Study on Immunization Status of Slum-dwelling Children Living in Gazipur

A Research Report submitted to the Department of Pharmacy, East West University, Bangladesh in partial fulfillment for the requirements of the degree of Master of Pharmacy

Submitted by
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Declaration by the Research Candidate

I, Abdullah Al Rifat (ID # 2013 – 3 – 79 – 011), hereby declare that the research paper entitled "Study on immunization status of slum-dwelling children living in Gazipur " submitted by me to the Department of Pharmacy, East West University, Dhaka, Bangladesh in the partial fulfillment of the requirement for the award of the degree of Master of Pharmacy is a bonafide record of original work carried out by me under the supervision and guidance of Nigar Sultana, Senior Lecturer, Department of Pharmacy, East West University, Dhaka, and that no part of the project has been submitted for any other degree.

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Certificate by the supervisor

This is to certify that the research paper entitled "Study on immunization status of slum-dwelling children living in Gazipur" submitted to the Department of Pharmacy, East West University in partial fulfillment of the requirements of the Degree of Master of Pharmacy was carried out by Abdullah Al Rifat (ID # 2013 – 3 – 79 – 011) under my guidance and supervision. I further certify that all the sources of information and facilities availed of in this connection duly acknowledged.

Nigar Sultana
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Certificate by the Chairperson

This is to certify that the research entitled "Study on immunization status of slum- dwelling children living in Gazipur" submitted to the Department of Pharmacy, East West University, in partial fulfillment of the requirements for the Degree of Master of Pharmacy is a record of original and genuine research work was carried out by Abdullah Al Rifat (ID # 2013 – 3 – 79 – 011). I further endorse that all the sources of information and facilities availed of in this connection duly acknowledged.

Shamsun Nahar Khan, PhD

Chairperson & Associate Professor

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List of Acronyms

EPI	Expanded Programme on Immunization
AEFI	Adverse Events Following Immunization
BCG	Bacillus Calmette-Guerin (tuberculosis vaccine)
DGHS	Directorate General of Health Services
DPT or DTP	Diphtheria-Tetanus-Pertussis vaccine
DT	Diphtheria-Tetanus toxoids
DTaP	Diphtheria-Tetanus-acellular Pertussis vaccine
GAVI	Global Alliance for Vaccines and Immunization
GoB	The Government of Bangladesh
HCP	Health care providers
HepB	Hepatitis B vaccine
Hib	Haemophilus Influenza type b (disease or vaccine) HLC High
NIP	National Immunization Programme
OPV	Oral Polio Vaccine
IPV	Inactivated Polio Vaccine
Td	Tetanus and Diphtheria Toxoid
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VPD	Vaccine Preventable Disease
WHO	World Health Organization

Abstract

Immunization has been one of Bangladesh's greatest public health success stories . However, it is a challenge to ensure that all children of Bangladesh benefit equitably from this intervention, because extremely poor have lack of awareness, lack of time and money to use basic health services. This study was performed to assess the present immunization status of slum-dwelling child, to understand the reasons for not getting immunizations, and to identify the impact of mother`s age, education, tetanus immunization and birth order of the child on immunization status. For this face to face interview was performed with 200 parent or primary caregiver of slum-dwelling child aged ≤ 60 months through a standard questionnaire. Valid immunization coverage was significantly lower (48.50%) in slum dwelling areas compared to the national level coverage (71%),but drop-out rate(40%) and invalid doses reception rate (10.50%) were higher compared with national level (33%) and (7%). 98% parent or primary caregiver at least knew about vaccination and 95% to retain the vaccination card. Analysis showed that, among the valid dose recipient children`s mother 83.51% had some level of schooling, 88.66% aged between 18-30 years and 67.01% received proper tetanus immunization during their pregnancy. Findings of the study also showed that major source of information about vaccination was health care provider (35.86%), major reasons for dropout was lack of concern (57.50%). Most common problem faced during vaccination was long waiting time (17.48 %). Furthermore the study also revealed that 81.50% parent or primary caregiver prefer morning session to vaccinate their child while (56.93%) prefer vaccination center as a choice of vaccination place. On the other hand slum dwelling child`s mother and father childhood vaccination rate were 57.50% and 46% respectively and 19% siblings completed immunization. Among valid dose recipient child 71.13% were first child of the parent. At the end we can say that present immunization status of slum dwelling child is not up to the mark. So, to increase awareness mass media and health campaign can play vital role. At the same time Govt. should come forward to minimize long waiting time, unofficial fee and shortage of vaccine by ensuring sufficient number of center, health care provider and quality vaccine.

Key words: Bangladesh, immunization, slum dwelling child, vaccine, valid dose recipient.

CHAPTER - ONE

INTRODUCTION

1.1Infection

Infection is the invasion of an organism's body, tissues ,their multiplication, and the reaction of host tissues to these organisms and the toxins they produce. Infectious disease, also known as transmissible disease or communicable disease. Infection are caused by virus ,viroid, prion, bacteria, nematodes, arthropods, fungi and parasites (Cancer ResearchUK, 2014).

1.2 Types of infections

1.2.1 Bacterial Infection

Bacteria are the most common cause of infections. Types of bacteria that cause infection are mentioned bellow :

Staphylococcal Infections

Mainly affect the skin. Two common types are Staphylococcus epidermis and Staphylococcus aureus. They usually cause mild infections, but these can be more serious in people with cancer. MRSA is a type of Staph aureus infection, stands for Methicillin Resistant Staphylococcus Aureus also caused by Staphylococcus.

Streptococcus Infections

Streptococci are common bacteria that can cause tonsillitis and skin infection .They are usually treated with antibiotics like penicillin. Pneumococcal pneumonia is a chest infection also caused by a type of strep.

Enterococcus Infection

Another type of bacteria are Enterococci that can affect people with cancer. These can cause bladder infections and blood poisoning .

Pseudomonas Infections

They are more rare, but can be a problem for people who have weak immune systems.

Clostridium Difficile Infection

It is most common in people who are already on antibiotics. Certain bacteria can live normally in the bowel to keep it healthy. But being on antibiotics can upset the balance and allow some bacteria to multiply ,become harmful and causes Clostridium difficile .

Escherichia coli (E. coli) Infections

It affect the gut causing diarrhoea and fever.

Listeria Infections

Listeria monocytogenes is known as Listeria. Caused by contaminated food. It is rare, but can be serious if caught by pregnant women, unborn or newborn babies, elderly people, or those with a weak immune system (Cancer ResearchUK, 2014).

1.2.2 Viral Infection

Common viral Infection

These viruses can cause serious infections, such as pneumonia, in people whose immune systems are weak.

Herpes simplex virus Infection

These infections are usually mild in healthy immune systems, but the virus can cause serious infections in those with weakened immune systems.

Varicella zoster virus infection

Varicella zoster is the same virus that causes chicken pox. It can cause very serious and fatal infections, such as pneumonia . The virus also causes a painful condition called shingles.

Cytomegalovirus Infection

It causes chest infections .Virus remain inactive in body for many years and cause recurrent infections in people who have weakened immune systems.

Flu

It is very infectious and caused by viruses. Spread through coughing and sneezing. Flu also causes high temperatures , aching muscles, coughing and headaches (Cancer Research UK, 2014).

1.2.3 Fungal infections

Tinea

It is a type of fungal infection of the hair, skin, or nails. When it's on the skin, tinea usually begins as a small red area. As it grows, it spreads out in a circle or ring. Tinea is often called ringworm because it may look like tiny worms are under the skin.

Athlete's foot

It is another type of fungal infection that usually appears between the toes but can also affect toenails and the bottom or sides of the feet.

Jock itch

It is a fungal infection of the groin and upper thighs.

Candida

It is a yeast, similar to a fungus. It most often affects the skin around the nails or the soft, moist areas around body openings.

Pityriasis versicolor

It is caused by a fungus that normally lives on human skin. It can appear over the chest, shoulders, and back, and is common in teenagers (Cancer Research UK, 2014).

1.2.4 Protozoal infections

Protozoa are the smallest animals known to man. Toxoplasmosis is an infection caused by protozoa. It causes a mild illness in healthy people, but people with severely weakened immune systems can get serious infections that can spread to the brain (Cancer ResearchUK, 2014).

1.3 Common infectious disease for which vaccines are available

1.3.1Tuberculosis

Tuberculosis is an infectious diseases caused by *Mycobacterium tuberculosis*. Tuberculosis generally affects the lungs, but can also affect other parts of the body. Most infections do not have symptoms, known as latent tuberculosis. About 10% of latent infections eventually progresses to active disease which, if left untreated, kills about half of those infected (WHO, 2015).

Signs and symptoms

Fever, chills, night sweats, loss of appetite, weight loss, blood-tinged sputum, nail clubbing and fatigue (CDC, 2012).

Transmission

Tuberculosis is spread through the air when people have active TB in their lungs cough, spit, speak, or sneeze. People with latent TB do not spread the disease (WHO, 2015).

Pathogenesis

When the mycobacteria reach the pulmonary alveoli, where they invade and replicate within endosomes of alveolar macrophages. Macrophages identify the bacterium as foreign and attempt to eliminate it by phagocytosis. During this process, the bacterium is enveloped by the macrophage and stored temporarily in a membrane-bound vesicle called a phagosome. The phagosome then combines with a lysosome to create a phagolysosome. In the phagolysosome, the cell attempts to use reactive oxygen species and acid to kill the bacterium. But, *M.tuberculosis* has a thick, waxy mycolic acid capsule that protects it from these toxic substances. *M.tuberculosis* is able to reproduce inside the macrophage and will eventually kill the immune cell (Kumar *et al.*, 2007 ; WHO, 2015).

Prevention

Prevention of TB involves vaccination with the bacillus Calmette-Guérin vaccine (Harris, 2013).

1.3.2 Diphtheria

Diphtheria caused by *Corynebacterium diphtheriae*. Symptoms beginning with a sore throat and fever. In severe cases a grey or white patch develops in the throat. This can block the airway and create a barking cough (Atkinson *et al.,* 2012).

Complications

Complications may include myocarditis, inflammation of nerves, kidney problems, and bleeding problems due to low blood platelets (Atkinson *et al.,* 2012).

Transmission

Diphtheria is usually spread between people by direct contact or through the air. It may also be spread by contaminated objects (Atkinson *et al.,* 2012).

Prevention

A vaccine, known as diphtheria toxoid, is effective for prevention. A surgical procedure known as a tracheostomy is sometimes needed to open the airway in severe cases. Antibiotics are used in patients or carriers to eradicate *C. diphtheriae* and prevent its transmission to others.

1.3.3 Tetanus

Tetanus is caused by *Clostridium tetani*. which is commonly found in soil, dust and manure. The bacteria generally enter through a break in the skin such as a cut or puncture wound by a contaminated object. They produce toxins that interfere with muscle contractions. Tetanus also known as lockjaw, is an infection characterized by muscle spasms. In spasms begin in the jaw and then progress to the rest of the body. These spasms usually last for few minutes each time and occur frequently for three to four weeks. Spasms may be so severe that bone fractures may occur (Atkinson *et al.,* 2012 ; CDC, 2013 ; CDC, 2007).

