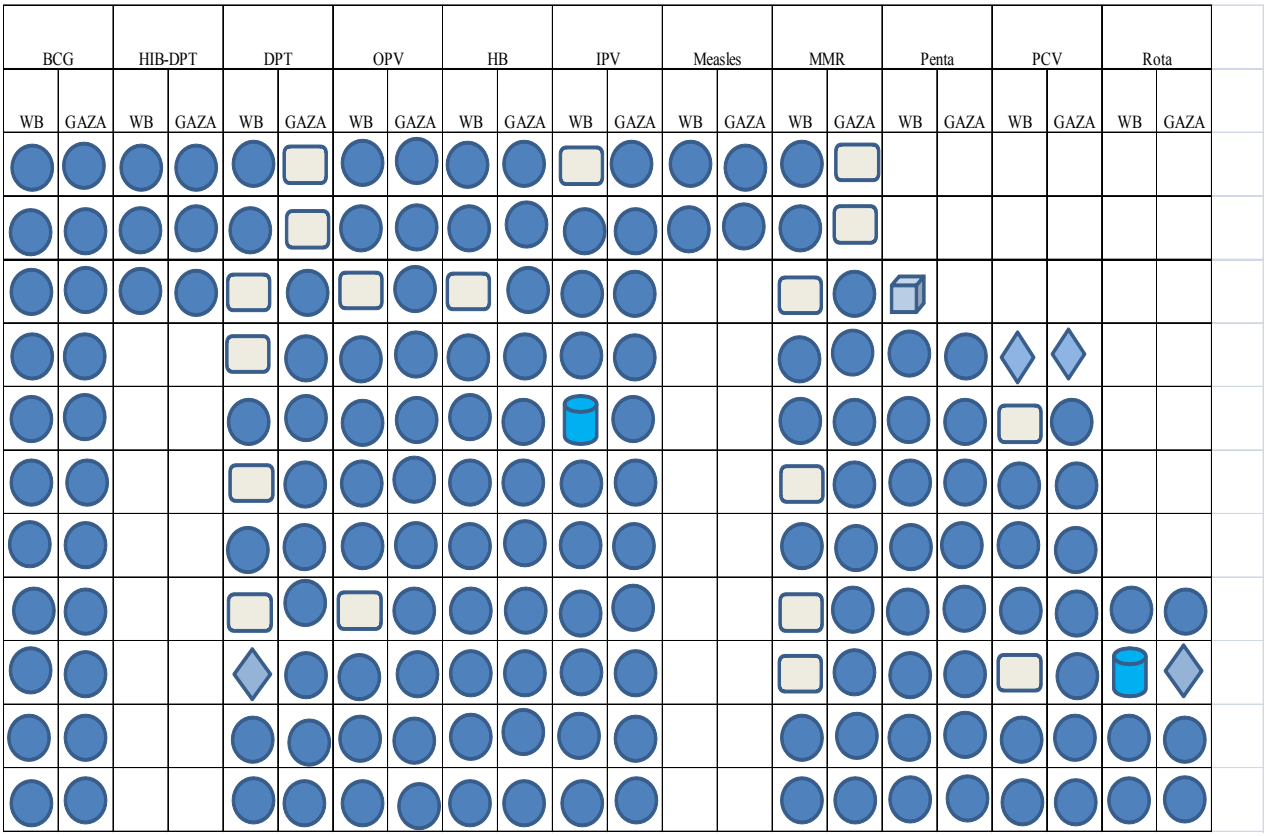
The **Penta vaccine** was added to the routine immunization program in 2012 and the coverage rate was initially less than 50% at national level but reached more than 95% after the first year. The vaccination started in WB in 2012, the coverage rate reaches less than 50% after that the coverage rate reached more than 95% in all years. In GS, the vaccination started in year 2013, the coverage rate reached more than 95% an all years.

The MoH added the **PCV vaccine** to the routine immunization program in 2013, and the coverage rate in the first year was between 50-79% at national level but reached more than 95% in the years after. In the WB, the coverage rate reached more than 95% in all years except 2013, the coverage rate was between 50%-79%, in 2014 and 2018, the coverage rate was between 90%-94%. In GS, the coverage rate reached more than 95% in all years except 2013, the coverage rate was between 50%-79%.

The addition of the **Rota vaccine** began in 2017 and the coverage rate was more than 95% at national level in all subsequent years except for 2018 when the coverage rate was 50%-79% at national level, 80%-89% in the West Bank, and 50%-79% in Gaza.

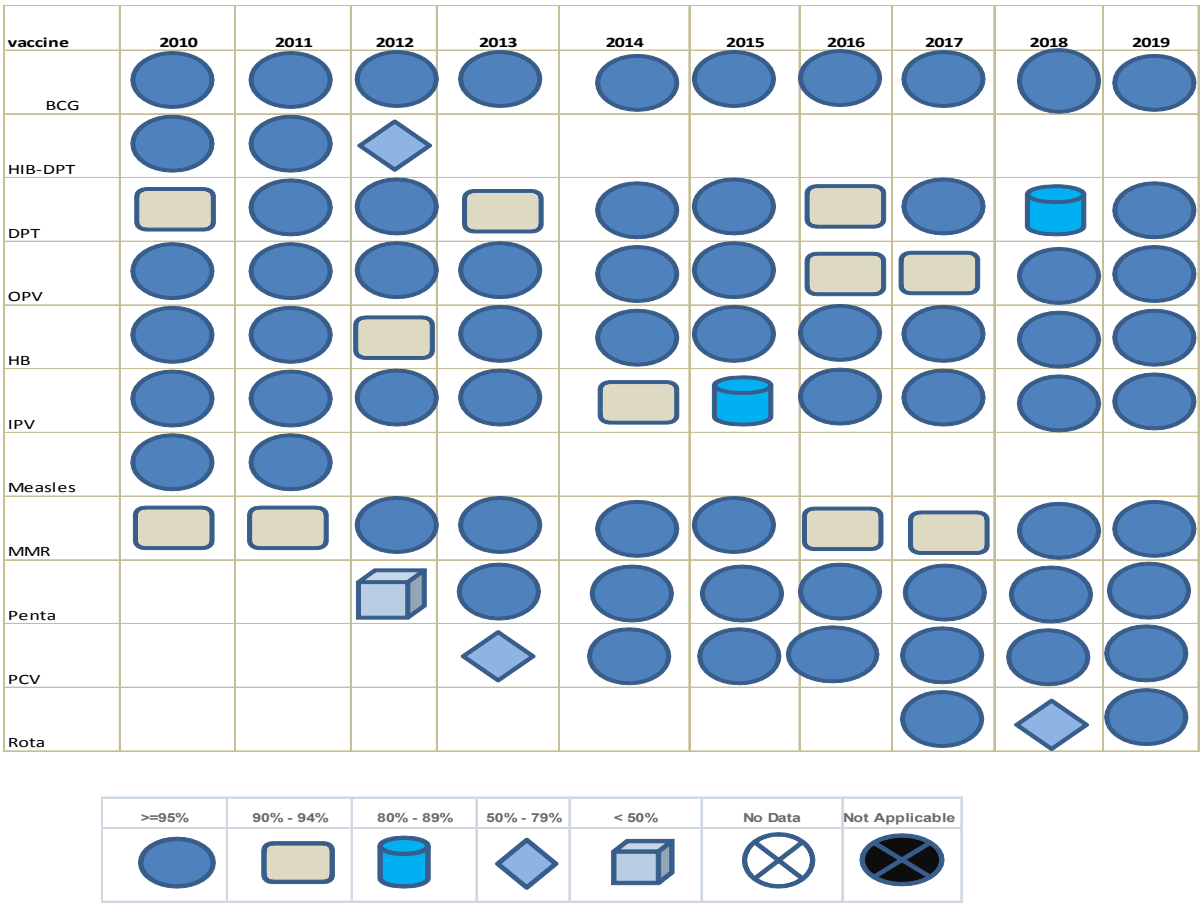
The table (4-1) below shows the vaccination coverage in Palestine by type of vaccine and province (west Bank & Gaza) 2010-2020.

Table (4-1): Vaccination Coverage in Palestine by Vaccine and Province 2010-2020



The table (4-2) below shows the vaccination coverage in Palestine by type of vaccine 2010-2020.

Table (4-2): Vaccination Coverage in Palestine by Vaccine 2010-2020



4.3 Telephone-based interview

Telephone-based interviews with vaccine providers in the primary healthcare units and the directors of the preventive medicine departments in each governorate were conducted, and the data was entered and analyzed into SPSS version 15 and Microsoft Excel 2010.

The interviews were conducted with all centers that provide vaccination in Palestine: 415 centers in total, 365 in the West Bank (323 MOH, 42 UNRWA) and 50 in the Gaza Strip (28 MOH, 22 UNRWA).

The distribution of provide vaccination interviewed by gender was 94% of females and 6% of males, 92% of provide vaccination are over 30 years old, 90% of them have a bachelor's degree and 10% have a master's degree.

The results of the interviews did not report any failure of vaccine efficacy, however a shortage of some vaccines occurred particularly in Gaza Strip during the period of 2010-2020. This includes: IPV, Penta, PCV, Rota, DPT.

4.3 Preventable disease incidence

Polio:

During the period of analysis, no cases of polio were recorded in Palestine, and incidence rate was 0 per 100,000 from target population.

Tetanus (Neonatal and Other):

During the period of analysis, a case of neonatal tetanus was registered in 2011 in the West Bank (Bethlehem) in a female newborn, less than a month old. Three other tetanus cases were recorded in 2011, 2014 and 2016 in (Ramallah, Nablus, and Nablus), and incidence rate for neonatal tetanus in all year was 0 per 10,000 expected year 2011 was 0.08 per 10,000 from target population, incidence rate for Other Tetanus less than 0.03 per 100,000

from population in 2011, 2014 and 2016, and no deaths were recorded among the cases during the study period.

Diphtheria:

During the period of analysis, no cases of Diphtheria were recorded in Palestine and incidence rate was 0 per 100,000 from total population.

Rubella:

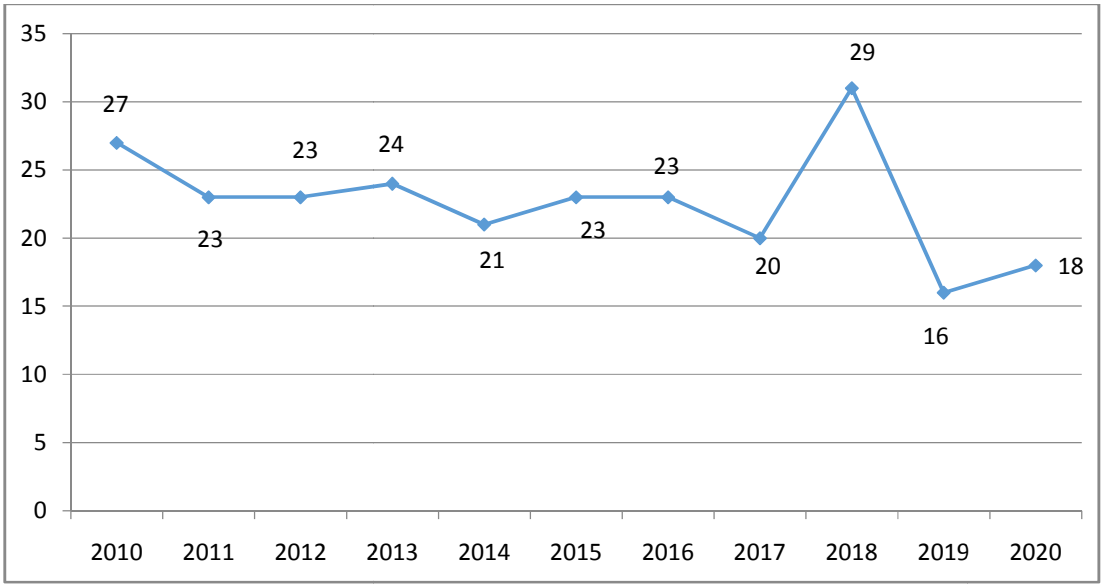
During the period of analysis, 5 rubella cases were recorded; Two cases occurred in 2010, one in Nablus and the other in Qalqelia. Another case was recorded in 2011 in Nablus. The fourth case occurred in 2012 in Ramallah and the final case occurred in 2017 in Hebron, incidence rate was less than 1% per 100,000 from total population in 2010,2011,2012,2017, and no deaths were recorded among the cases during the study period.

Hepatitis B Cases:

During the period of analysis, 247cases of hepatitis B were recorded.27 cases were recorded in 2010, 23 cases in 2011, 2012, 2015, and 2016, 24 cases in 2013, 21 cases in 2014, 20 cases in 2017, 29cases in 2018, 16 cases in 2019 and 18 cases in 2020 as shown in Table (4-3) and Graph below (4-1).

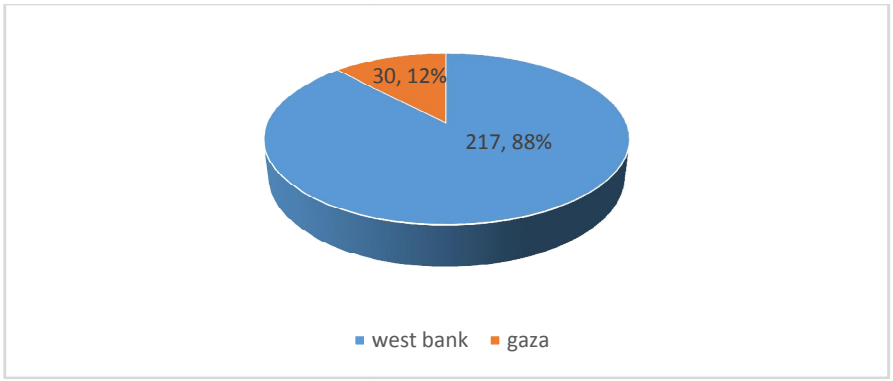
Table (4-3): Reported Cases of Hepatitis B in Palestine by District & Rate of Incidence 2010-2020

Year \ District		Hebron	Bethlehem	Ramallah	Jerusalem	Jericho	Nablus	Tulkarm	Salfeet	Qalqiliah	Jenin	Tubas	Total WB	Gaza	Total
2010	No. of cases	11	0	0	1	4	6	0	0	2	3	0	27	0	27
Incidence Rate 2010/100,000		1.86	0.00	0.00	0.75	9.05	1.78	0.00	0.00	2.07	1.11	0.00	1.21	0.00	0.72
2011	No. of cases	7	0	0	5	1	1	5	0	1	3	0	23	0	23
Incidence Rate 2011/100,000		1.15	0.00	0.00	3.67	2.22	0.29	2.97	0.00	1.01	1.08	0.00	1.01	0.00	0.59
2012	No. of cases	7	2	0	3	2	1	0	0	4	3	1	23	0	23
Incidence Rate 2012/100,000		1.12	1.03	0.00	2.16	4.37	0.28	0.00	0.00	3.97	1.06	1.82	0.99	0.00	0.58
2013	No. of cases	3	0	6	0	0	1	0	0	2	4	3	19	5	24
Incidence Rate 2013/100,000		0.47	0.00	1.96	0.00	0.00	0.28	0.00	0.00	1.94	1.39	5.35	0.80	0.30	0.59
2014	No. of cases	5	0	4	1	0	2	1	0	1	1	0	15	6	21
Incidence Rate 2014/100,000		0.76	0.00	1.28	0.69	0.00	0.55	0.57	0.00	0.95	0.34	0.00	0.62	0.35	0.50
2015	No. of cases	9	1	0	0	0	2	1	0	1	2	0	16	7	23
Incidence Rate 2015/100,000		1.34	0.48	0.00	0.00	0.00	0.54	0.56	0.00	0.93	0.67	0.00	0.65	0.39	0.54
2016	No. of cases	8	4	3	0	0	2	2	1	0	2	0	22	1	23
Incidence Rate 2016/100,000		#REF!	1.89	0.93	0.00	0.00	0.53	1.10	1.37	0.00	0.65	0.00	0.87	0.05	0.53
2017	No. of cases	6	0	0	2	0	1	1	1	1	2	0	14	6	20
Incidence Rate 2017/100,000		0.87	0.00	0.00	1.30	0.00	0.26	0.54	1.34	0.90	0.64	0.00	0.54	0.32	0.45
2018	No. of cases	9	1	2	3	1	3	2	4	0	1	1	27	4	31
Incidence Rate 2018/100,000		1.28	0.45	0.60	1.91	1.98	0.76	1.06	5.22	0.00	0.31	1.62	1.02	0.21	0.68
2019	No. of cases	3	2	3	0	0	4	0	1	3	0	0	16	0	16
Incidence Rate 2019/100,000		0.41	0.89	0.88	0.00	0.00	1.00	0.00	1.28	2.58	0.00	0.00	0.59	0.00	0.34
2020	No. of cases	3	0	4	0	1	0	0	5	2	0	0	15	3	18
Incidence Rate 2020/100,000		0.39	0.00	1.15	0.00	1.91	0.00	0.00	6.23	1.68	0.00	0.00	0.54	0.15	0.37

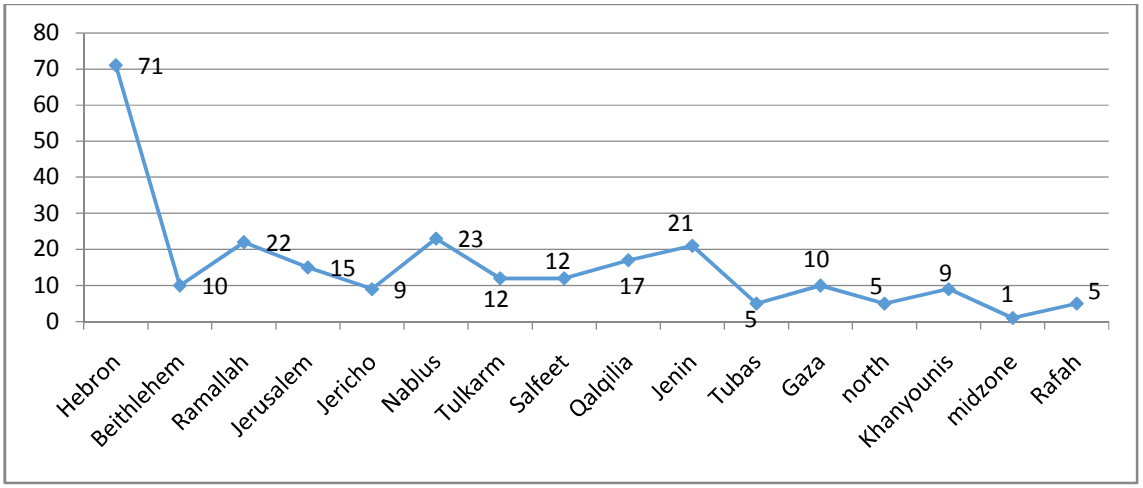


Graph (4-1): No. of Hepatitis B Cases in Palestine by year

The geographic distribution of cases was as follows: 217 (88%) of cases occurred in the West Bank and 30 (12%) of cases occurred in the Gaza Strip shown in Graph (4-2) and (4-3) below.



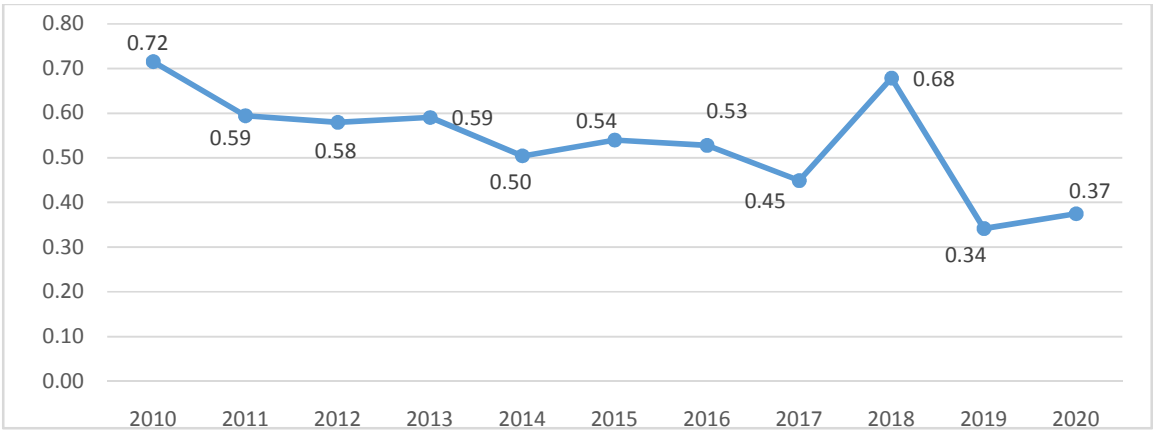
Graph (4-2): % of Hepatitis B Cases in Palestine by Provence



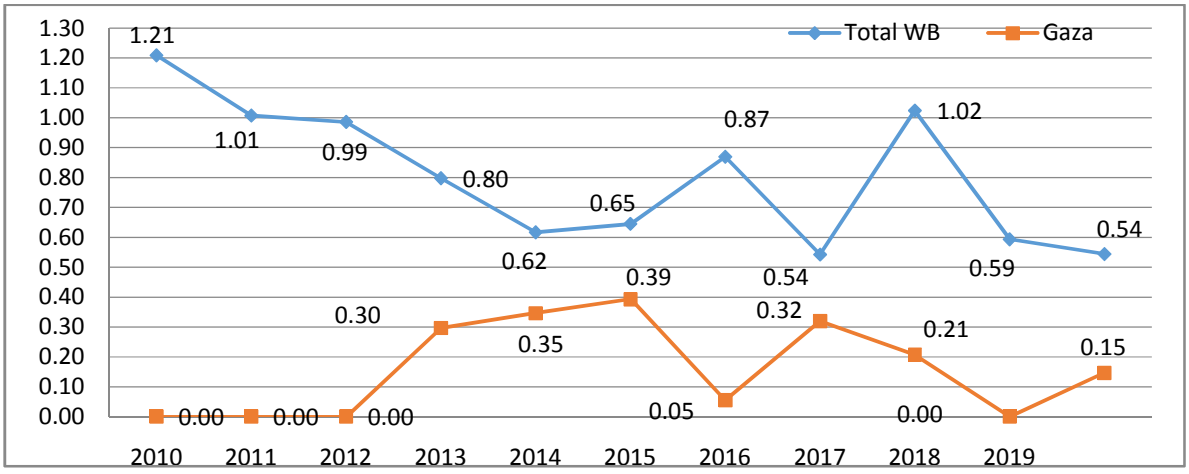
Graph (4-3): No. of Hepatitis B Cases in Palestine by District 2010-2020

Incidence rate of hepatitis B 2010-2020

The data analyzed indicated that incidence rate of hepatitis B in Palestine was less than 1 case per 100,000 people in the period of study. In the West Bank the incidence rate rose above1 per 100,000 people in 2010,2011, and 2012, while in the Gaza Strip, the rate of incidence remained less than 1 per 100,000 people as shown in Graph below (4-4, 4-5).