Sign and symptoms

Fever, sweating, headache, swallowing, high blood pressure, and a fast heart rate (Atkinson *et al.,* 2012 ; CDC, 2013) .

Pathophysiology

The tetanus toxin initially binds to peripheral nerve terminals. It is transported within the axon and across synaptic junctions until it reaches the central nervous system. There it becomes rapidly fixed to gangliosides at the presynaptic inhibitory motor nerve endings, and is taken up into the axon by endocytosis. The effect of the toxin is to block the release of inhibitory neurotransmitters glycine and gamma-aminobutyric acid (GABA) across the synaptic cleft, which is required to check the nervous impulse. If nervous impulses cannot be checked by normal inhibitory mechanisms, the generalized muscular spasms characteristic of tetanus are produced. The toxin appears to act by selective cleavage of a protein component of synaptic vesicles, synaptobrevin II, and this prevents the release of neurotransmitters.

Prevention

Proper immunization with the tetanus vaccine can prevent tetanus (Karnad, 1995).

1.3.4 Pertussis

Pertussis caused by *Bordetella pertussis* ,also known as whooping cough or 100-day cough.

Transmission

It is an airborne disease which spreads easily through the coughs and sneezes of an infected person (CDC, 2014).

Sign & symptoms

Runny nose, fever, and mild cough followed by weeks of severe coughing fits. The classic symptoms of pertussis are a paroxysmal cough, inspiratory whoop, fainting, or vomiting after coughing. Coughing from pertussis cause subconjunctival hemorrhages, rib fractures, urinary incontinence, hernias, vertebral artery dissection, pleura rupture leading to a pneumothorax. (Carbonetti & Nicholas, 2010).

Prognosis

Pertussis is fatal in infants under one year of age. Infants more likely to develop complications, such as: pneumonia (20%), encephalopathy (0.3%), seizures (1%), failure to thrive, and death. Pertussis can cause severe paroxysm-induced cerebral hypoxia, and 50% of infants admitted to hospital suffer apneas (CDC, 2015 ; Carbonetti & Nicholas, 2010).

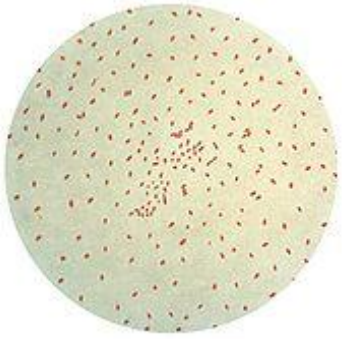

Figure1.1: Gram stain of *Bordetella pertussis*

Prevention

Prevention through vaccination with the pertussis vaccine (Heininger, 2010).

1.3.5 Measles

Measles is a highly contagious infection caused by the measles virus, also know as morbilli, rubeola, or red measles (Caserta *et al.*, 2013).

Signs and symptoms

Fever, cough, runny nose, and red eyes. red, flat rash which starts on the face and then spreads to the rest of the body. small white spots may form inside the mouth, known as Koplik's spots (Caserta *et al.*, 2013 ; CDC, 2014).

Complications

Complications include diarrhoea, blindness, inflammation of the brain and pneumonia (WHO, 2014 ; Atkinson *et al.*, 2011).

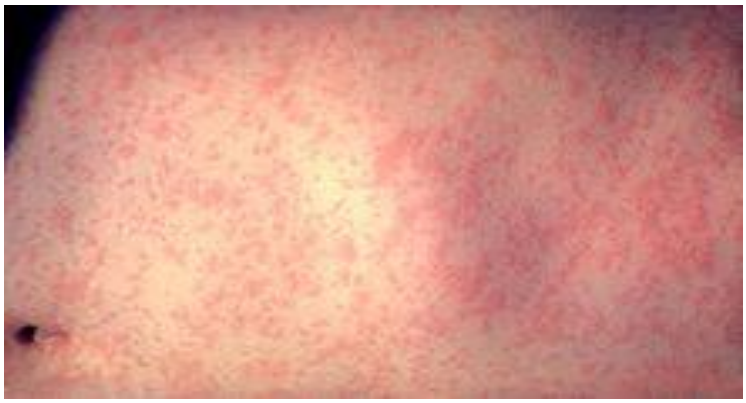

Figure1.2 Skin of a person after 3 days of measles infection.

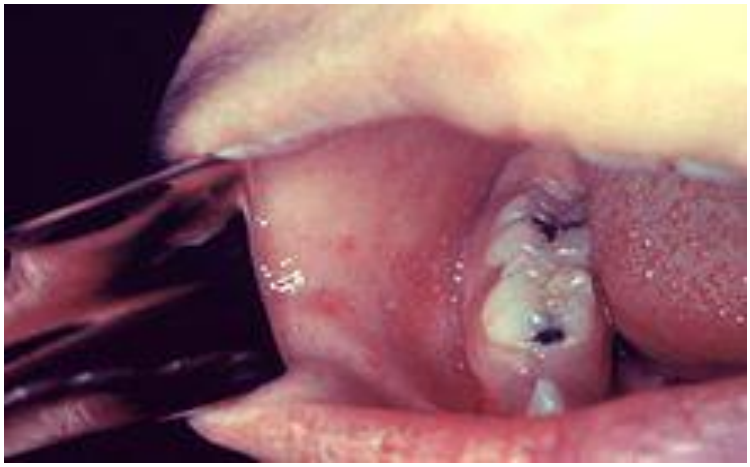

Figure1.3 : Koplik's spots .

Transmission

Measles is an airborne disease which spreads easily through the coughs and sneezes of infected person . It may also be spread through contact with saliva or nasal secretions, sharing living space with an infected person will catch it (WHO, 2014).

Complications

Diarrhea, pneumonia , bronchitis , otitis media acute brain inflammation corneal ulceration and very rarely subacute sclerosing panencephalitis (SSPE) (Fisher *et al.,* 2014).

Prevention

Measles vaccine is effective to prevent the disease.

1.3.6 Poliomyelitis

Poliomyelitis, caused by the poliovirus ,often called polio or infantile paralysis. The muscle weakness involves the legs resulting inability to move but less commonly involve the muscles of the head, neck and diaphragm. Many but not all people fully recover from this. People with muscle weakness about 2% to 5% of children and 15% to 30% of adults die due to it (Atkinson *et al*., 2009).

Transmission

Poliovirus is usually spread from person to person through infected feces . It may also be spread by food or water containing human feces and from infected saliva (Atkinson *et al*., 2009) .

Table 1.1: Sign and symptom of poliovirus infection

Outcome	Proportion of cases
No symptoms	72%
Minor illness	24%
Non paralytic aseptic meningitis	1–5%
Paralytic poliomyelitis	0.1–0.5%
Spinal polio	79% of paralytic cases
Bulbospinal polio	19% of paralytic cases
Bulbar polio	2% of paralytic cases

(Atkinson *et al*., 2009; Chamberlin & Narins, 2005 ; Leboeuf, 1992).

Pathophysiology

Poliovirus enters the body through the mouth, binding to poliovirus receptor or CD155 and infecting the cells of the pharynx and intestinal mucosa. The virus then hijacks the host cell's own machinery, and begins to replicate. Poliovirus divides within gastrointestinal cells then spreads to the tonsils , the intestinal lymphoid tissue , and the deep cervical and mesenteric lymph nodes, where it multiplies abundantly. The virus is subsequently absorbed into the bloodstream and widely distributed throughout the body. Poliovirus can survive and multiply within the blood and lymphatics for long periods of time. In a small percentage of cases, it can spread and replicate in other sites .Rarely, the virus may invade the central nervous system, provoking a local inflammatory response of the meninges (Todar, 2012).

Prevention

The disease is preventable with the polio vaccine (WHO, 2014).

1.3.7 Hepatitis

Hepatitis is a medical condition defined by the inflammation of the liver. Hepatitis is acute when it lasts less than six months and chronic when it persists longer. Acute hepatitis can be self-limiting or may progress to chronic hepatitis, rarely, cause acute liver failure. Chronic hepatitis have no symptoms, it may progress to fibrosis and cirrhosis (WHO, 2014 ; Rubin & Strayer, 2008).

Causes

Viral hepatitis is the most common one. Other common cause of hepatitis are drug induced, alcoholic, autoimmune, fatty liver, and metabolic disorders. some bacterial, parasitic, fungal, mycobacterial and protozoal infections can also cause hepatitis. Complications of pregnancy, cholestasis and decreased blood flow to the liver can also induce hepatitis (Devlin *et al*., 2005 ; Dienstaq, 1981).

Mechanism of hepatitis

In viral hepatitis, the presence of the virus in the liver cells causes the immune system to attack the liver, resulting inflammation and impaired function. In autoimmune hepatitis, the

immune system attacks the liver due to the autoimmune disease. In other hepatitis, where hepatitis caused by alcoholism, fat deposits in the liver, resulting steatohepatitis (Tong & Wand, 1999 ; Schaefar, 2007; Urban & Glebe, 2007).

Sign & symptoms (Acute)

Symptoms in acute hepatitis are profound loss of appetite, malaise, enlarged lymph nodes, aches, fever, nausea or vomiting, diarrhea ,and choluria (dark urine), enlargement of the liver, and enlargement of the spleen. A small proportion of people with acute hepatitis progress to hepatic encephalopathy. Aplastic anemia may occur 2–3 months after an acute attack of hepatitis (Lancet, 2014 ; Shulman *et al.*,1996 ; Pungpapong *et al.*, 2007).

Sign & symptoms (Chronic)

Chronic hepatitis may cause nonspecific symptoms such as malaise, tiredness, and weakness, enlargement of the liver, scarring of liver leads to weight loss, easy bruising and bleeding, swelling of the legs, fluid in the abdomen and cirrhosis ,hepatic encephalopathy (confusion and coma), and kidney dysfunction (Schilsky, 2013).

Prognosis

For Hepatitis A infection, the person may not experience any symptoms. In other causes hepatitis can result in irreparable damage to the liver and require a liver transplant. Chronic liver damage causes formation of scar tissue called fibrosis that block the liver from functioning properly; this condition is called cirrhosis and is irreversible. Another complication of chronic hepatitis, is hepatocellular carcinoma (Dienstaq, 2008).

Prevention

Vaccines are available to prevent hepatitis A and B. Hepatitis A immunity is achieved by receiving the two-dose inactivated virus vaccine. The hepatitis A vaccine is not approved for children under one year of age (Cao, 2009).

1.4.1 Vaccine

A vaccine is a substance that is introduced into the body to prevent infection or to control disease due to a certain pathogen .The vaccine “teaches” the body how to defend itself against the pathogen by creating an immune response. Unlike traditional pharmaceuticals,

vaccines are biologics since, they are made from living organisms .Specifically, vaccines are preparations of components derived from a pathogen.

1.4.2 Importance of Vaccination

•In 1974, only 5% of the world's children received vaccination(s). By 2005, 75% people were immunized, saving about three million lives a year (Iglehard, 2005).

• Collectively, over 5.9 million deaths are prevented annually through vaccination against major infectious diseases such as diphtheria, tetanus, pertussis, hepatitis B, measles, polio, and tuberculosis (Ehreth, 2003).

• An unprecedented global vaccination campaign against smallpox has spared the global community of over 350 million new smallpox victims and some 40 million deaths from the disease. So vaccination campaign against smallpox is a must to prevent it (Ehreth, 2003).