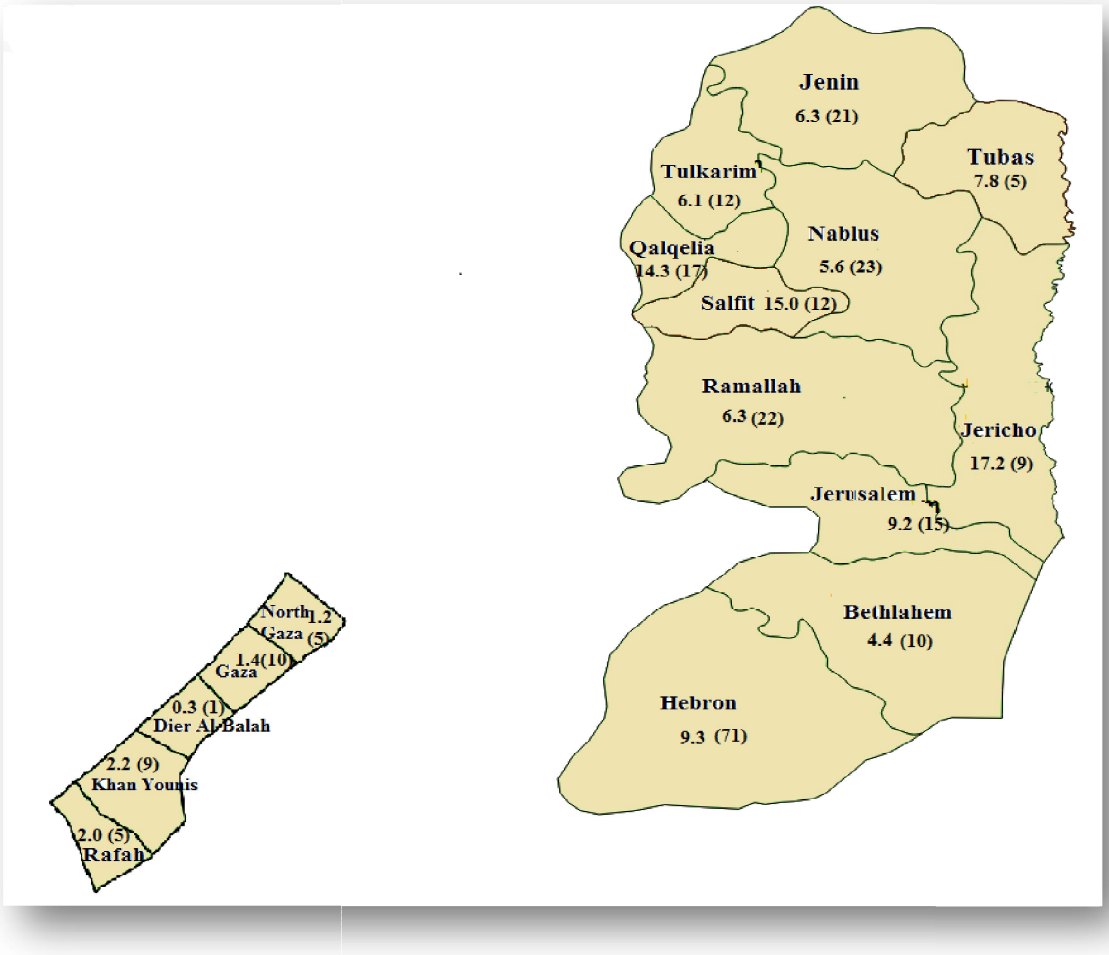
Graph (4-4): Incidence rate/100,000 of Hepatitis B cases 2010-2020 by year in Palestine



Graph (4-5): Incidence rate/100,000 of Hepatitis B cases 2010-2020 by province in Palestine

The analyzed data indicated that the prevalence of hepatitis B in Palestine by district indicated that Jericho, Salfit and Qalqilya district are among the district with the highest prevalence rate of the disease, The map below, showing the distribution of

Hepatitis B cases from 2010 to 2020 in each district. Cases are represented on the map by annual number of patients recorded, and prevalence rate per 100 000 population in each district.



Graph (4-6): Distribution of prevalence rate for hepatitis b in Palestine by district and **annual number of patients recorded from 2010-2020**

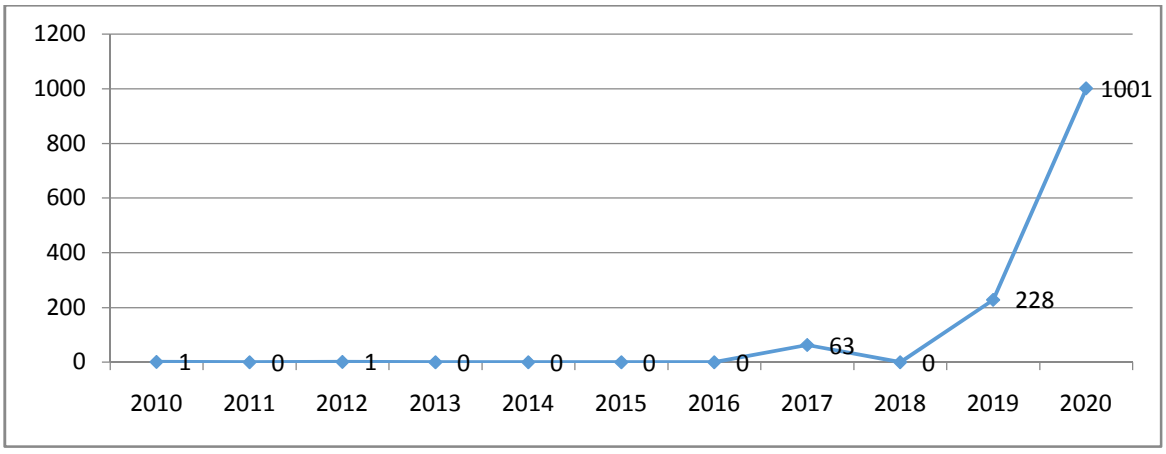
All cases confirmed cases were admitted to hospital and given treatment, 6.5% from cases were vaccinated for hepatitis B. The gender breakdown of the cases was 37% male and 63% were female. The age group breakdown of the cases was less than 1% in age group less than one year, 20,3% from confirmed cases in age group 15-25, 37,7% from confirmed cases in age group 26-45, 21% from confirmed cases in age group 46-60,20,3% from confirmed cases in age group more than 60 year, and no deaths were recorded among the cases during the study period.

Measles:

During the period of analysis, 1294 cases of measles were recorded in Palestine with 98 cases occurring in the WB and 1196 in the GS. All 63 cases recorded in 2017 occurred in the West Bank. 70% (201 cases) of cases recorded in 2019 and almost 99% in 2020 occurred in the Gaza Strip as shown in Table (4-4) and the Graph below (4-7), Incidence rate was between 0.02 to 4,9 per 100,000 from total population, and no deaths were recorded among the cases during the study period.

Table (4-4): Reported Cases of Measles in Palestine, By District 2010-2020

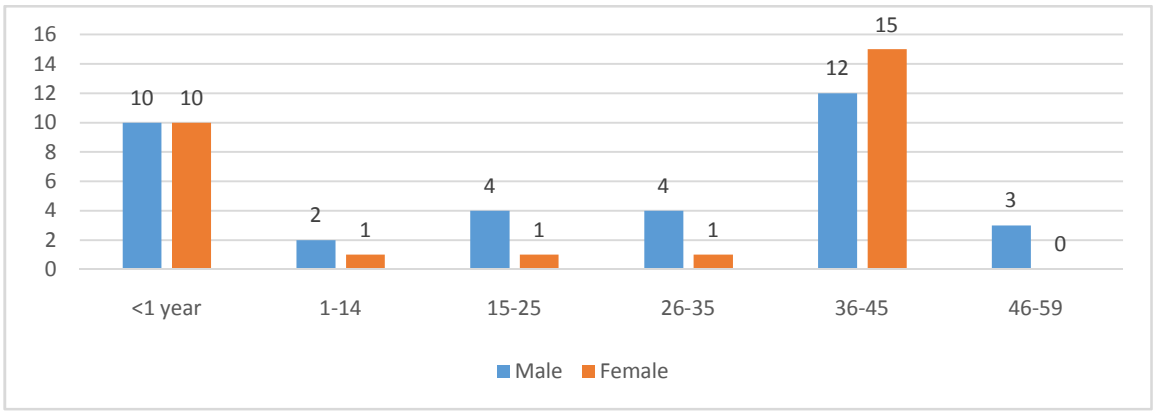
District	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Hebron	0	0	0	0	0	0	0	4	0	0	0	4
Beithlehem	0	0	0	0	0	0	0	0	0	0	0	0
Ramallah	0	0	0	0	0	0	0	1	0	27	0	28
Jerusalem	1	0	0	0	0	0	0	0	0	0	0	1
Jericho	0	0	0	0	0	0	0	0	0	0	0	0
Nablus	0	0	1	0	0	0	0	1	0	0	0	2
Tulkarm	0	0	0	0	0	0	0	0	0	0	0	0
Salfeet	0	0	0	0	0	0	0	1	0	0	0	1
Qalqilia	0	0	0	0	0	0	0	0	0	0	0	0
Jenin	0	0	0	0	0	0	0	56	0	0	6	62
Tubas	0	0	0	0	0	0	0	0	0	0	0	0
Total WB	1	0	1	0	0	0	0	63	0	27	6	98
Gaza	0	0	0	0	0	0	0	0	0	173	753	926
north	0	0	0	0	0	0	0	0	0	14	71	85
Khanyounis	0	0	0	0	0	0	0	0	0	5	61	66
midzone	0	0	0	0	0	0	0	0	0	4	78	82
Rafah	0	0	0	0	0	0	0	0	0	5	32	37
Total Gaza	0	0	0	0	0	0	0	0	0	201	995	1196
Total Palestine	1	0	1	0	0	0	0	63	0	228	1001	1294



Graph (4-7): No. of measles cases in Palestine 2010-2020

Measles outbreak in 2017

In the year 2017, 2 confirmed cases of measles were recorded in Jenin district of the West Bank. The first case was a female aged 41years old and the second is a male aged 42yearsold. These cases marked the beginning of a rapid increase in cases eventually reaching 63 confirmed infections in 2017. Of the total cases, 55% (35 cases) were male, and 45% (28 cases) were female. 31% of the cases were infants, and 43% of the cases belonged to the age group 36-59.In terms of vaccination statues of confirmed cases: in 30% of cases the patient did not receive any doses of the vaccine, in 7% of cases they had received one dose of vaccine, in 8% of cases they had received two doses of the vaccine, and in 65% of cases the patient's vaccine history was unknown as shown in Table (4-5) and Graph below (4-8).



Graph (4-8): Distribution of confirmed cases according to age and sex in measles outbreak 2017

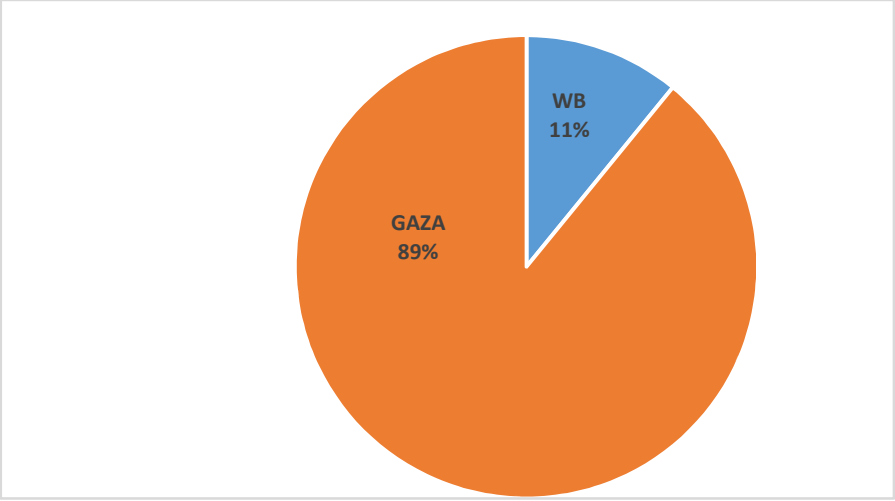
Table (4-5): Distribution of confirmed cases according to age group and vaccine doses in Measles outbreak 2017:

		Measles Vaccine Doses				Total
		0	**1**	**2**	**Unknown**	
Age Group	**<1 year**	19	1	0	0	**20**
	1-14	1	2	0	0	**3**
	15-25	0	1	2	2	**5**
	35-26	0	0	0	5	**5**
	36-45	0	0	0	27	**27**
	46-59	0	0	0	3	**3**
Total		**20**	**5**	**4**	**37**	**66**

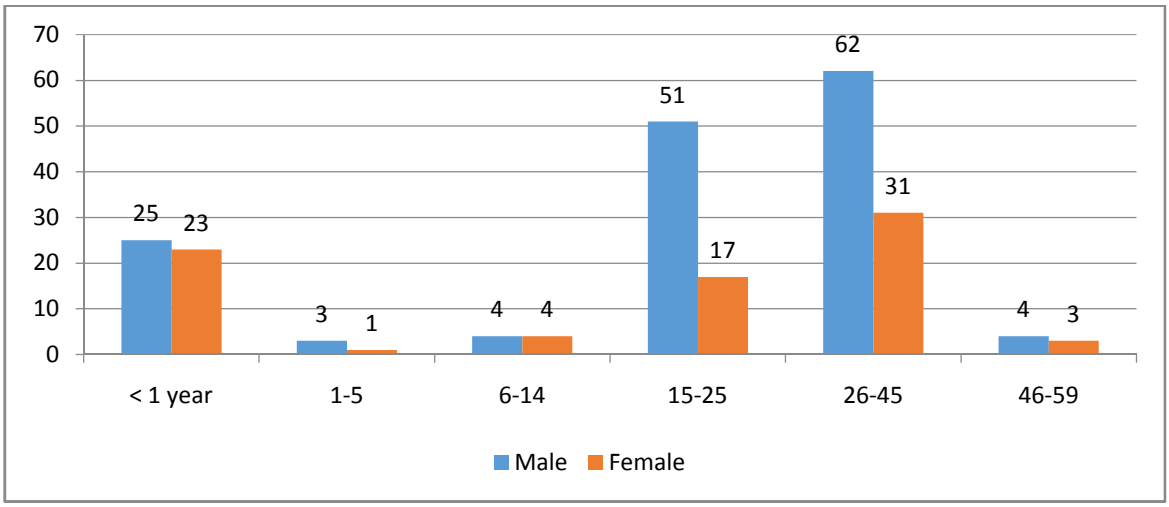
0, 1, 2, unknown: Number of measles vaccine doses.

Measles outbreak in 2019:

Data analysis for measles confirmed another outbreak in 2019 with 228 total cases broken down as follows: 89% (201 cases) of the cases occurred in the Gaza Strip, 11% (27 cases) occurred in the WB. 35% were female and 65% were male. **The vaccination status** of the recorded cases was: 28% of confirmed cases had received zero doses of the vaccine, in 7% of cases the patient had received one dose of the vaccine, in 49% of cases they received the two doses of the vaccine, and in 16% of cases the vaccination status of the patient was unknown as shown in Graph below (4-9, 4-10).



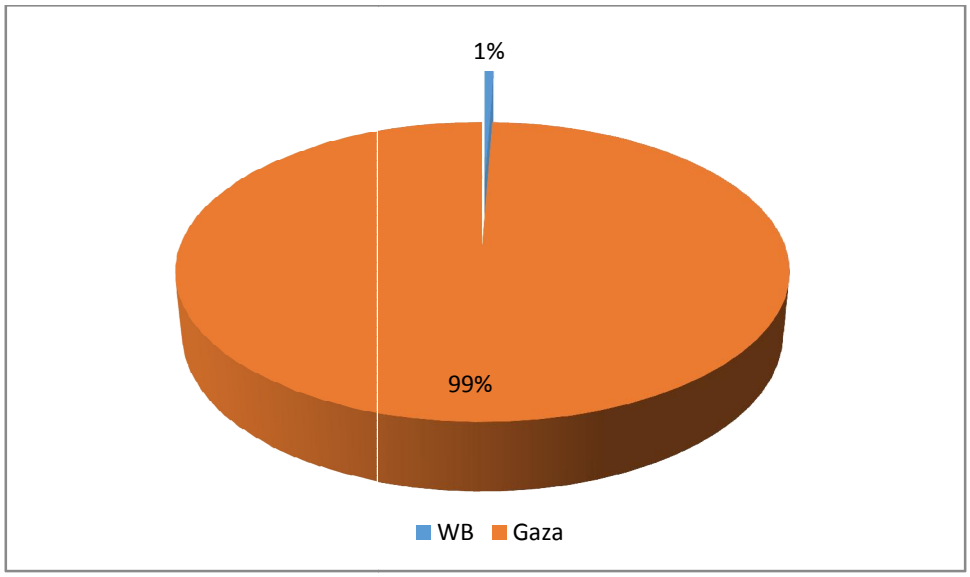
Graph (4-9): Distribution of confirmed cases according to province (Measles outbreak in 2019)



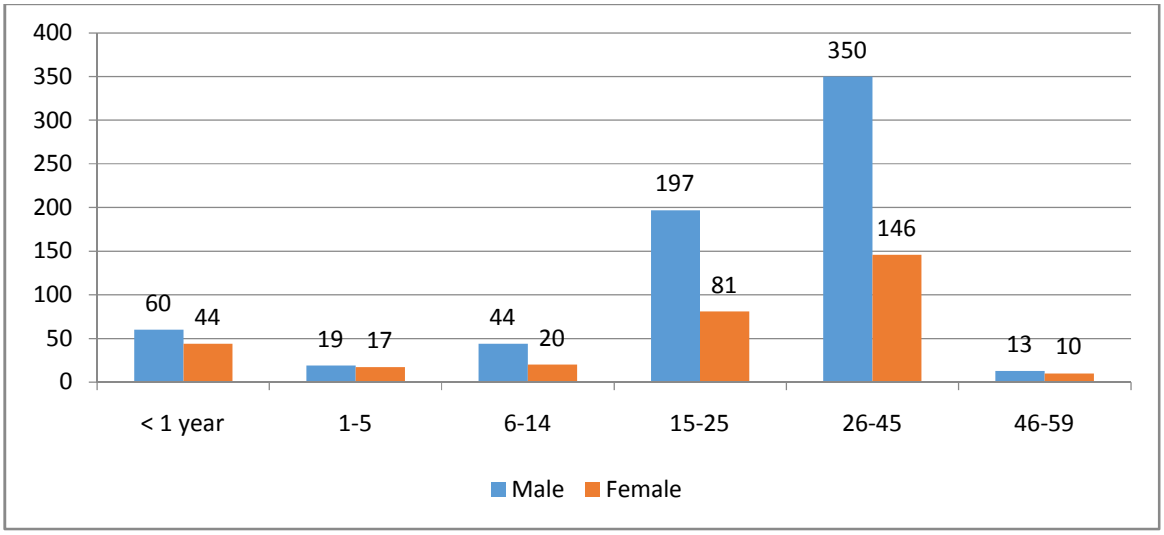
Graph (4-10): Distribution of confirmed cases according to age group (Measles outbreak in 2019):

Measles outbreak in 2020:

The data confirmed another outbreak of the measles in 2020 with 1001 total cases. For this outbreak, more than 99% of the confirmed cases occurred in the Gaza Strip as compared with less than 1% in the WB. In 2019 outbreak, 32% of cases were female and68% were male. The **vaccination status** analysis showed that 20% of the confirmed cases received zero doses of the vaccine, 16% of cases had received one dose of the vaccine, and 64% of cases had received two doses of the vaccine as shown in Graph below (4-11, 4-12).



Graph (4-11): Distribution of confirmed cases according to province (Measles outbreak in 2020):



Graph (4-12): Distribution of confirmed cases according to age group (Measles outbreak in 2020)

World Health Organization Measles Indicators:

Measles surveillance should be evaluated routinely at national and sub national/local levels and are frequently important in decision-making to achieves measles elimination.