• Poliomyelitis, causes infantile paralysis, muscle weakness. People with muscle weakness about 2% to 5% of children and 15% to 30% of adults die (Atkinson *et al*, 2009) . Since 2001, more than 190 countries and territories have been polio-free and the disease now exists in only about 20 countries, all in the regions of Southeast Asia and Sub-Sahara Africa. Since 1988, the number of cases reported to WHO has declined by 99% through vaccination intervention (CDC, 2001).

• In the period from 2000 to 2006, targeted immunization campaigns helped reduce the number of global deaths caused by measles by 68%, from 757,000 to 242,000, with a corresponding 91% reduction in Africa (WHO, 2007).

• Vitamin A supplementation costs only $0.02 cents for each capsule and given 2-3 times a year saved an estimated 2.3 million lives between 1999 and 2004 (UNICEF Statistics, 2015).

• While vaccines have played a vital role in preventing infectious diseases and improving individual wellbeing and quality of life. vaccines also offer tremendous value to society. immunization does more than just protect individuals; it protects entire populations by preventing the spread of disease from one person to another. Hence vaccination is a collective activity that can protect an entire group of people, and can also cross boundaries between countries and continents and high rates in one generation benefit the next generation to follow (Ehreth, 2003).

The social value of vaccines also includes reductions in disease outbreaks, and population growth through reduced mortality (Van Exan, 2008).

• Immunization programs have been widely recognized as best investments in health, based on both cost-savings and cost-effectiveness. Vaccines also offer additional economic benefits, through reduced hospitalization and decreased need of treatment expenses. Thus vaccines play a pivotal role in the sustainability of health care systems, while helping to realize the full economic growth potential of a population free of disease (Chabot, 2005) .

1.4.3 Types of immune response

Active immunity

Naturally acquired active immunity occurs when the person is exposed to a live pathogen, develops the disease with clinical or sub-clinical symptoms and becomes immune as a result of the primary immune response (upon first exposure) to the pathogen. In contrast, artificially acquired active immunity can be induced by a vaccine that contains the antigen administered in the form of live, attenuated or dead pathogens or their components. In this case, the vaccine stimulates a primary immune response against the antigen without causing symptoms of the disease (Landry & Heilman, 2005).

Passive immunity

In the case of "passive immunity", immunity is acquired without the immune system being challenged with an antigen, but rather, by transfer of antibodies from an immune donor, human or animal to a non-immune individual. Naturally acquired passive immunity occurs during pregnancy, where immunoglobulin G (IgG), are passed through the placenta from the maternal into the fetal bloodstream, or via colostral. In contrast, artificially acquired passive immunity can be achieved by the injection of antibodies such as gamma-globulins from other individuals or gamma-globulin from an immune animal that are not produced by the recipient's cells (Landry & Heilman, 2005).

1.4.4 Mechanism of Action of Vaccine

Diseases causing organisms to exhibit two distinct types of effects on the body. The first are the obvious effects including symptoms such as fever, nausea, vomiting, diarrhea, rash and many others. Second, less obvious, promoting the immune system's response against infection. In general, vaccines are designed to imitate the second effect without the consequences of the first (Landry & Heilman, 2005).

1) The vaccine introduces a small non-harmful component form of the pathogen into the body. This is called the foreign antigen or immunogen.

• An antigen is defined as a substance that is recognized by a component of the immune system, such as antibodies. Bacteria or viruses are well known as antigens.

• Similarly, immunogens are substances capable of provoking an immune response.

2) The body's immune system produces an immune response to the pathogen by generating antibodies, killer cells, or both.

• In the humoral response, the body's B-cells produce antibodies that neutralize and eliminate antigens form the blood, epithelial surfaces, and from the fluid.

• In cell-mediated response, specific killer cells called cytotoxic T-cells attack cells that have been infected .

3) A small group of "memory" B-cells and T-cells remain in the body and can quickly initiate a strong immune response, by producing antibodies, and T-cells or. The next time when real pathogen is encountered again , the immune system remembers it and mounts a much larger, quicker response than frist time . This is known as "immune memory".

4) This larger, quicker immune response obtained in several ways to fight infection or disease:

• by stopping replication of the pathogen, so it cannot infect more cells, or

• by producing antibodies that attach to the pathogen, rendering it harmless or

• by producing immune cells that attack and kill other cells that have been already infected (French, 2008 ; Ghaffar & Haqqi, 2008).

1.4.5 Types of Vaccine

Table 1.2: Vaccine Types and Immune Responses

Vaccine type	Definition	Immune response	Examples
Killed, inactivated	Pathogen is killed, usually through a chemical process such as formalin	Evokes a robust immune response that mimics most of the responses seen during an infection	• Typhoid vaccine • Salk polio vaccine • Hepatitis A vaccine
Live, attenuated	Pathogen is weakened by genetic	Evokes a broad immune	• Oral Sabin polio vaccine

	manipulations such that growth in the host is limited and does not cause disease; other version of live vaccine is using an organism that is related to the pathogen, but grows poorly, naturally, in humans	response similar to that seen by the host infected with a natural pathogen	• Nasal influenza vaccine • Bacille Calmette-Guerin (BCG) vaccine • Varicella vaccine • Rotavirus vaccine
Subunit, acellular	Well-defined part(s) of the organism is purified and used as an antigen (e.g. proteins, peptides, polysaccharides, inactivated toxins)	A fragment of the "whole agent" vaccine can create an immune response	• Acellular pertussis Vaccine
Conjugate	Poorer antigens (such as bacterial polysaccharides) are chemically linked to a carrier protein	Addition of other proteins (via conjugation) confers the immunological attributes of the carrier to the antigen, and thus evokes a stronger immune response; effective approach for younger children	• *Haemophilus influenza* type b (Hib)conjugate vaccine • Pneumococcal conjugate vaccine • Meningococcal C conjugate vaccine • Meningococcal (A, C,Y,W-135conjugate Vaccine
DNA/RNA	Genetic material from the pathogen	Immune system detects	• AIDS vaccine (in development)

	enter into human cells and use the cell's "equipment" to produce some protein(s) of the pathogen encoded by the gene(s)	protein as a foreign or harmful antigen, produces an immune response, also will prepare a response against whole pathogen	
Recombinant	Defined genes are incorporated into plasmid vehicle to allow for the production of large quantities of well-defined proteins, which are then used as vaccines	Immune response can be modified and targeted by insertion of specific genetic sequences	• Hepatitis B vaccine • Human papillomavirus (HPV) vaccine • AIDS vaccine (in development)

(Landry & Heilman, 2005 ; Kew *et el.*, 2002 ; Yang, 2003 ; CDC, 2004).

1.5 Vaccines included in EPI schedule of Bangladesh

1.5.1 BCG Vaccine

BCG means Bacillus Calmette–Guérin, historically known as Vaccine Bilié de Calmettee Guérin is a vaccine against tuberculosis. It is prepared from a strain of the attenuated live bovine tuberculosis bacillus named as *Mycobacterium bovis*, that has lost its virulence in humans**.**

Route of administration

Figure 1.4 : An apparatus (4–5 cm length, with 9 short needles) used for BCG vaccination

BCG is given as a single intradermal injection at the insertion of the deltoid. If BCG is accidentally given subcutaneously, then a local abscess may form that can sometimes ulcerate, and may require treatment with antibiotics .

Adverse effects

Pain, keloids and scarring at the site of injection. Subcutaneous adminstration, causing either suppurative and nonsuppurative lymphadenitis, breast and gluteal abscesses can occur due to haematogenous and lymphangiomatous spread. Regional bone infection, BCG osteomyelitis or osteitis and disseminated BCG infection are rare complications of BCG vaccination, but potentially life-threatening.

Contraindication

BCG should not given to an immunocompromised patient, it can cause disseminated or life-threatening infection. The documented incidence of this happening is less than one per million immunizations given. In 2007, The WHO stopped recommending BCG for infants with HIV, even if there is a high risk of exposure to TB, because of the risk of disseminated BCG infection (Mohamed & Mahler, 1955).

History

Jean Antoine Villemin first recognized bovine tuberculosis in 1854, and Robert Koch first distinguished *Mycobacterium bovis* from *Mycobacterium tuberculosis*. It was hypothesized that infection with bovine tuberculosis might protect against infection with human tuberculosis. In the late 19th century, clinical trials using *M. bovis* were conducted in Italy with disastrous results, because *M. bovis* was found to be as virulent as *M. tuberculosis*.

Albert Calmette, a French physician and bacteriologist, and his assistant, Camille Guérin, a veterinarian, were working at the Institut Pasteur de Lille in 1908. Their work included subculturing virulent strains of the tubercle bacillus and testing different culture media. They noted a glycerin-bile-potato mixture grew bacilli that seemed less virulent, and changed the course of their research to see if repeated subculturing would produce a strain that was attenuated enough to be considered for use as a vaccine. The BCG vaccine was first used in humans in 1921 (Styblo & Meijer, 1976).

In the summer of 1930 in Lubeck, 240 infants were vaccinated in the first 10 days of life; almost all developed tuberculosis and 72 infants died. It was discovered that vaccine contaminated with a virulent strain that was being stored in the same incubator.

Dr. R.G. Ferguson, working at the Fort Qu'Appelle Sanatorium in Saskatchewan, was pioneers in developing the practice of vaccination against tuberculosis. In 1928, BCG was adopted by the Health Committee of the League of Nations (Mohamed & Mahler, 1955).

1.5.2 Diphtheria vaccine

Diphtheria vaccine used against *Corynebacterium diphtheriae*. Three initial doses are recommended after which it is about 95% effective. Immunization start at six weeks of age with further doses given every four weeks (Wkly Epidemiol Rec, 2006).

Adverse effect

Pain and bump may form at the site of injection that lasts a few weeks (Atkinson *et al*, 2012).

History

Several combined vaccines are used to prevent diphtheria. This includes tetanus toxoid known as dT or DT vaccine and with tetanus and pertussis vaccine known as DPT vaccine. The World Health Organization has recommended it use since 1974 (Wkly Epidemiol Rec, 2006).

Route of administration

It is given as a intramuscular injection (Wkly Epidemiol Rec, 2006).

Precausion

The vaccine needs to be kept cold but not frozen. The vaccine is safe in both pregnancy and among those who have a poor immune function (Atkinson *et al*, 2012).

1.5.3 Tetanus vaccine

Tetanus vaccine is composed of deactivated tetanus toxins and it is used against *Clostridium tetani* . This vaccine is immunogenic but not pathogenic and is used to prevent an individual from contracting tetanus. Tetanus vaccine, also known as tetanus toxoid (Frist aid, 2015).

History

The first inactive tetanus toxoid was discovered and produced in 1924. This vaccine was proven to be successful when it was used to prevent tetanus in the military during World War II. DTP was first used in 1930 for diphtheria, tetanus, and pertussis and was continued until 1991. Half of those who received the DTP vaccine had redness, swelling, and pain around the injection site which convinced researchers to find a replacement vaccine. Two new vaccines were launched in 1992, these include tetanus and diphtheria with acellular pertussis (WHO, 2013).

Mechanism of action

This type vaccine produce artificial active immunity. Immunity generated when dead or weakened version of diseases enter into body causing immune system to produce antibodies, so if the disease ever introduce into body immune system will recognize it and produce antibodies rapidly.

Side effect

Fever, redness, swelling, soreness or tenderness around the injection site, body aches, heavy edematous, urticaria, arthralgia, nephrosis, and anaphylactic shock.

1.5.4 Pertussis (Whooping Cough) Vaccination

Pertussis vaccine is used against *Bordetella pertussis* the causative agent of pertussis. The best way to prevent it is through vaccinations.

Pertussis Vaccine Ingredients

Contain reduced bioactive pertussis toxin, less endotoxin or reduced mercury, aluminum adjuvant, filamentous hemagglutinin (FDA), pertactin, fimbriae, formaldehyde, polysorbate 80 (Tween 80), gluteraldehyde, 2-phenoxoyethanol, aluminum and thimerosal (mercury).

History

Belgian scientists Jules Bordet and Octave Gengou isolated the bacterium *Bordetella pertussis*, the causative agent of pertussis, which they had first observed in 1900. It would later also known as the Bordet-Gengou bacillus. In 1948 Whooping Cough Vaccine Combined with Tetanus and Diphtheria. Pertussis vaccine is administered as combination shot that contains vaccines for diphtheria (D), tetanus (T), and pertussis. Combined shot is routinely given at two, four, and six months old, between 15 and 18 months old and between four and six years old. Another booster dose is given at 12-13 years of age.

Side effect

Initial symptoms include runny nose, sneezing, fever, redness, swelling, soreness and tenderness and a mild cough. Cough slowly becomes more severe, patient experiences bouts of rapid coughing followed by the "whooping" sound .

Figure 1.5: Pertussis (Whooping Cough) Causative Agent.

Treatment and Care

The childhood vaccine is called DTaP and for adolescents and adults it is called Tdap. Pregnant women are recommended to get a booster dose of Tdap during the third trimester of pregnancy.

Complications

Complications include pneumonia, seizures, ear infections, and dehydration, rib fracture from coughing. Common complications in infants is *B. pertussis* pneumonia, which accompanies by deaths .

Contraindication to get a pertussis containing vaccine

- life-threatening allergic reaction after a previous dose.
- Suffering from brain or nervous system disease .

Precaution to get a pertussis containing vaccine

- Progressive neurologic disorder, including infantile spasms, uncontrolled epilepsy, progressive encephalopathy; defer DTaP until neurologic status clarified and stablized.

- Temperature of ≥105° F, hypotonic, hypo -responsive episode, Seizure ≤3 days , GBS <6 weeks, arthus-type hypersensitivity within 48 hours after vaccination with a previous dose of DTP or DTaP.

1.5.5 Measles Vaccination

Measles can be prevented with the MMR (measles, mumps, and rubella) vaccin. The vaccine is available both by itself and in combination with other vaccines. This includes rubella vaccine and mumps vaccine to make the MMR vaccine, in 1971. The addition of the varicella vaccine against chickenpox gave the term MMRV vaccine (Deborah, 2013).

History

Dr. Enders was known as "The Father of Modern vaccines". Enders shared the Nobel Prize in 1954 for his research on cultivating the polio virus. Dr. Thomas C. Peebles worked with Dr. John Franklin Enders, as a fellow at Children's Hospital Boston. Switching to measles study, Enders sent Peebles to Fay School in Massachusetts, where an outbreak of the disease was occured, and there Peebles was able to isolate the virus from blood samples and throat swabs. Peebles was able to cultivate the virus and show that the disease could be passed on to monkeys. Enders was able to use the cultivated virus and developed vaccine based on the Edmonston strain of attenuated live measles virus, which was named after Fay student. The first ever trials of vaccine were undertaken by David Morley in Nigeria. Dr. Maurice Hilleman developed the MMR vaccine in 1971. "Attenuvax" one form of vaccine where measles component composed of more than 40 peptide sequences. (Douglus, 2010 ; Maurice, 1992).

Adverse effect

Pain at the site of injection, red or purple discolorations on the skin, mild fever, Guillain–Barré syndrome, autism, and inflammatory bowel disease, anaphylaxis (WHO, 2009).

Contraindications

MMR vaccine should not be administered to pregnant women (Demicheli *et al.,* 2012).
HIV-infected children may receive measles vaccines if their CD4+ lymphocyte count is greater than 15% (CDC, 2011) .

1.5.6 Polio vaccine

There are two types of polio vaccines used against poliomyelitis (polio), to provide immunity to poliovirus.One uses inactivated (dead) poliovirus and the other uses attenuated (weakened) poliovirus.

Mechanism of action of vaccine

Vaccination works by priming the immune system with an 'immunogen', thus stimulating immune response, via use of an infectious agent, is known as immunization. The development of immunity to polio efficiently blocks person-to-person transmission of wild poliovirus, thus protecting both individual vaccine recipients and the wilder community (WHO, 2014) .

Figure1.6: Dose of oral polio vaccine

Adverse effect

Vaccine-derived poliovirus paralysis. vaccine-associated paralytic poliomyelitis (Plotkin, 2001; Collins & Huntly, 2000).

History of Polio vaccine

In 1936, Maurice Brodie, attempted to produce a formaldehyde-killed polio vaccine. Brodie first tested the vaccine on himself, several of his assistants and then gave to three thousand children. Many of these children developed allergic reactions, but none developed immunity to polio. Philadelphia pathologist John Kolmer also claimed to developed a vaccine at the same year, but it also produced no immunity and was blamed for causing paralytic polio. (Engels, 2005)

In March 1948 Thomas H. Weller was attempting to grow varicella virus in embryonic lung tissue. He had inoculated planned number of tubes and there were a few unused tubes. He retrieved a sample infected with polio virus from mouse brain and added it to the remaining test tubes. The varicella cultures failed to grow but the polio cultures were successful. This development greatly facilitated the development of vaccines against polio. Later Enders, Thomas H. Weller and Frederick C. Robbins, were recognized with a Nobel Prize .

Hilary Koprowski, also claimed to create the first successful polio vaccine, in 1950. His vaccine, being a live attenuated virus taken orally. Koprowski's attenuated vaccine was prepared by successive passages through the brains of Swiss albino mice. By the seventh passage, the vaccine strains could no longer infect nervous tissue or cause paralysis. After one to three further passages on rats, the vaccine was deemed safe for human use (Eddy *et al*. , 1961) (Offit , 2005).

Figure 1.7: Mass polio vaccination in Columbus, Georgia during the early days of the National Polio Immunization Program.

Figure 1.8: Administration of the polio inoculation, including by Salk himself, in 1957 at the University of Pittsburgh.

The first effective polio vaccine was developed in 1952 by Jonas Salk. The Salk vaccine had been 60–70% effective against poliovirus type 1, over 90% effective against PV2 and PV3, and 94% effective against bulbar polio. Salk's vaccine was licensed for vaccination campaigns in1955 (Hinman, 1984).

Figure 1.9: A Somali boy is injected with inactivated poliovirus vaccine (Mogadishu, 1993.

In 1961, type 1 and 2 monovalent oral poliovirus vaccine (MOPV) was licensed, and in 1962, type 3 MOPV was licensed. In 1963, trivalent OPV (TOPV) was licensed, OPV is usually provided in vials containing 10–20 doses of vaccine. A single dose of oral polio vaccine usually two drops contains 1,000,000 infectious units of Sabin 1, 100,000 infectious units of

the Sabin 2 strain, and 600,000 infectious units of Sabin 3. The vaccine contains small traces of antibiotics—neomycin and streptomycin but does not contain preservatives (Strickler *et al.*, 1998).

1.5.7 Hepatitis B vaccine

Hepatitis B vaccine is a vaccine that prevents hepatitis B. The vaccination schedule most often used for adults and children has three intramuscular injections**,** the first dose is recommended within 24 hours of birth, the second and third administered 1 and 6 months after the first. Hepatitis B vaccine is suitable for person with poor immune function suffering from HIV/AIDS and in those who born premature. It is also safe for use during pregnancy or while breastfeeding (Hamilton & Richart, 2015).

Route of administration

The vaccine is given through injection into a muscle (WHO, 2009).

Precaution to get vaccination

Rcepient should not get the vaccine if had a severe allergic reaction to an earlier dose or are allergic to yeast, because yeast is used to make the vaccine.

The following people are considered at risk for the disease and should be vaccinated :

1. Anyone who has a sex partner with hepatitis B

2.People who are sexually active but aren't in a long-term relationship in which both partners are monogamous

3. Anyone being evaluated or treated for an STD

4. People who share needles used to inject drugs

5. Anyone who lives with someone who has hep B

6. Anyone whose job routinely puts them at risk for coming in contact with blood or blood-contaminated body fluids

7. People with end-stage kidney (renal) disease

8. Travelers to regions with moderate to high rates of hepatitis B

9. People with chronic liver disease

10. People with HIV infections

History

Hepatitis B vaccine came in spotlight in 1963 when American physician Baruch Blumberg discovered "Australia Antigen" now called HBsAg in the serum of an Australian Aboriginal person. In 1968, virologist Alfred Prince found that this protein causes "serum hepatitis". The American microbiologist Maurice Hilleman at Merck used three treatments (pepsin, urea and formaldehyde) of blood serum together with rigorous filtration to yield a product that could be used as a safe vaccine. Hilleman hypothesized that he could make an HBV vaccine by injecting patients with hepatitis B surface protein lack infectious viral DNA. The immune system, recognizing the surface proteins as foreign, would manufacture specially shaped antibodies. Then, in the future, if the patient were infected with HBV, the immune system could promptly deploy protective antibodies, destroying the viruses (Blumberg & Alter 1965).

The blood-derived hepatitis B vaccine was withdrawn from the marketplace in 1986 when Pablo DT Valenzuela succeeded in making recombinant vaccine developed by inserting the HBV gene into the yeast *Saccharomyces cerevisiae*. This allows the yeast to produce only the noninfectious surface protein (Fisher & Lawrence, 1986).

Side effect

Pain at the site of injection, Guillain-Barre syndrome, demyelinating diseases such as multiple sclerosis (MS), sudden infant death syndrome, chronic fatigue syndrome (Zuckerman *et al*., 2006).

1.5.8 Combined vaccine

Table 1.3: Combined vaccine ,manufacturer and included vaccine

Vaccine	Producer	Containing vaccine	Licensed for
Infanrix	GlaxoSmithKline	3 in 1 combination shot containing diphtheria, tetanus toxoids, and acellular pertussis vaccine	children under 7 years of age
Daptacel	Sanofi Pasteur Ltd	3 in 1 combination shot containing diphtheria and tetanus toxoids and acellular pertussis vaccine	children under 7 years of age
Pediatrix	GlaxoSmithKline	5 in 1 combination shot containing diphtheria and tetanus toxoids and accelluar pertussis, hepatitis B recombinant and inactivated poliovirus vaccines	children under 7 years of age
Kinrix	GlaxoSmithKline	4 in 1 combination vaccine containing diphtheria and tetanus toxoids, acellular pertussis and inactivated poliovirus vaccines	children 4 to 6 years old

Pentacel	Sanofi Pasteur Ltd	5 in 1 combination shot containing diphtheria and tetanus toxoids and acellular pertussis, inactivated poliovirus and Haemophilus b conjugate	children under four years old
Adacel	Sanofi Pasteur Ltd	3 in 1 combination booster shot containing tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine	11 years old or older
Boostrix	GlaxoSmithKline	3 in 1 combination booster shot containing tetanus toxoid, reduced dipththeria toxoid and acellular pertussis vaccine	10 years old or older
ActHIB	Sanofi Pasteur	4 in 1 combination shot contains diphtheria and tetanus toxoids and acellular pertussis vaccine and Haemophilus Influenza b vaccine	children 15 -18 months

(Cherry, 2009).