This is some indicators established by WHO against which the measles surveillance system can be evaluated in order to help pinpoint problems and make improvements. see table (4-6)

Table (4-6): Measles surveillance indicator established by WHO

SURVEILLANCE	**INDICATOR**	**TARGET**	**HOW TO CALCULATE (NUMERATOR / DENOMINATOR)**
SENSITIVITY	Reporting rate of discarded nonmeasles cases at the national leve	≥ 2/ 100,000 population per 12 months	# suspected cases that have been investigated and discarded in 12 month period / national population x 100,000
REPRESENTATIVENESS	Percentage of subnational administrative units (at the province level) reporting at least 2 discarded non-measles cases per 100,000 population per year	≥ 80%	# of subnational units achieving ≥ 2 per 100,000 population discard rate / # of subnational units x 100
SPECIMEN COLLECTION AND TESTING ADEQUACY	Percentage of suspected cases with adequate specimens for detecting acute measles infection collected and tested in a proficient laboratory	≥ 80%	# of suspected cases with an adequate specimen tested in a proficient lab / # of suspected cases – # of suspected cases of measles or rubella that are not tested by a laboratory and are (a) confirmed as measles by epidemiological linkage or (b) discarded as nonmeasles by epidemiological linkage to another laboratory-confirmed communicable disease case x 100
VIRAL DETECTION	Percentage of laboratory confirmed outbreaks with samples adequate for detecting measles virus collected and tested in an accredited laboratory	≥ 80%	# of outbreaks for which adequate samples have been submitted for viral detection / # of outbreaks identified x 100
TIMELINESS OF SPECIMEN TI	Percentage of specimens received at the laboratory within 5 days of collection	≥ 80%	# of specimens received within 5 days of collection by laboratory / # of specimens x 100
TIMELINESS OF REPORTING	Percentage of IgM results reported to national public health authorities by the laboratory within 4 days of specimen receipt	≥ 80%	# of IgM test results reported within 4 days of specimen receipt / # of specimens received by lab x 100

Measles elimination indicator target (Emro.WHO.int), used by the WHO to establish the status of measles elimination: Incidence: less than 1 case per million. Reporting rate of discarded nonmeasles cases at the national level, Percentage **of** subnational administrative units (at the province level) reporting at least 2 discarded non-

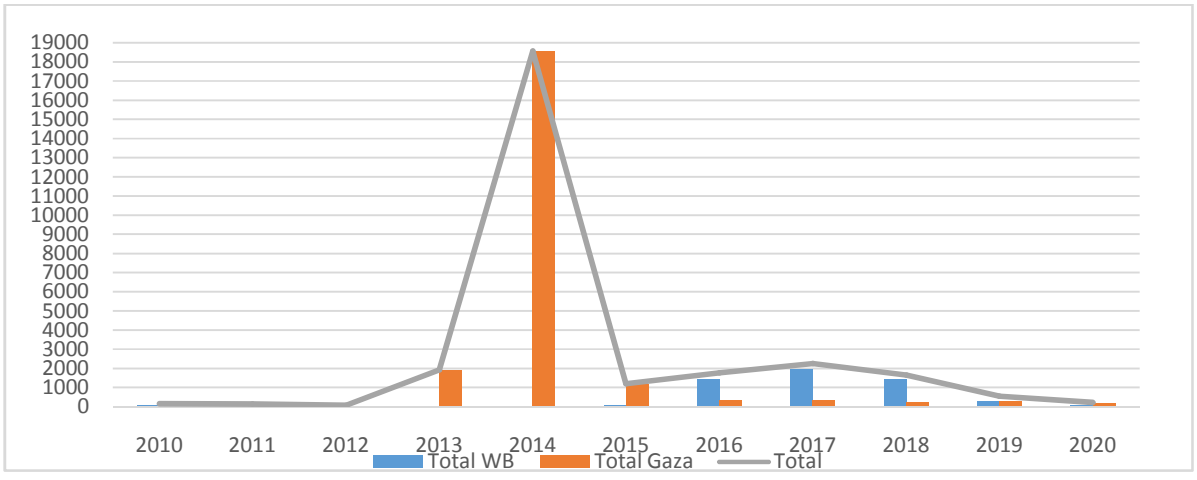
measles cases per 100,000 population per year, ≥ 80%. Percentage of suspected caseswith adequate specimens for detecting acute measles infection collected and tested in a proficient laboratory, ≥ 80%. Percentage of laboratory confirmed outbreakswith samples adequate for detecting measles virus collected and tested in an accredited laboratory, ≥ 80%. Percentage of specimens received at the laboratory within 5 days of collection, ≥ 80%. Percentage of IgM results reported to national public health authorities by the laboratory within 4 days of specimen receipt, ≥ 80%. All WHO indicators were confirmed by EPI committee between 2010-2020.

MUMPS:

Data analysis showed that of the 5,479 total cases of mumps that occurred in the West Bank over the study period, 35% were recorded in year 2017 and 26% were recorded in both 2016 and 2018. In the Gaza Strip, 80% of the total 23,136 cases recorded over the study period occurred in 2014 with 8% in 2013 and 5% in 2015.For each year between 2010-2015 the Gaza Strip had 56%,59%,67%, 98%, 99.8%, and 94% of the national case load of mumps. However, in the years 2016-2018 the majority of cases (81%, 85%, and 86% respectively) on the national level occurred in the West Bank, and in 2020, 71% of the cases were reported in Gaza Strips shown in Table (4-7) and Graph below (4-13).

Table (4-7): Reported Cases of Mumps in Palestine, By District 2010-2020

District	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Hebron	2	3	3	0	0	62	1424	1142	245	56	11	2948
Beithlehem	1	1	0	0	0	0	6	157	146	25	15	351
Ramallah	16	8	17	6	2	7	5	30	5	4	2	102
Jerusalem	0	0	0	0	0	1	0	49	22	4	0	76
Jericho	1	3	2	10	1	0	3	10	1	2	1	34
Nablus	21	11	1	2	3	1	1	5	155	37	5	242
Tulkarm	6	6	0	3	2	0	0	288	605	33	3	946
Salfeet	3	3	0	0	1	0	0	0	2	28	19	56
Qalqilia	9	17	2	12	13	0	10	171	69	94	9	406
Jenin	9	7	4	6	13	0	0	3	55	1	0	98
Tubas	2	3	0	1	0	0	0	82	128	1	3	220
Total WB	70	62	29	40	35	71	1449	1937	1433	285	68	5479
Gaza	48	22	13	141	5471	394	97	79	62	50	27	6404
north	5	8	19	90	2882	432	44	75	61	43	45	3704
Khanyounis	18	31	21	1010	4236	87	79	89	55	75	45	5746
midzone	6	26	3	531	2886	137	42	45	31	57	31	3795
Rafah	12	4	4	119	3060	93	62	34	25	51	23	3487
Total Gaza	89	91	60	1891	18535	1143	324	322	234	276	171	23136
Total	159	153	89	1931	18570	1214	1773	2259	1667	561	239	28615



Graph (4-13): Reported Cases of Mumps in Palestine, By Provence 2010-2020

The Map below, show distribution of Mumps cases and prevalence rate per 100,000 from total population, 2010 - 2020 in Palestine by district.

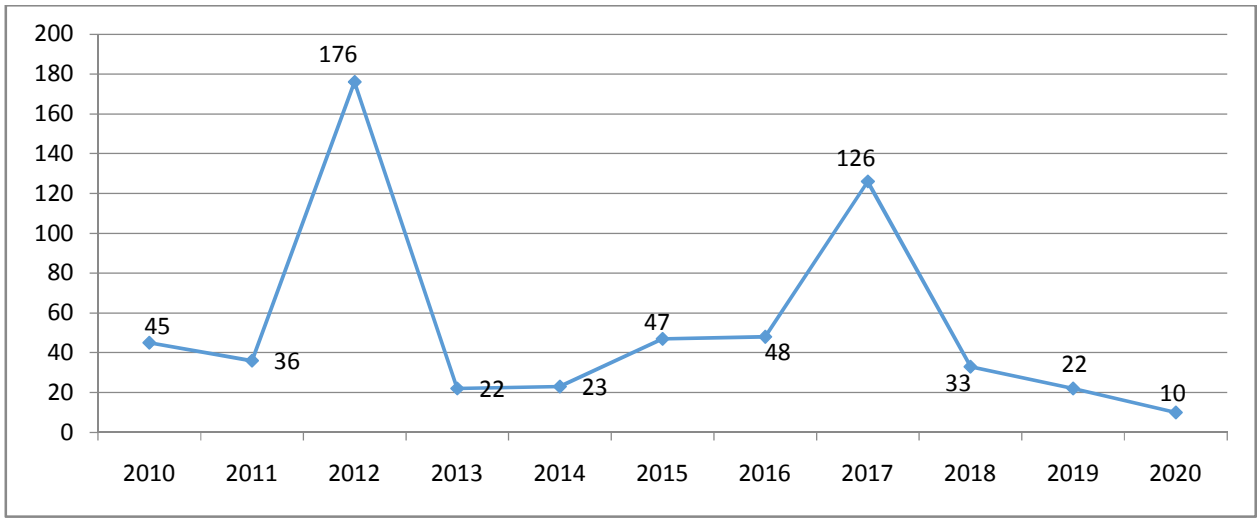
Graph (4-14): Map of Palestine, showing the distribution of Mumps cases from 2010 to 2020 in each district. cases are represented on the map by annual number of patients recorded, and prevalence rate per 100 000 population in each district.

Pertussis (Whooping Cough):

During the period of 2010-2020, 588 cases of whooping cough were registered, all of which occurred in the West Bank. The highest percentage of cases was recorded during 2012 (30%) followed by 2017 (23%). No cases were recorded in Gaza Strip during the period of analysis, despite the presence of suspected cases. Of the confirmed cases 55% occurred in patients under 2 months, 25% between 2-4 month, 4.7% between 4-6 months, 6.5% between 6-12 months, and 8.2% over one year old. 48% of all cases were male and52 % female as shown in Table (4-8) and Graph below (4-15).and Incidence rate was between 0.5 to 4.4 per 100,000 from total population.

Table (4-8): Reported Cases of Pertussis in Palestine, By District 2010-2020

District	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Hebron	8	10	45	10	3	7	4	43	4	3	4
Beithlehem	0	0	11	5	2	1	2	13	7	1	1
Ramallah	18	17	39	2	5	19	7	13	0	3	0
Jerusalem	2	2	16	2	1	3	1	6	1	1	0
Jericho	0	0	0	0	0	1	0	0	2	0	0
Nablus	3	2	28	1	11	7	16	29	10	4	1
Tulkarm	1	0	2	0	0	0	5	12	1	5	2
Salfeet	2	0	0	1	1	2	2	2	0	0	2
Qalqilia	0	0	3	0	0	0	0	0	0	0	0
Jenin	11	5	31	1	0	7	10	5	8	5	0
Tubas	0	0	1		0	0	1	3	0	0	0
Total WB	**45**	**36**	**176**	**22**	**23**	**47**	**48**	**126**	**33**	**22**	**10**
Gaza	0	0	0	0	0	0	0	0	0	0	0
north	0	0	0	0	0	0	0	0	0	0	0
Khanyounis	0	0	0	0	0	0	0	0	0	0	0
midzone	0	0	0	0	0	0	0	0	0	0	0
Rafah	0	0	0	0	0	0	0	0	0	0	0
Total Gaza	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**