1.6 Status of immunization

1.6.1 Bangladesh

EPI in Bangladesh was launched on April 7, 1979. EPI coverage remained less than 2% by 1984. In 1985, the Government of the People's Republic of Bangladesh committed to the Global Universal Child Immunization Initiative (UCI), and began a phase-wise process of EPI intensification from 1985-1990. During this time period, EPI was intensified throughout 476 Upazila, 92 major Municipalities and 6 City Corporations. EPI was made available to all target groups such as infants and pregnant mothers by 1990.In the year 1993 Govt. endorsed TT5 dose schedule for women of child bearing age initially from 15 to 49 years age. Polio eradication and Maternal & Neonatal tetanus elimination activities initiated in 1995. New vaccines for selected emerging diseases such as Hepatitis- B (2003) and Hib Disease have been introduced into the EPI in 2009 ,as combined Pentavalent vaccine. Measles catch up programme was conducted in 2005. Since 1995 to 2010, 18 National immunization days were conducted with 90% coverage in Bangladesh.

Table1.4: Vaccination schedule for under 1 year children available in Bangladesh

Name of the disease	Name of the vaccine	Amount of dose	No of dose	Interval between doses	Starting time for vaccination
Tuberculosis	BCG	0.05 ml	1	-	After Birth
Diphtheria Pertussis Tetanus Hepatitis-B Hib Disease	Pentavalent (DTP-HepB-Hib Vaccine)	0.5 ml	3	4 Weeks	1st Dose -6 weeks 2nd Dose-10 weeks 3rd Dose -14 weeks
Poliomyelitis	OPV	2 Drops	4	4 Weeks	1st Dose -6 weeks 2nd Dose-10

					weeks 3rd Dose -14 weeks 4th Dose-38 weeks
Measles	Measles Vaccine	0.5 ml	1	-	After completion of 9 Months
Night Blindness	Vitamin-A	1 (Blue)	1	-	With Measles

(Directorate General of Health Services ,Dhaka, Bangladesh, 2011).

Table 1.5: TT immunization schedule for the females of child bearing age (15-49 Years)

Dose number	Interval between doses	Amount of dose
TT-1	Just after 15 years of age	0.5 ml
TT-2	28 days after TT-1	0.5 ml
TT-3	6 months after TT-2	0.5 ml
TT-4	1 year after TT-3	0.5 ml
TT-5	1 year after TT-4	0.5 ml

(Directorate General of Health Services ,Dhaka, Bangladesh, 2011).

Table 1.6: Status of the childhood vaccination to the national level

Arena	Percentage
Valid complete coverage	71%
Drop-outs	20%
Invalid doses	07%
Retention of vaccination card	65%

(Directorate General of Health Services ,Dhaka, Bangladesh, 2011).

1.6.2 Introduction of new vaccine in the immunization schedule of Bangladesh

Pneumococcal vaccine

WHO estimated that 1.6 million people die of pneumococcal disease every year, this includes the deaths of 0.7–1 million children, aged <5 years. According to study pneumococcal disease to be the most prevailing in 48% of patient aged less than 6 months, and 72 % aged less than 12 months. It is estimated that one million episodes of pneumonia each year can be prevented with Pneumococcal vaccine.

Rota vaccine

According to the hospital based surveillance study carried out in Bangladesh from 2000 to 2006 revealed that 33% of all diarrhoeal admissions among children less than 5 years were due to Rotavirus and 56% of the reported rotavirus positive cases occurred in less than 1 year of aged. Incident rates of rotavirus ranged from 10.8 to 19.6/1000 children aged less than 5 years. So rotavirus vaccination is needed to eradicate this diseases.

Second dose of measles vaccine

In Bangladesh mean coverage of measles was 80-85%. With 85% vaccine effectiveness actual protection was given to only 72% (85% x 85% = 72%). In other words, at least 28% remained susceptible to measles. So it was decided in the national measles control plan 2004-2005 that measles second dose will be introduce into routine EPI to sustain the achievement of measles mortality reduction.

Birth dose of Hepatitis B vaccine

In Bangladesh it was estimated that eight per cent of Bangladesh's total population are infected with the hepatitis B virus. According to the Liver Foundation of Bangladesh 3.5 per cent of the pregnant mothers are affected by hepatitis B virus. In those countries where a high proportion of HBV infections are acquired perinatally, WHO recommend the first dose of hepatitis B vaccine <24 hours. Above evidence justify the introduction of birth dose of Hep B into the EPI schedule.

Low-dose diphtheria & tetanus toxoid

Government of Bangladesh introduced low-dose diphtheria and tetanus toxoid vaccine (Td) to the national EPI schedule from the year 2011 for strengthening of MNT control measures. WHO also advocates to introduce vaccine combinations containing diphtheria toxoid (D or d) and tetanus toxoid, rather than tetanus toxoid alone, when immunization against tetanus is indicated.

Rubella vaccine

In 2006, the surveillance system has reported 83 outbreaks of fever and rash. It confirmed by serology that, 34 of them were measles outbreaks and 26 were rubella outbreaks.In 2007,102 rubella outbreaks cases was reported but no measles outbreaks. For the year 2009 surveillance system has reported 1206 rubella cases. The above mentioned epidemiological evidence creat a demand to include it in the EPI schedule (Directorate General of Health Services ,Dhaka, Bangladesh, 2011).

1.6.3 Common socio demographic & economic obstacle affecting immunization in Bangladesh

Mother education

Mother who had completed primary level education are 1.8 times more likely to be immunized than individual who have no schooling.

Age (years) of mothers

Younger & more educated mother 40% more likely to be immunized than woman who are 30 years old or more older.

Table 1.7: Sex of the vaccinated child

Male	Female
In rural area male child 30% more likely to be vaccinated than female child	In rural area female child 30% less likely to be vaccinated than male child
In 1993-94 boys immunization coverage was 62.1	Girls immunization coverage was 55.6%.
in the 1996-97 boys immunization coverage was 55.8%	Girls immunization coverage was 52.2%
In 1999-00 boys immunization coverage increased up to 63.4%	Girls coverage increased up to 57.1%.

(Bangladesh demographic and health survey, 1999- 2000).

Table 1.8: Economic status & Distance

Effect of Economic status & Distance	
Economically advantage group	If the distance to health center is increased it has no effects of being immunized with economically advantage group & children of relatively better household had 80% better chance of being immunized.
Economically disadvantage group	If the distances to health center is increased it has negative effect of being immunized with economically disadvantage group

(Jamil *et al*., 1999).

Table 1.9: Influence of Mass media

Influence of Mass media	
Access to mass media	listening to radio once in a week has 40% higher chance of being immunized compared to those who did not listen or did not have radio.
Not access to mass media	Immunization is not at satisfactory level

(Jamil *et al*., 1999).

Health worker visit

Family planning & health worker visit play important role , where health worker are present pregnant woman are 50% more likely to be immunized than the area where health worker is not present (Jamil *et al.*,1999).

Card retention

It was found from the survey performed in Jamalgong upazilla of sunamgong district shows that, except a few, all the vaccinated children`s mother received the EPI card. Out of 205 children`s mother who received the card,174 (85%) retained it. Sometime loss of card making children`s mother discouraged by vaccinator.

Perception of the parent to vaccinate their child

To assess the knowledge of mothers, they were asked about the benefits of full immunization. From the study perform with143 mothers shown that they had not enough knowledge about the benefits of completion of all doses.

1.6.4 Common problem face during vaccination

Unofficial fee or a bribe

Official policy was that immunization services should be provided free of charge to all persons both by Government & NGOs. However, there was a widely-known practice among the government healthcare providers and other staff to charge 'unofficial' fees for many

different types of heath services, usually Tk 5.00-10.00, or about US$ 0.10-0.20 for immunization card & had to pay Tk 100.00 (about US$ 2.50) to obtain immunizations.

Loss of the immunization card

The respondents commonly mentioned that, if they lost immunization card, The vaccinators become 'angry', and they 'scolded' and even 'shouted' at them and sometime they have to pay an additional fee to obtain another card.

The side-effects of immunizations

Some mothers mentioned that their children had developed fever, swelling at the injection site, or become sick after immunization so, they did not want to allow their children to become immunized. Sometime mother is compelled to discontinue due to pressure of the other member of the family.

Long waiting time

Sometime long waiting time discourage the mother of the vaccine receiving child (Perry *et al*., 2007).

Not informed about the session day, center and place

From a study performed with 205 mothers were asked for their suggestion to increase full immunization. About two-thirds suggested that informing parent about the session day and center previously and bringing their children to an EPI centre will promote immunization. Other suggested that providing vaccines to their children at their home will increase vaccination. Organizing afternoon or evening sessions may enable working mothers to vaccinate their children at their suitable time (Quaiyum *et al*., 2008).

1.7 Immunization status in neighboring countries

Table 1.10: Coverage of BCG ,DPT1, DPT3 ,polio ,MCV , HepB and Hib in neighboring country including Bangladesh

Country	BCG coverage (%)	DPT1 coverage (%)	DPT3 coverage (%)	polio coverage (%)	MCV coverage (%)	HepB coverage (%)	Hib coverage (%)
Bangladesh	94	95	95	95	94	95	95
India	87	88	72	70	74	70	-

Pakistan	87	88	81	75	83	81	81
Afghanistan	75	86	71	71	68	71	71
Nepal	96	90	90	90	86	90	90
Srilanka	99	99	99	99	99	99	99
Maldives	99	99	99	99	98	99	-

(The State of World's Children 2012, UNICEF).

Table 1.11: Immunization related information of Bangladesh & neighboring country

Country	Under 5 mortality rate	Infant mortality rate	Neonantal mortality rate
Afghanistan	149	103	-
Bangladesh	48	38	27
Bhutan	54	44	26
India	68	48	31
Maldives	15	14	09
Nepal	50	41	28
Pakistan	87	70	41
Srilanka	17	14	10

(The State of World's Children 2012, UNICEF).

From the above data it is cleared that, EPI is successful in Bangladesh. It has reduced the death by preventing vaccine preventable diseases in infant and neonate. It has prevented an estimated 2 million deaths from 1987-2000, and continues to prevent approximately 200,000 deaths. Bangladesh is considerably in better positioned than India, Pakistan and other countries. Though, it is not enough which clearly indicated by the data of Sri Lanka and Maldives. There is a lot to improve. This is possible by the proper implementation of the EPI.