Graph (4-15): Reported Cases of Pertussis in Palestine, 2010-2020

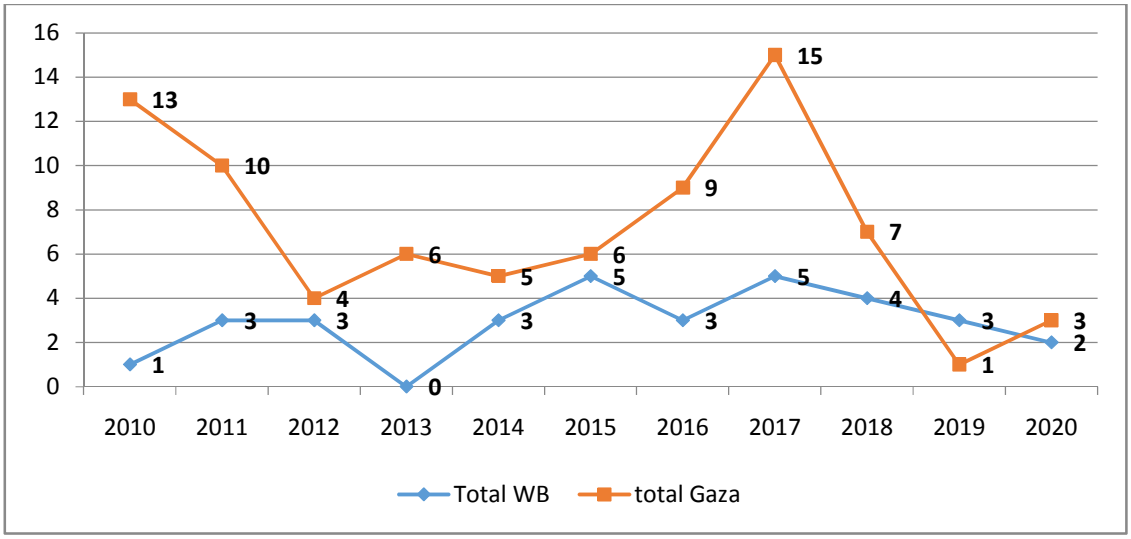
Tuberculosis (pulmonary and extra-pulmonary)

Extra-pulmonary TB:

During the period of 2010-2020, 111 cases of extra-pulmonary TB were registered with 71% (79 cases) occurring in the Gaza Strip and 29% (32 cases) occurring in the West Bank. One of cases also had HIV co infection and 2 cases were fatal. The overall incidence rate was less than 1 per100,000 people at the national level as shown in Table (4-9) and Graph below (4-16).and Incidence rate was less than 1 % per 100,000 from total population.

Table (4-9): Reported Cases of Extra pulmonary TB in Palestine, By District 2010-2020

District	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Hebron	0	1	0	0	0	0	1	3	1	0	0
Beithlehem	0	1	0	0	0	0	0	0	0	0	0
Ramallah	0	0	0	0	0	0	1	0	0	0	0
Jerusalem	0	0	0	0	0	0	0	0	0	0	0
Jericho	0	0	0	0	0	0	0	0	0	0	1
Nablus	1	0	0	0	0	3	0	1	2	0	0
Tulkarm	0	0	0	0	0	0	0	0	0	2	1
Salfeet	0	0	0	0	0	1	0	0	0	0	0
Qalqilia	0	0	0	0	1	0	0	0	1	0	0
Jenin	0	1	3	0	2	1	1	1	0	0	0
Tubas	0	0	0	0	0	0	0	0	0	1	0
Total WB	**1**	**3**	**3**	**0**	**3**	**5**	**3**	**5**	**4**	**3**	**2**
Gaza	4	4	1	4	2	2	6	6	4	1	2
north	2	1	3	0	1	2	0	1	1	0	1
Khanyounis	5	1	0	1	2	1	2	2	1	0	0
midzone	1	3	0	0	0	1	1	6	1	0	0
Rafah	1	1	0	1	0	0	0	0	0	0	0
total Gaza	**13**	**10**	**4**	**6**	**5**	**6**	**9**	**15**	**7**	**1**	**3**
Total	**14**	**13**	**7**	**6**	**8**	**11**	**12**	**20**	**11**	**4**	**5**



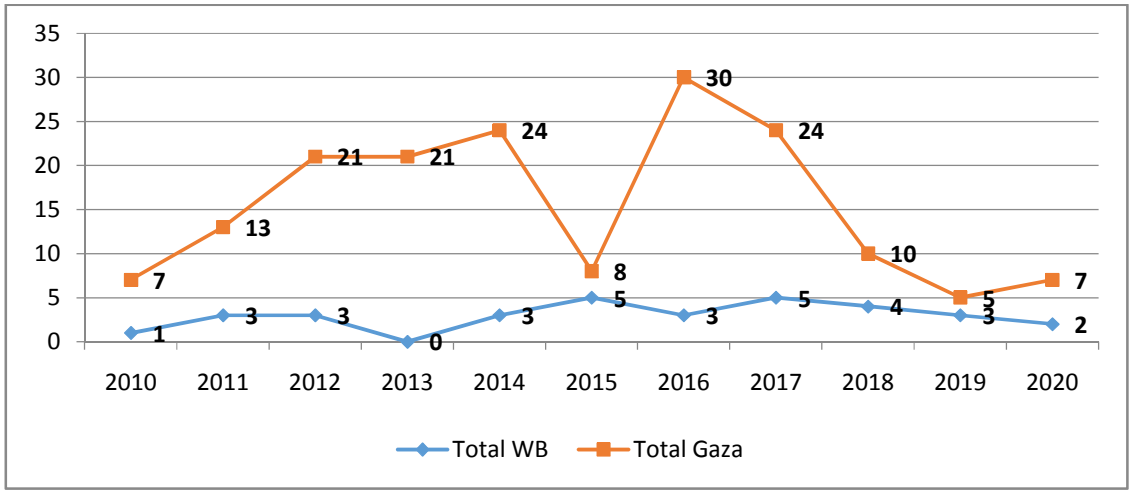
Graph (4-16): Reported Cases of Extra pulmonary TB in Palestine, 2010-2020:

Pulmonary:

During the period of 2010-2020, 254 cases of pulmonary TB were registered with 67% (170 cases) in the Gaza Strip and 33% (84 cases) in the West Bank and an incidence rate of less than 1 per100,000 people at the national level as shown in Table (4-10) and Graph below (4-17).And Incidence rate was less than 1 % per 100,000 from total population.

Table (4-10): Reported Cases of Pulmonary TB In Palestine, By District 2010-2020

District	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Hebron	1	0	2	0	1	1	0	0	0	1	1
Beithlehem	0	0	2	0	0	0	0	0	0	0	0
Ramallah	0	1	0	0	0	0	0	0	0	1	1
Jerusalem	1	0	0	0	1	0	0	0	1	0	0
Jericho	1	2	0	0	0	0	0	2	0	0	0
Nablus	1	0	0	2	2	1	3	0	0	0	0
Tulkarm	2	1	1	2	2	2	0	0	3	6	1
Salfeet	0	0	0	0	0	0	0	1	0	0	0
Qalqilia	0	0	0	0	0	2	1	1	1	0	0
Jenin	3	2	4	6	2	4	0	1	2	0	0
Tubas	1	0	3	0	0	0	0	0	0	0	1
Total WB	10	6	12	10	8	10	4	5	7	8	4
Gaza	2	4	2	10	7	3	14	9	2	1	2
north	0	2	1	3	7	0	5	7	4	0	1
Khanyounis	1	5	7	7	1	1	2	5	2	4	2
midzone	4	1	9	1	6	3	4	0	1	0	0
Rafah	0	1	2	0	3	1	5	3	1	0	2
Total Gaza	7	13	21	21	24	8	30	24	10	5	7
Total	17	19	33	31	32	18	34	29	17	13	11



Graph (4-17): Reported Cases of Extra pulmonary in Palestine, 2010-2020:

CHAPTER FIVE

DISCUSSION

5.1 Introduction

The Central Preventive Medicine Department in the Palestinian Ministry of Health works to deliver all necessary services to provide and distribute vaccines to all health service providers (government and UNRWA) in terms of providing the necessary vaccines in a timely manner and managing the safe storage and transfer of these vaccines between governorates and clinics. The department also supervises the work of the health centers to ensure that the process of vaccinations is carried out properly beginning with the receipt and storage of the vaccine in cold rooms and carrying on to the process of their fair and equal distribution at the national level. The department ensures the vaccines are administered to children in the proper manner, all within the guidelines and recommendations of the World Health Organization. In this study we evaluated the success of the vaccine program through investigation of the MoH reports and a telephone interviews with the central clinics It was found that there are shortage of some vaccines including: IPV vaccine, Penta vaccine, PCV vaccine, Rota vaccine, DPT vaccine. There were several reasons for this shortage: obstruction of the entry of supplies into the Gaza Strip due to the Israeli blockade imposed on the Gaza Strip since 2007, financial problems related to the method of payment and purchase, especially since Palestine depends on donations from UNICEF for a large part of vaccinations, approval being denied for the

entry of some vaccines into the West Bank from the Israeli side, and issues with the estimation of the annual needs for the vaccine. If there is a potential failure of any of the vaccines: may be from the vaccine itself and the way it was manufactured, or due to actions on the part of the vaccinators. If there is a failure in the vaccination process, it is usually related to how the vaccine is administered or stored, especially if the transportation and coordination took longer than necessary, or if it is improperly stored in central refrigerators and appropriate transferred between governorates.

Such shortages in supply of vaccines have led to the inability to reach full coverage of some vaccinations. However, the Preventive Medicine Department attempts to compensate for this deficiency by bringing all children who were not vaccinated fully into vaccination coverage through a unified program. Yet, this delay can affect the health of children or the spread of some diseases if children are not properly vaccinated in a timely manner.

Successful implementation of the routine immunization program for preventable disease has contributed to a steep decrease in the incidence of such disease in Palestine.

High vaccination coverage led to the eradication of polio, the elimination of Rubella, measles, diphtheria, pertussis, tetanus, and tuberculosis, and the control of hepatitis, all of which contribute to the decline in the incidence and mortality rate of these diseases.

Disease control has always been the primary goal of Palestine immunization efforts and disease incidence and vaccination coverage rat have always been the main metrics used to

guide the development of immunization strategies and to assess immunization program performance under guidelines established by the WHO. (PMD, MoH, 2021)

The national vaccination program has been modified more than one time based on the recommendations of the World Health Organization and the National Vaccination Committee works with the WHO to follow global developments and add new vaccines and protocols to the required programs in the interest of public health and to prevent disease before its spread.

The national routine immunization program was last updated in the past year to add NRIP for children at birth to the age of 18 month and it joins the other vaccines required: BCG, IPV, OPV, MMR, DPT, PENTA, and ROTA. (PMD,MoH, 2021)

5.2 Vaccination coverage

Immunization coverage levels are used to monitor the performance of immunization services at the national level; to determine a policy to control, eradicate or limit the spread of vaccine-preventable diseases(WHO, 2003; SEA-EPI-143 Distribution: General Measles Mortality Reduction Regional Strategic Plan 2003-2005, n.d.; WHO & UNFPA, 2000). Coverage levels are also used to determine whether there is a need to introduce new vaccines to the immunization program(Wang et al., 2013)as high levels of immunization coverage are important to prevent and control vaccine-preventable diseases.