1.8 Conclusion

Vaccines have recently been recognized by the British Medical Journal as one of the greatest medical advances of the past 160 years. Indeed, vaccination is generally considered as one of the greatest public health achievements in industrialized countries during the 20th century, reducing morbidity and mortality from a broad range of vaccine-preventable diseases. With the exception of clean, safe drinking water, no treatment has rivaled immunization in reducing mortality rates. Along with enormous improvements in sanitation and hygiene, immunization is also credited with the significant increase in life expectancy observed in the past century. Vaccine use has resulted global eradication of smallpox and regional elimination of polio and measles, and has essentially eliminated most infectious diseases that causing mortality in infants and children (Worboys, 2007 ; Plotkin *et al*, 2004 ; WHO, 2007).

CHAPTER - TWO
LITERATURE REVIEW

2.1

Barriers to immunization among women and children living in slums of Zone 3 of Dhaka city, Bangladesh.

Improving the health of extremely poor people is essential for improving the health of the public more generally and for promoting equity. Disease, illness, and mortality are disproportionately concentrated among the extremely poor. Extreme poverty is inexorably linked to poor environmental conditions, such as crowding and lack of clean water and sanitation, poor nutritional status as a result of poverty and lack of food, and frequent childbearing, and all these contribute to a greater burden of disease. Furthermore, the extremely poor often lack resources which are essential for preventing or treating disease. They lack access to basic health services, lack awareness of the importance of timely use of basic health services, lack the time and money needed to use health services, and often need to address other more pressing issues. One of the most basic of all health services is immunization. This study attempted to understand the reasons that extremely poor people do not obtain immunizations. One hundred women living in the slums of Zone 3 of Dhaka city (in the central part of the city) participated in the study. Twenty women were randomly selected from each of 5 groups of women participating in an ongoing panel survey conducted by ICDDR,B: (a) mothers of minimally-vaccinated children, (b) mothers of partially-vaccinated children, (c) mothers of fully-vaccinated children, (d) mothers partially vaccinated against tetanus, and (e) mothers fully vaccinated against tetanus. Field staff with special training in qualitative techniques interviewed these women using an open-ended questionnaire. According to the respondents, the major barrier to obtaining immunizations was the fees—both official and unofficial—that clients were required to pay. Other major barriers included loss of immunization card (making mothers reluctant to go for immunizations because of a fear that the vaccinator would be upset with them), fear of side-effects, and the long-waiting time. The findings suggest that extremely poor mothers and children should be able to obtain immunizations free of charge. Vaccinators need to receive sufficient salaries and reimbursement of expenses so that they do not need to charge 'unofficial' fees. Improved counselling about side-effects and their treatment, along with

minimizing the waiting times for clients, should also improve the use of immunization services among the extremely poor (Perry *et al.*, 2007).

2.2

Coverage of Child Immunization in Rural Hard-to-reach Haor Areas of Bangladesh.

Immunization is essential to achieve the Millennium Development Goals (MDGs) of substantially reducing child mortality rates. Results of some studies suggest that the coverage of child immunization is low in hard-to-reach areas of Bangladesh. Alternative strategies for improving the immunization coverage in those remote areas have not been assessed. The study was conducted to assess the status of childhood vaccination coverage in rural hard-to-reach haor areas of Bangladesh and also to assess the acceptability of selected alternative strategies in those areas. During September–November 2006, the acceptability study was carried out in a remote hard-to-reach haor (low-lying) upazila of Sunamgonj district under Sylhet division. The World Health Organization (WHO)-recommended 30 cluster-sampling methodology was used for determining the sample size. Seven children aged 12-23 months were selected from each cluster. Data were collected through a survey, in-depth interviews, group discussions, and observations of vaccination sessions. The chi-square tests were performed to compare the coverage in the study area with the national coverage. To ascertain the status of child immunization coverage by socioeconomic status, univariate and bivariate analyses were performed. Qualitative data collected through in-depth interviews and group discussions were first transcribed and then translated into English. Data were then analyzed using content analysis.The complete immunization coverage among children aged 12-23 months was significantly lower in the hard-to-reach areas compared to the national coverage level. The drop-out rate was significantly higher in the hard-to-reach areas compared to the national level. The overall rate of invalid doses in the upazila was also higher (9%) compared to the national level (7%). Results of bivariate analysis showed that, as expected, children with more educated parents were more likely to have complete immunizations. The findings also showed that complete immunization was significantly higher among children of parents who had exposure to mass media than those who had not. The study identified the following reasons for low coverage of child immunization in the hard-to-reach areas: (a) irregular/cancelled EPI sessions; (b) less time spent in EPI spots by field staff; (c) absence of

any alternative strategy for remote areas; (d) absence of any mechanism to involve the community with the EPI; (e) side-effects; (f) invalid doses; (g) poor knowledge of mothers about benefits of complete vaccination; (h) less/absence of supervision; (i) mothers did not get information about EPI sessions; (j) an inadequate number of field workers for the increased population; (k) the post of Health Assistant (HA) remained vacant; (l) geographical barriers; and (m) lack of money to meet necessary transportation costs. The findings indicated that the existing service-delivery strategy was not sufficient to improve the immunization coverage in the hard-to-reach areas. However, most strategies assessed, such as modified EPI service schedules, organizing EPI days, EPI support groups, use of a screening tool in health centres other than EPI spots, training of service providers on invalid doses, and elimination of geographical barriers, were considered acceptable by healthcare providers for the hard-to-reach areas. The coverage of child immunization in the hard-to-reach haor areas was low, and a number of strategies were acceptable for implementation for improving the coverage in those areas. Before implementing the alternative strategies in the hard-to-reach areas, the feasibility and effectiveness of the acceptable strategies need to be tested to identify evidence-based strategies for scaling up in all hard-to-reach areas of Bangladesh (Uddin *et al.,* 2008).

2.3

Effectiveness of Combined Strategies to Improve Low Coverage of Child Immunization in Urban Slums of Bangladesh.

Rapid urbanization, high density of population, and low coverage of immunization in urban slums call for the increased emphasis on immunization coverage for vulnerable urban poor children where spread of infection is faster. The study assessed the impact of an EPI intervention package to improve the coverage of child immunization in urban slums. This was an intervention trial with pre- and post-test design. The intervention package was tested for 12 months during September 2006–August 2007 in two purposively-selected urban slums of Dhaka city. The interventions package included: (a) a modified EPI service schedule, (b) training for service providers on valid doses, (c) a screening tool to identify immunization needs among clinic attendants, and (d) an EPI support groups for social mobilization. Data

were drawn from the following three main sources: the random sample surveys to assess the immunization coverage (interview with mothers of children aged 12-23 months), service statistics, and qualitative data. Analysis of quantitative data was based on a before and after assessment of the selected immunization-coverage indicators by Pearson's chi-square test/proportions test and to compare means by t-test for continuous variables. Qualitative data collected through in-depth interviews and observations were analyzed using content analysis. The findings of the study revealed that 99% of 526 children were fully immunized after the implementation of the interventions while it was only 43% before their implementation, and the difference was highly significant. Antigen-wise coverage after the implementation of the interventions was also higher compared to before their implementation, and the difference was also highly significant. Only 1% drop-out was found after the implementation of the interventions while it was 33% before their implementation, and the difference was also highly significant. Not a single invalid dose was found after the implementation of the interventions while 22% of the children had invalid doses before their implementation. Although it was not possible to assess the individual contribution of each component intervention with great accuracy because of overlapping effects, the findings suggest that each intervention contributed to improving the coverage. Therefore, the policy-makers and programme manages should implement the package of successful interventions in all the slums of Bangladesh for improving the coverage of child immunization among this marginalized group of people. Manuals and guidelines need to be developed and distributed among service providers, and training for them is essential before scaling up of the interventions. Moreover, a team consisting of the partners of the study should provide technical assistance in scaling up the interventions (Quaiyum *et al*., 2008).

2.4

Comprehensive multi year plan of the national immunization programme of Bangladesh

Immunization has been one of Bangladesh's greatest public health success stories. It has prevented an estimated 2 million deaths from 1987-2000, and continues to prevent approximately 200,000 deaths each year. However, in order to ensure that all children of Bangladesh benefit equitably from this intervention, a strategic, i.e., long-term approach to

planning and implementation is essential. This comprehensive Multi Year Plan (cMYP) provides a framework to plan activities to achieve important objectives of the national immunization program, as contained in the national health policy. This plan sets out the medium-term (2011-2016) strategic goals of the immunization program, the related objectives, indicators, milestones, key activities and the associated costing and funding plan. Bangladesh cMYP for the immunization program is based on the Global Immunization Vision and Strategy (GIVS) - ratified by the World Health Assembly in May 2005. The approach involved three- steps: (a) identifying the key issues, (b) developing the plan, and (c) articulating the implementation, monitoring and evaluation approaches (Directorate General of Health Services, 2011).

2.5

The immunization programme in Bangladesh: impressive gains in coverage, but gaps remain.

The paper reviews the achievements in tetanus immunization coverage and child immunization in Bangladesh. It uses data from the 1993-94 Bangladesh Demographic and Health Survey to identify and examine the programmatic and non-programmatic factors that influence the coverage of tetanus (TT) immunization during pregnancy, and full immunization among children 12-23 months old in rural Bangladesh. The purpose of this analysis is to identify the areas that need further programme attention. The logistic regression results show that the coverage of TT immunization was significantly associated with proximity to outreach clinics and the presence of a health worker in the community. Home visits by health/family planning fieldworkers and the proximity to outreach clinics had larger influences on TT coverage of poorer households compared to those better-off. The effect of distance to static clinics varied by regions. Among children, full immunization coverage (coverage of all of BCG, DPT1, DPT2, DPT3, Polio1 Polio2, Polio3) was significantly associated with distance to outreach clinics, the greater the distance to the clinics, the less the likelihood of immunization (Jamil *et al*., 1999).

2.6

Effect of infant immunization on childhood mortality in rural Bangladesh: analysis of health and demographic surveillance data

Diphtheria-tetanus-pertussis (DTP) and oral polio vaccination were independently associated with decreased risk of death before age 9 months, as were amount of maternal education, maternal age, and birth order of the child. DTP vaccination was associated with increased survival (hazard ratio=0·76, 95% CI 0·67–0·88; p=0·001) in a model evaluating mortality between 6 weeks and 9 months of age. Measles vaccination was also associated with increased survival when data after late immunisation with DTP and Bacille Calmette-Guérin (BCG) were excluded. BCG vaccination was associated with reduced survival; however, children vaccinated with BCG during the first 6 months of life had significantly lower risk of death than those vaccinated later (hazard ratio=0·59; 95% CI 0·47–0·73; p=0·0001) (Streatfield *et al.*, 2004).

2.7

Inequity in childhood immunization between urban and rural areas of peshwar

Purpose of this study was to find coverage of vaccines in EPI and compare the factors related to vaccine failure or missed vaccination in urban and rural areas of Peshawar. Methods: This cross-sectional survey was conducted in Urban and rural of Peshawar from 20th to 31st of June 2010. A questionnaire was used to interview parents of 548 children, aged 1 year and below, about demographics, vaccination status, reasons for missed vaccination and views on immunization. Results from both urban and rural areas were compared to find the impact of different factors on immunization failure. The immunization coverage in urban areas was 76.5% while in rural areas it was 48.8%. Causes for non immunization were different in urban and rural areas. In urban areas, lack of awareness and care takers/parents being busy were the main reason for non immunization. In rural areas, in addition to formers, lack of accessibility to health centres and misconceptions about vaccination were major reasons for non-immunization. Parents were more educated in urban areas than rural areas. Rural areas had a lower immunization rates due to lack of awareness, low accessibility and much lower education of parents (Naeem *et al.*, 2011).

2.8

Factors affecting acceptance of immunization among children in rural Bangladesh.

This paper uses the Bangladesh Fertility Survey 1989 data to identify the factors affecting acceptance of immunization among children in rural Bangladesh. Acceptance of DPT, measles and BCG vaccinations were the dependent variables. The independent variables included proximity to health facilities, frequency of visit by health worker, respondent's mobility, media exposure, education, age, economic status of household, region of residence, and gender of child. Logistic regression analysis was performed to assess the net effects of the variables in addition to univariate analysis. Among the independent variables, proximity to health facility, frequency of health worker's visit, mother's mobility, education, age, gender of child, ownership of radio, economic condition of household, and region of residence showed statistically significant association with acceptance of immunization. The effect of frequency of health worker's visit was dependent on region of residence, possession of radio, and mother's education. The effect of mother's ability to visit health centre alone was also dependent on ownership of radio, economic condition of household, and mother's education (Chowdhury *et al*., 1995).

2.9

Immunization in urban areas: issues and strategies.

In the past, immunization programmes have focused primarily on rural areas. However, with the recognition of the increasing numbers of urban poor, it is timely to review urban immunization activities. This update addresses two questions: Is there any need to be concerned about urban immunization and, if so, is more of the same kind of rural EPI activity needed or are there specific urban issues that need specific urban strategies? Vaccine-preventable diseases have specific urban patterns that require efficacious vaccines for younger children, higher target coverage levels, and particular focus to ensure national and global eradication of poliomyelitis. Although aggregate coverage levels are higher in urban than rural areas, gaps are masked since capital cities are better covered than other urban areas and the coverage in the poorest slum and periurban areas within cities is as bad as or worse

than that in rural areas. Difficult access to immunization services in terms of distance, costs, and time can still be the main barrier in some parts of the city. Mobilization and motivation strategies in urban areas should make use of the mass media and workplace networks as well as the traditional word-of-mouth strategies. Use of community health workers has been successful in some urban settings. Management issues concern integration of the needs of the poor into a coherent city health plan, coordination of different health providers, and clear lines of responsibility for addressing the needs of new, urbanizing areas (Atkinson & Cheyne, 1994).

2.10

Factors influencing childhood immunisation in an urban area of Brazil.

The aim was to examine the factors associated with incomplete vaccination in an urban area in Sao Paulo, Brazil; and to explore whether differences in vaccine coverage in the catchment area of health centres remain after the demographic constitution of the population in these areas is controlled for.The children were selected as controls for a case-control study. 455 children were selected at random (but age matched) from the health centre registries. Data was collected from the health centre records and from home interviews.All children were registered in FAISA, a municipal health service comprising a large network of health centres and hospitals. FAISA's services are free at the point of delivery, and over 85% of the city's children are registered.Participants were selected to represent, except in their age distribution, all children registered in the municipal health service.Information was collected on subjects' vaccine history, year of birth, sex, birth order and birth weight, and health centre of registration; their mothers' age, education, and marital status; and the family's income per capita and history of migration. Analysis was undertaken to identify risk factors for vaccination and whether the differential coverage in health centres' catchment areas remained after demographic characteristics of the population were controlled for. The high coverage for DPT and polio vaccines suggests that low overall coverage was not simply a result of mothers failing to bring children for vaccination. The variable that best predicted vaccine coverage was year of birth. Children born to immigrant mothers or into large families had lower vaccine uptake. The characteristics of children and their mothers did not account for the variation in vaccination coverage in catchment areas of different health centres.It is likely

that in this area vaccination completeness was associated mainly with the health centre's ability to deliver vaccination to the target population (Barreto & Rodrigues, 1992).

2.11

Maternal education and child immunization.

This article explores the hypothesis that formal education of women results in increased child survival because of greater knowledge of the protective function of the major childhood immunizations. Education is also associated with greater awareness of proper immunization schedules. Irrespective of mother's formal education level, specific immunization knowledge is associated with an increased likelihood of using immunization. The Indonesian analysis is important as a model for preventive health campaigns among other populations with low education levels among women (Streatfield, Singarimbun & Diamond, 1990).

2.12

Barriers to universal child immunization in rural Senegal 5 years after the accelerated Expanded Programme on Immunization.

Although the Expanded Programme on Immunization (EPI) has been a worldwide success, weak points remain, particularly in Africa. In Senegal, for example, immunization coverage was low in 1990 (60%), in part because of poor results in rural areas. In order to identify obstacles to EPI in such areas, we carried out an immunization survey in Bandafassi, a rural area of Senegal, where 6078 inhabitants lived in 23 small villages. Only 41% of children aged 1-10 years were completely vaccinated in February 1992, with considerable variations in coverage from one village to another, according to their geographical location: 71% of children were completely vaccinated in villages less than 10 km from the health centre, whereas in remote villages only 10% of children had been completely vaccinated. There was no variation according to ethnic group. From 1987 to 1992, the gap in immunization coverage between the remote villages and those located close to the health centre has steadily increased. There is a need to improve the performance of the mobile teams in the remote villages and to increase awareness about the importance of immunization (Desgrées & Pison, 1994).

2.13

Maximizing immunization coverage through home visits: a controlled trial in an urban area of Ghana.

A strategy of home visits to maximize children's immunization coverage was implemented in three towns in Ghana. The strategy was tested in town 1 in a controlled trial where clusters of children were allocated to the intervention and control groups. A total of 200 mothers in the intervention group were visited at home by non-health workers and their children were referred to a routine under-fives' clinic. Subsequent home visits targeted at those who failed to complete immunization schedules were made by nurses. After 6 months, coverage had risen from 60% to 85%, which was 20% higher than in the town 1 control group of 219 age-matched children ($P < 0.005$). A similar home-visiting strategy in a neighbouring town resulted in a rise in coverage from 38% to 91% ($n = 55$), mainly through home immunizations. Children were more likely to complete the schedule if their fathers were interviewed and participated in the decision to send them to the clinic. Countries with national service programmes can use a home-visiting strategy to supplement and strengthen their routine immunization programmes. A wide range of other community-based primary health care interventions could also be tested and implemented using this methodology (Brugha & Kevany, 1996).

Objective of the study

- Highlight the present immunization status of slum dwelling child lived in urban area.
- Understand the reasons that extremely poor people do not obtain immunizations for their child in slum area.
- Identify the impact of mother`s age, education, tetanus immunization and birth order of the child on immunization of their child with valid dose.

Significance of the study

Vaccination is generally considered as one of the greatest public health achievements in the 20th century by reducing morbidity and mortality, with the exception of clean and safe drinking water, no treatment has rivaled immunization in reducing mortality.

In 1974, only 5% of the world's children received vaccination. By 2005, 75% world's children were immunized, still 25% world child is out of immunization (Iglehard, 2005).

Every year 9.2 million children aged of 5 years die from diarrhea, pneumonia, malaria. Nearly 14,000 children die every day due to pneumonia, diarrhea , where measles and tetanus still kill more than 1 million children every year aged under 5. Meanwhile from 250,000 to 500,000 children become blind every year, with 70 percent of them dying within 12 months due to lack of Vitamin A supplementation. According to UNICEF in 2008, one million child deaths could be prevented annually at a cost of $US 1 billion through interventions of immunization (UNICEF Statistics, 2015 ; UNICEF Facts on Children, 2008).

Among 22 countries where tuberculosis is considered high burden, Bangladesh is ranked 6thwith a mortality rate of 45/100,000 and an incidence rate of 225/100,000 annually. Every year 37000 child infected with tuberculosis where 12000 children die due to it (Authorstream, 2013).

In 2014, there were 6094 cases of diphtheria reported in India, 1079 in Nepal and 35 in Bangladesh, all are neighboring countries of Bangladesh ,so there is a very good chance to migrate those disease in our country (MNT, 2015).

Neonatal tetanus is still an important public health problem in both urban and rural Bangladesh, with an estimated 41,000 cases occurring annually (Bull World Health Organ, 1998).

An unprecedented global vaccination campaign against smallpox has spared over 350 million new smallpox victims and resulting 40 million deaths from the disease (Ehreth, 2003).

Poliomyelitis, causes infantile paralysis, muscle weakness. Every year from 2% to 5% of children and 15% to 30% of adults die because of muscle weakness (Atkinson *et al*, 2009) .

Since 2001, more than 190 countries and territories have been polio-free but disease still exists in about 20 countries, all in the regions of southeast asia, south asia and Sub-Sahara Africa.

According to WHO from 2000-2006, 242000 global deaths occur due to measles (WHO, 2007).

WHO estimated that 1.6 million people die of pneumococcal disease every year ,this includes the deaths of 0.7–1 million children, aged <5 years. According to a study pneumococcal disease to be the most prevailing in 48% of patient aged less than 6 months, and 72 % aged less than 12 months (Directorate General of Health Services, Ministry of Health and Family Welfare, Government of Bangladesh, 2011).

According to the hospital based surveillance study carried out in Bangladesh from 2000 to 2006 revealed that 33% of all diarrhoeal admissions among children less than 5 years were due to rotavirus and 56% of the reported rotavirus positive cases occurred in less than 1 year of aged. Incident rates of rotavirus ranged from 10.8 to 19.6/1000 children aged less than 5 years (Directorate General of Health Services, Ministry of Health and Family Welfare, Government of Bangladesh, 2011) .

According to a study perform on urban slum dwelling child of Dhaka city in 2008 mentioned that only 53% boys and 47% girls were immunized in urban slum area where proportion of fully-immunized children aged ≤ 12 months was only 54%, drop-outs rate was 33%, invalid doses rate 22%, card retention rate was 64%. On the other hand to the national level valid complete coverage is 71%, drop-outs rate is 20%, invalid doses rate 7%, card

retention rate is 65%. (Directorate General of Health Services, Ministry of Health and Family Welfare, Government of Bangladesh, 2011 ; Quaiyum *et al.*, 2008)

So from the above data we can see that slum dwelling child are under served one and their immunization status is relatively poor compare with national level status and unfortunately still under 5 infant morality rate in Bangladesh is 38 per 1000, where post neonatal deaths aged 1-59 months occurred due to pertussis 1%, tetanus, 1% measles 3%,diarrheal diseases 15%,pneumonia 28% due to lack of proper immunization. In this study we select parent of slum dwelling child or primary caregiver in case working parent to conduct our study. So through our study we will be able to highlight the present immunization status of slum dwelling child lived in urban area .Here we will also be able to understand the reasons that extremely poor people do not obtain immunizations for their child and formulate recommendations for designing an appropriate programme for improving the immunization coverage. At the same time increasing awareness among parent and respondent regarding the status of child immunization.

Furthermore we will also be able to get idea how mother`s age, education, tetanus immunization and birth order of the child playing a vital role to immunize their child with valid dose.

CHAPTER – THREE

MATERIALS &METHOD

3. Materials & Method

3.1 Place of study:

This study was performed in 6 slum area of Gazipur district, Bangladesh.