In 1974, the WHO established the Expanded Program on Immunization with the objective to promote essential vaccinations in all countries of the world (Plans-Rubió, 2021).The national immunization plan presented by the WHO for the years 2011-2020 and adopted by most countries included several goals: achieving a world free of polio, achieving high vaccination coverage in all countries, developing and introducing new vaccines and improving previously approved vaccines. All of these work in conjunction with the broader goals of the WHO (polio eradication, elimination of measles, rubella and tetanus, high vaccination coverage of at least 85%).

The best preventive measure to successfully control and eliminate diseases is high coverage of immunization, as immunization programs have eradicated polio and elimination other diseases such as measles and tetanus.

The surveillance system for communicable disease and vaccination in Palestine is robust and well established and the burden of vaccine-preventable disease in Palestine is very low for most VDPs thanks to very high vaccination coverage and good follow-up on disease spread from healthcare service providers.

However, when vaccination coverage rate exceeds 100%, it clearly indicates that there is something wrong and the most probable reason is an incorrect population register. This is confirmed by a study conducted by the World Health Organization, in which it was found that the completeness of the birth registry in Palestine was between 88% to 94% through

years 2015-2019. (PNIPH, 2019) and not all children who received immunizations were included.

5.3 Preventable Disease

The introduction of vaccines for vaccine-preventable diseases has reduced the spread of disease and infant mortality, despite the high vaccination coverage, some diseases are still prevalent. (Bustreo, F.2015)

The surveillance of poliomyelitis in Palestine is very good and in accordance with the WHO global vaccine action plan 2011-2020 to achieve a world free of poliomyelitis(WHO, 2019). No cases of polio have been recorded in Palestine since 1988, the vaccination coverage is high, and surveillance of acute flaccid paralysis is sensitive and accurate. This demonstrates a success in providing the polio vaccine (3 doses of OPV vaccine) as a part of the national immunization program and thus Palestine eradicated polio and obtained a certificate of being free of polio from the WHO. This is evidence on the effectiveness of vaccination and its importance for public health is the eradication of smallpox and the almost complete eradication of polio.(Nathanson, N. 1982).

But within the reports of the World Health Organization, there are still some countries affected by the polio virus, as reports indicated that two affected countries, Egypt, Iran, Somalia, Yama outbreak countries; Sudan, China at risk countries; Afghanistan, Pakistan are endemic countries.(Poliomyelitis (who.int))

In the period of our study, No register cases of Diphtheria were recorded, due to the success of vaccination program;55% of Pertusis cases were in infants less than 2 months who are not eligible for vaccination and a further 25% of the cases were in infants between 2-4 month who had received one dose of the vaccine. According to the routine vaccination program, no cases were recorded in the Gaza Strip, although there were suspected cases unable to be confirmed due to the lack of examination kits during that period. Which is further evidence of the success of the national vaccination program in Palestine and puts Palestine in line with the recommendations of the World Health Organization and the objectives of the global vaccination action plan(Organization, 2019) to reach diphtheria eradication, Tetuns, Pertussis elimination. WHO Vaccine - Preventable Diseases Report shows that in Israel, Jordan, Turkey there are no register cases of diphtheria, tetanus during the period 2010-2019; And it was found that the registration of cases of Pertussis varied during the same period, as the highest number of cases was recorded in 2015 / 5,338 cases, and in 2019 it decreased to 706 cases in Israel; in Jordan 41 cases of pertussis were registered during the period 2010-2019, according to the reports of the WHO, and in Turkey, 1105 cases were registered during the same period, the highest was in 2015/322 cases and decreased in 2019 to 60 cases.(immunization_monitoring (who.int))

According to the Palestinian immunization program, children receive two doses of the Measles, Mumps and Rubella (MMR) vaccine—the first dose at 12 months, and the second dose at 18 months of age(MOH, 2011). From1969 - 1988 one single dose of Measles

vaccine was introduced at age 12-15 month. In 1988 a single dose of MMR the vaccine was added to the EPI instead of the measles vaccine at 15 months. In1995 the measles vaccine was reintroduced to the EPI at age 9month alongside the MMR vaccine. In 2009 a second dose of the MMR vaccine was added to the EPI at age 18 month and in November 2011 the measles vaccine was stopped entirely and the process involved only 2 doses of MMR at ages 12 and 18 month, a policy which continues to this day(MOH, 2011).

During the study period, three outbreaks occurred, the first was in 2017 and began in the Jenin governorate in the West Bank, and all cases were recorded in the West Bank. Based on this event, the Ministry of Health decided to intervene quickly to limit the spread of the disease, and thus conducted a vaccination campaign in the area of Jenin and Tubas giving an additional dose of the MMR vaccine based on the recommendations of the WHO. However, at this time the Gaza Strip refused to implement this campaign, and the vaccination campaign was carried out only in the West Bank, which led to another outbreak in the Gaza Strip in the year 2019 and extended into the year 2020 (Site.MOH.PS; PMD, MoH,2021).

Data analysis of the measles outbreak in 2017 show that 32% of the confirmed cases were not eligible for the measles vaccine according to the Palestinian national immunization program, 8% had received a single dose of MMR and were not yet eligible for second dose, 3% had received2doses of MMR and 59% of cases had an unknown vaccination status. Further analysis of the 37 cases with an unknown vaccination status show that 30 cases

(81%) were above 35 years old, which means that they would have received only one dose according to national EPI program, whereas the remaining 19% of confirmed cases received 2 doses of MCV according to the national EPI program. Vaccination status for cases in the measles outbreak in 2019 show that 28% of confirmed cases were not eligible for the measles vaccine according to Palestinian national immunization program (65% were under 1 year and 20% were above 30 year), 7% had received a single dose of MMR and were not eligible for second dose, 49% had received 2dosesormore of MMR and 16% of cases had an unknown vaccination(90% of which were aged above 30) which means that only one dose was given to them according to national EPI program. However in 2020, vaccination status for confirmed cases in the measles outbreak show that 20% of the confirmed cases were not eligible for the measles vaccine (25% were under the age of 1 year and 74% were aged above 30 years), 16% had received a single dose of MMR and were not eligible for second dose (25% under 1 year and 72% above 30 years old), and 64% had received 2dosesormore of MMR. Further analysis of confirmed cases shows that 52% were above 30 years old, meaning that they only received one dose according to national EPI program.

The Palestinian National EPI committee is working to achieve measles elimination, which is a WHO goal through WHO indicators. The Strengths for Elimination of Measles in Palestine program emphasizes the following: high vaccine coverage, zero reporting of new

cases (no case is reported inside the country, any exist case is brought from outside the country) daily notifications, IgM confirmation, and an excellent surveillance system.

The vaccination coverage for the MMR vaccine is high in Palestine although there is a gap. All children born after 1995 should be protected against mumps having received at least one dose of the vaccine. In the West Bank the incidence rate of mumps during the study period was between (1.1-64.4 per 100,000 population) which is the largest incidence rate in years of mumps outbreak. The incidence rate in the Gaza Strip was even higher at 2.3 to more than 1000 cases per 100,000 populations). In the Gaza Strip most cases are diagnosis clinically not by lab confirmation. This is the latter number from Gaza represents the largest outbreak of mumps seen in more than 20 years and the number of reported cases reflects on the number of patients who sought medical attention and help. The real number of cases is surely higher, likely including many cases that did not reach healthcare centers.

However, several questions can be asked when considering the wide spread of cases. Was there a failure in the vaccination program? Was there a problem with the method of vaccination? Was there a problem with the transportation, storage, and preservation of the vaccine in the cold chain? Is there a failure in the antibodies produced by the vaccination? Or is there a real problem with coverage for the vaccination?

The national vaccination program in Palestine is among best programs in the world (Ramlawi A, 2014). Based on the recommended national immunization program, the

immunization coverage rate for MMR ranged between 94-100% from2010-2020 even with the increase in the number of cases.

According to the Centers for Disease Control and Prevention CDC, one dose of the measles, rubella, and mumps vaccine offers 80% protection while two doses protects at a level between 90-95% (Centers for Disease Control and Prevention, 2017).But with considering 10-20% of children who are not yet fully vaccinated, the spread of the disease is still possible among vulnerable groups who did not receive complete doses of the vaccine.

Few cases were recorded of rubella and the incidence rate for rubella disease was very low during the study period, which points to the fact that rubella is adequately controlled in Palestine.

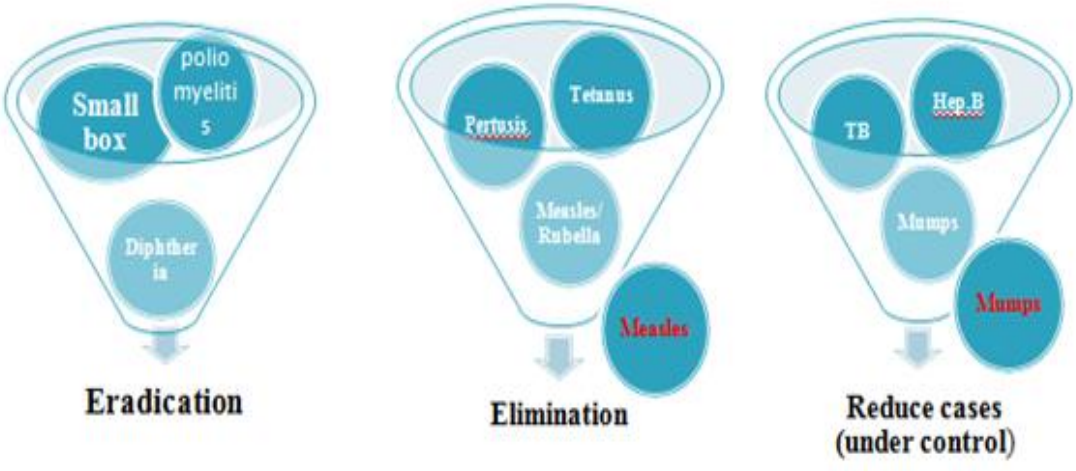
The same period in which Palestine was exposed to the outbreak of measles cases, Israel was exposed to a rise in the number of registered cases of measles, as indicated by the reports of the World Health Organization, where 3177 cases were registered during the year 2018 and during the year 2019, 939 cases were recorded, in addition to 239 cases of Mumps during 2018, and two cases of Rubella.(immunization_monitoring(who.int))

More than 80% of hepatitis B cases recorded in the period of study were in the WB. In the Gaza Strip most registries recorded carriers, not new cases. This was reflected in the incidence rate of cases, which was lower than 1 per 100,000 population in the Gaza Strip.

In the West Bank, the incidence rate in some years was more than 1 per100,000 population, but at the national level, we did not exceed the recommendations of the World Health Organization of 1/100,000 of the total population. After reviewing the investigation forms of the infected persons the data shows that more than 94 % of the cases were born before introduction of hepatitis B to the Palestinian national immunization program, more than 90% of cases were reported that they receive blood transfusion, one case were vertical transmission and other cases unknown sours of infection. In 2019, the World Health Organization estimated that 296 million people are living with hepatitis B and there are 1.5 million new infections each year globally. (Hepatitis (who.int). Additionally, the disease causes bout 820,000 deaths, mostly due to liver cancer.(Hepatitis (who.int). The World Health Organization recommends that all children receive the hepatitis vaccine within 24 hours of birth, and then two or three doses with a period of at least 4 weeks between each dose.

The recommendations of the World Health Organization include the elimination of tuberculosis by 2030, by reducing cases and deaths and reducing the incidence of tuberculosis by 80% compared to 2015(World Health Organization,2019). In the period of study, the incidence rate was less than 1 per 100,000 population in Palestine. After 2016, the number of pulmonary cases began to decrease and after 2017, the number of extra-pulmonary cases began to decrease, bringing Palestine in line with the recommendations of the World Health Organization to reach the target.

According to the global action plan (WHO) for diseases: Eradication, Elimination and reduction of cases (under control),Preventable diseases in Palestine are in line according to the global action plan (WHO), where Palestine, like most countries, got eradication of Polio, Diphtheria and Smallpox, and it also elimination some diseases within the global action plan (WHO), pertussis, Tetanus, Measles and Rubella, But after 2019, measles Drop out, Palestine has become one of the countries that seek to limit the spread of measles. In addition to the diseases that must be controlled according to the global action plan (WHO), tuberculosis, hepatitis B, and mumps, However, mumps in Palestine drop out from the global action plan (WHO) to reduce the number of cases shown in Graph(5-1).



Graph (5-1):WHO global action plan for diseases.

Finally; Through our study, it was found that the incidence of diseases is low and this is reflected in Morbidity, and there are no deaths among the registered cases recorded during the study period, therefore the Mortality rate is zero in diseases that can be prevented by vaccinations, and this is due to the effectiveness of vaccination

CHAPTER SIX

CONCLUSION AND RECEMENDATION

6.1 CONCLUSION

Vaccination is one of the most widely used means to reduce, eliminate, and eradicate vaccine-preventable diseases, and the greater the coverage of vaccination, the greater the chance of eradication.

Despite the shortage of some vaccines within the routine immunization program, the coverage rate nationally did not drop below 80%. During on-shortage periods, the coverage of vaccinations was high, reaching100% in some years. Polio and diphtheria were eradicated in Palestine by vaccination. Moreover, Tetanus and pertussis have been eliminated in Palestine by vaccination. Hepatitis B cases have been reduced to the point that shows reasonable control in Palestine by vaccination.

Measles, Mumps, Rubella are diseases that can be eliminated but are not quite to that point. In Palestine, rubella is under control and measles before 2017 was even in an elimination stage, however after 3 outbreaks, despite high vaccination coverage, measles no longer under control in Palestine. Mumps also has a high level of recorded cases despite high vaccination coverage.

6.2 Recommendation

The recommendations from this study are as follows:

1) Improve the population register, especially newborns to obtain a correct denominator figure for the data on vaccination coverage which will allow decision makers to prepare the annual needs of vaccines more accurately and to avoid the problem of shortage in some vaccines.

2) Improve the surveillance system to detect vaccinated cases to

3) Ensure the availability of lab testing for pertussis in the Gaza Strip to ensure continuity between case definitions in Gaza and the West Bank.

4) Ensure availability of lab testing for mumps in the Gaza Strip to ensure continuity between case definitions in Gaza and the West Bank.

4) Investigate all confirmed cases of mumps and assess on an individual and population level the reasons for the elevated case numbers.

5) Assess the efficacy of the MMR vaccine/vaccination process.

6.3 Future work

Research into the effectiveness of MMR vaccine by studying the effectiveness of the vaccine by taking random samples of children who received the vaccine. Study how vaccines are preserved and transported and how they are stored

6.4 Limitation

One of the difficulties that we faced during the study period was the difficulty of obtaining data from Gaza, in addition to the difference in the method of calculating vaccination between the West Bank and Gaza, although the West Bank and the Gaza Strip work on the same system and with the same recommendations and protocols, there is no standardization of databases between them, and databases in the West Bank have been updated more than once. Excel, Access, DHIS2, each database was built in a different system and in a different way and the data was not migrated from the old databases to the updated databases.

Appendix

State of Palestine
Ministry of Health
General Directorate of Education in
Health and Scientific Research

دولة فلسطين
وزارة الصحة
الإدارة العامة للتعليم الصحي
والبحث العلمي

Ref.: .....
Date:.....

الرقم: ع ص/ ٦٧٠/ ٢٠٢١
التاريخ: ٢٠٢١/٤/٢٩

الأخ مدير عام الادارة العامة للصحة العامة المحترم،،،

تحية واحترام،،

الموضـــوع: تسهيل مهمة بحث

يرجى التكرم بتسهيل مهمة الطالبة: بديعة مصطفى ابراهيم منصور، ماجستير معلومات صحية- الجامعة العربية الامريكية، لعمل بحث بعنوان:

"تقييم برنامج التطعيم في تخفيض معدل الاصابة والوفيات في فلسطينيين 2010-2020"

حيث سيقوم الطالب بجمع معلومات من دائرة الطب الوقائي، دون التعرض لمعلومات المرضى التعريفية، مع العلم أن مشرف الدراسة: د. احمد عمرو، ود. يوسف الميمي.

على ان يتم الالتزام بجميع تعليمات واجراءات الوقاية والسلامة الصادرة عن وزارة الصحة بخصوص جائحة كورونا، وتحت طائلة المسؤولية.

على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر.

الباحث يستطيع تقديم طلب بعد انتهاء بحثه للمنافسة على جائزة فلسطين للبحث العلمي

بامكان الباحث تقديم طلب للمشاركة ببحثه في المؤتمر الفلسطيني الدولي للبحث العلمي

مع الاحترام،،

د. عبد الله القواسمي
مدير التعليم الصحي والبحث العلمي

دولة فلسطين - وزارة الصحة
الإدارة العامة للتعليم الصحي

نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة الامريكية

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الملخص

خلفية

التطعيم هو أحد أكثر الطرق فعالية وأمانًا للوقاية من الأمراض على المستوى الفردي .الهدف الرئيسي من التطعيم هو الحد من انتشار الأمراض والسيطرة عليها من خلال تحقيق مناعة عالية في الفئات المستهدفة خلال فترة التطعيم.

الأمراض الوقائية هي الأمراض التي يمكننا تجنبها والحد من انتشارها من خلال برنامج التطعيم المتبع في تلك المنطقة (مثل: الدفتيريا ، التيتانوس ، شلل الأطفال ، التهاب الكبد ، السعال الديكي ، الحصبة ، النكاف ، الحصبة الألمانية ...)

في العام 1974 ، أنشأت منظمة الصحة العالمية البرنامج الموسع للتحصين بهدف الوصول إلى تغطية تطعيم عالية للأطفال في جميع أنحاء العالم لتحمل عبء الأمراض التي يمكن الوقاية منها؛ حيث تمتلك فلسطين أحد أقدم برنامج التطعيم في العالم ، وقد بدأ برنامج التطعيم في فلسطين عام 1969.

أهداف الدراسة

تقوم الدراسة على تقييم برنامج التطعيم الوطني الموسع في خفض معدلات الاعتلال والوفيات وحدوث الأمراض في فلسطين بين الأعوام (2010-2020) ، والتحقيق في نسب تغطية التطعيم بين السكان الفلسطينيين ، التحقيق في مستويات الفشل في تغطية التطعيم بين السكان الفلسطينيين ، تحديد أسباب فشل التطعيم بين السكان الفلسطينيين ، من خلال دراسة سجلات المرضى لدى وزارة الصحة.

منهجية البحث

مراجعة البيانات بأثر رجعي للحالات المسجلة في نظام مراقبة الأمراض التي يمكن الوقاية منها والتحصين في وزارة الصحة الفلسطينية ، واستخدمت الدراسة جميع البيانات التي سجلتها وزارة

الصحة الفلسطينية / دائرة الطب الوقائي خلال الفترة 2010-2020 المتعلقة بالأمراض التي يمكن الوقاية منها مع التطعيمات وبرنامج التطعيم الوطني الموحد في فلسطين ، تم جمع البيانات من دائرة الطب الوقائي المركزي ، والتي تجمع البيانات المرتبطة بالأمراض والتطعيمات ذات الصلة من جميع مقدمي الخدمات الصحية في فلسطين ، واجراء مقابلة عبر الهاتف ، تم اعتماد نهج التحليل الوصفي لتحليل البيانات على أساس العمر والجنس ونوع المرض ونسبة الإصابة بالمرض حسب التوزيع الجغرافي ، تم استخدام النسبة المئوية لحساب انتشار \ معدل الإصابة \ معدل المرض. أخلاقيًا ، تم الحصول على موافقة لجنة الجامعة العربية الأمريكية ووزارة الصحة للحصول على السجلات الطبية للمرضى

نتائج الدراسة:

اثبتت الدراسة نتيجة المقابلات أنه لا يوجد فشل في فعالية اللقاح ، ولكن حدث نقص في بعض اللقاحات خلال الفترة 2010-2020 ؛ من خلال التقارير التي تم جمعها وتحليلها من خلال حساب معدل التغطية للقاحات تبين أن نسبة التغطية تجاوزت 90٪ في معظم اللقاحات. من خلال معدل حدوث المرض الذي تم تحليله ، وجد أنه لا توجد حالات مسجلة في بعض الأمراض (شلل الأطفال والدفتيريا) ووجود بعض الفاشيات (النكاف والحصبة).

الاستنتاجات:

التطعيم هو أحد أكثر الوسائل استخدامًا للحد من الأمراض التي يمكن الوقاية منها بالتطعيم والقضاء عليها والقضاء عليها ، وكلما زادت تغطية التطعيم ، زادت فرصة الاستئصال ؛ على الرغم من النقص في بعض اللقاحات ضمن برنامج التحصين الروتيني ، لم ينخفض معدل التغطية على المستوى الوطني إلى أقل من 80٪ ؛ تم القضاء على شلل الأطفال والدفتيريا في فلسطين عن طريق التطعيم. تم القضاء على التيتانوس والسعال الديكي في فلسطين عن طريق التطعيم. تم تخفيض حالات التهاب الكبد الوبائي (ب) إلى درجة السيطرة المعقولة في فلسطين عن طريق التطعيم. تعتبر

الحصبة والنكاف والحصبة الألمانية من الأمراض التي يمكن القضاء عليها ولكنها لم تصل إلى هذه المرحلة تمامًا ؛ في فلسطين ، كانت الحصبة الألمانية تحت السيطرة كما كانت الحصبة قبل عام 2017 وكانت حتى في مرحلة القضاء عليها ، ولكن بعد 3 فاشيات ، على الرغم من التغطية العالية للتحصين ، لم تعد الحصبة مسيطر عليها في فلسطين. يحتوي النكاف أيضًا على مستوى عالٍ من الحالات المسجلة على الرغم من تغطية التطعيم العالية.

التوصيات:

توصي الدراسة بتحسين سجل السكان ، وضمان توافر الفحوصات المخبرية للسعال الديكي والنكاف في قطاع غزة ، والتحقيق في جميع حالات النكاف المؤكدة ، وإجراء تقييم للمرض. فعالية لقاح MMR / عملية التطعيم.

المعوقات:

صعوبة الحصول على البيانات من غزة ، لا توجد طريقة موحدة لحساب تغطية التلقيح ، لا يوجد توحيد لقواعد البيانات.