- Kalabaghan slum area
- Koroibaghan slum area
- Jinnat nagar slum area
- Lalmasjid slum area
- Nama bazaar slum area
- Ershad nagar slum area

3.2 Sample size

Here face to face conversation was performed with parent or primary caregiver of the child. Data were collected from 200 participants having or looks after children aged less than or equal to five years. For this purpose I have made a standard questionnaire format with the help of my Supervisor.

3.3 Study period

Two months were spent for selection of topic, development of the protocol. Subsequent months were spent on, data analysis, report writing. Data collection period was march 2016 to may 2016. To complete the study in time, a work schedule was prepared depending on different tasks of the study.

3.4 Data collection method

This survey was carried out with a standard questionnaire by directly interviewing the parent or primary caregiver. Here the each participant was being informed the purpose of the study and then noted down the answer of their question to the questionnaire format.

3.5 Inclusion criteria

- Children always included a general population of both gender.
- Only slum dwelling children should be included.
- Children should be ≤ 5 years of age.

3.6 Exclusion Criteria

- Unwilling to participate or unable to comply with protocol requirements

3.7 Data analysis

All the data were checked after collection. Then data were entered into computer and the collected data were analyzed with the help of Microsoft® Excel 2007 and filtered out accordingly for analysis . Data are presented as actual numbers, percentages and proportions. Outputs were presented in both graphs and tables. The results were shown in Horizontal bar, column chart and pie chart .

CHAPTER–FOUR

RESULT

4.1 Age group of the slum dwelling children

In this study after interviewing parent or primary caregiver of the child it was found that (47%) children were aged of less than 12 months ,where (25.50%) child`s age ranged between 13 months to 24 months ,(10%) child`s age ranged between 25 months to 36 months, ,(9%) child`s age range between 49 months to 60 months and (8%) child`s age ranged between 37 months to 48 months.

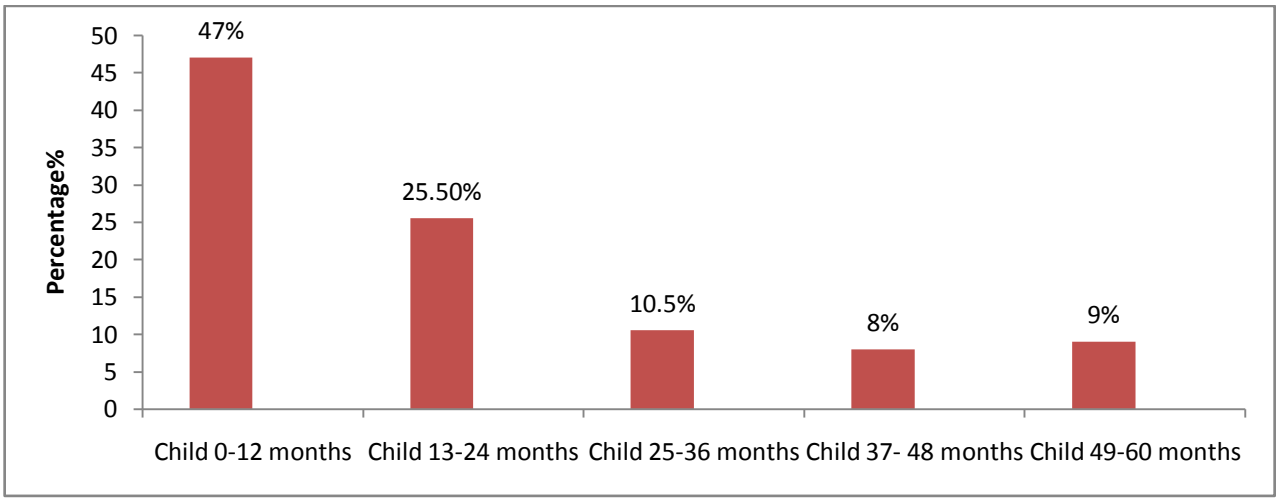

Figure 4.1: Age distribution of the slum dwelling child aged ≤ 60 months.

4.2 Gender distribution of the slum dwelling children

In this study (51%) immunization recipient were male children and (49%) immunization recipient were female children.

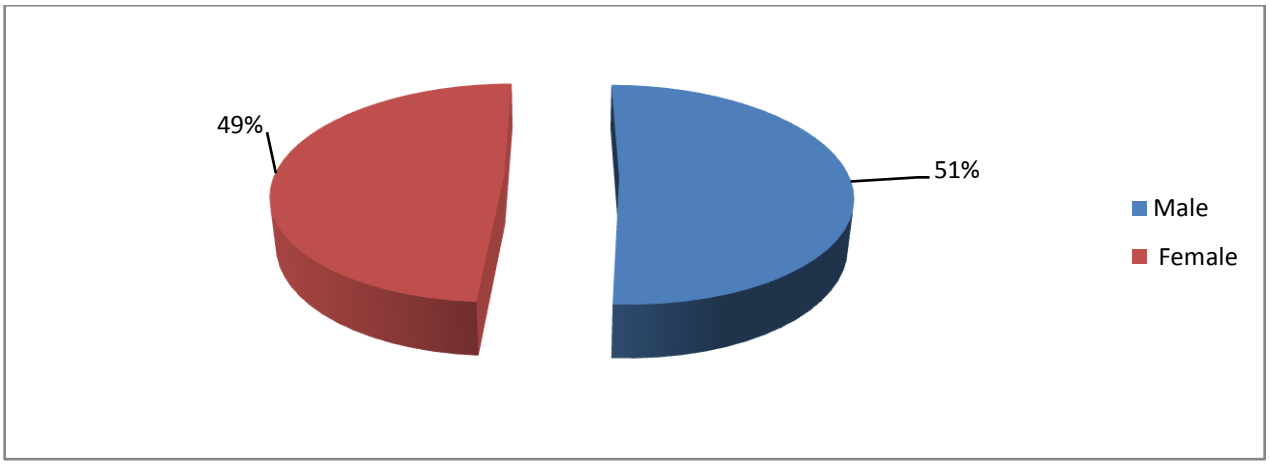

Figure 4.2: Gender distribution of the slum dwelling child.

4. 3 Religion of the slum dwelling child

Majority recipient were muslim (93.50%) and (6%) immunization recipient were hindu children, where others recipient were (0.50%).

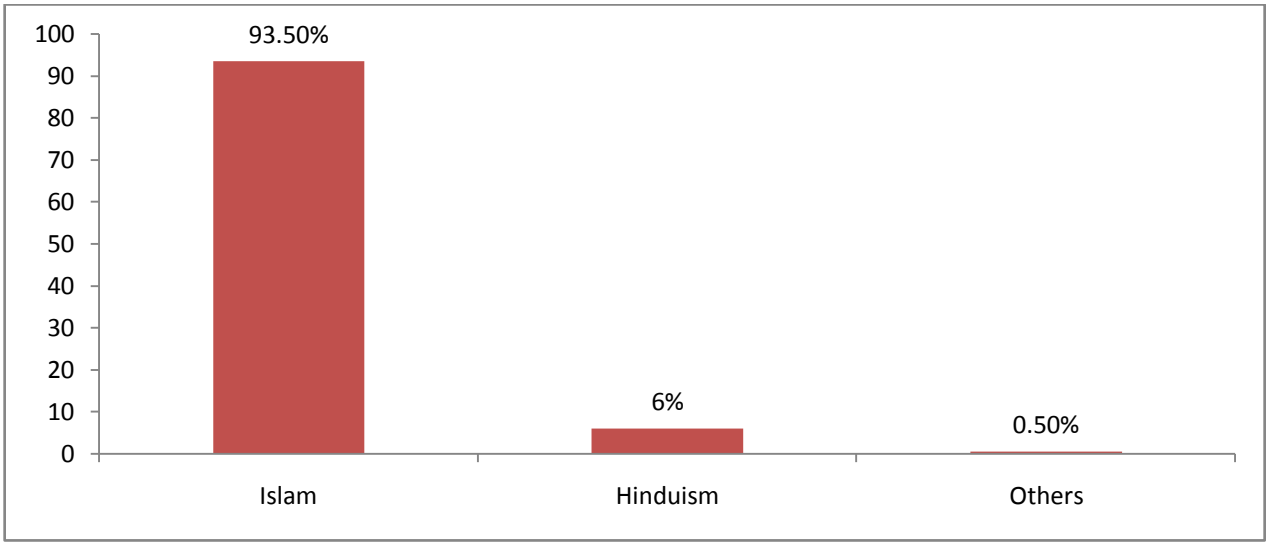

Figure 4.3: Religious status of the slum dwelling child.

4. 4 Respondent for the slum dwelling child

In this study during interviewing the parent or primary caregiver of the child it is noticed that mother was respondent for (81.50%) child , father was respondent for (10%) child and others respondent were (8%).

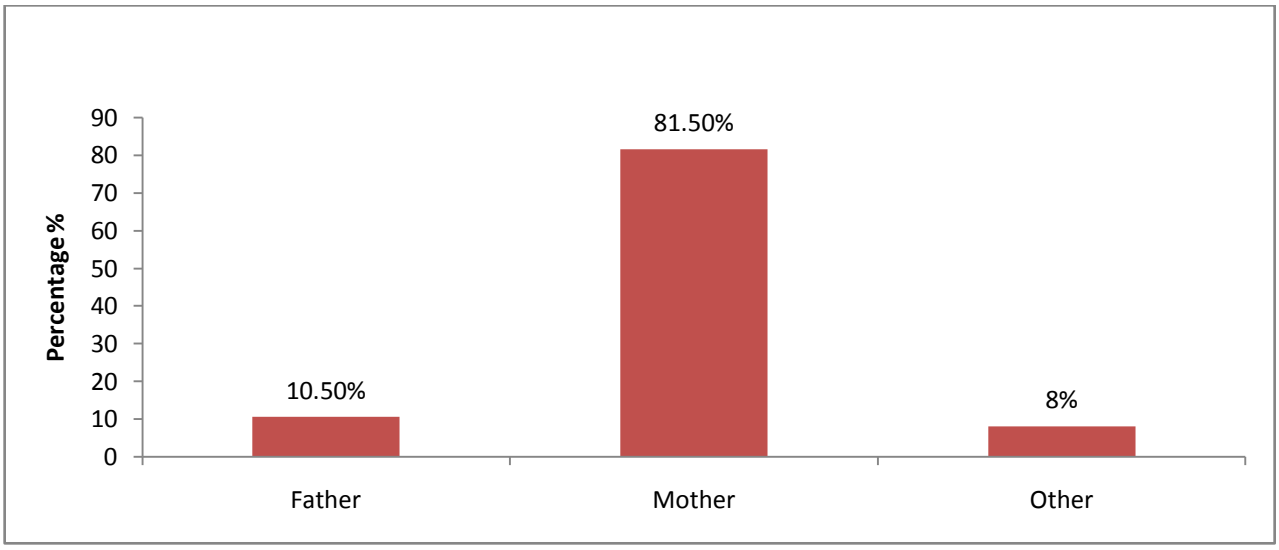

Figure 4.4: Respondent for the slum dwelling child.

4. 5 Age group of the father

Maximum slum dwelling child`s fathers age (62%) ranged between 20-30 years where (35%) father`s age ranged between 31-40 years and (3%) father`s age ≥ 41 years.

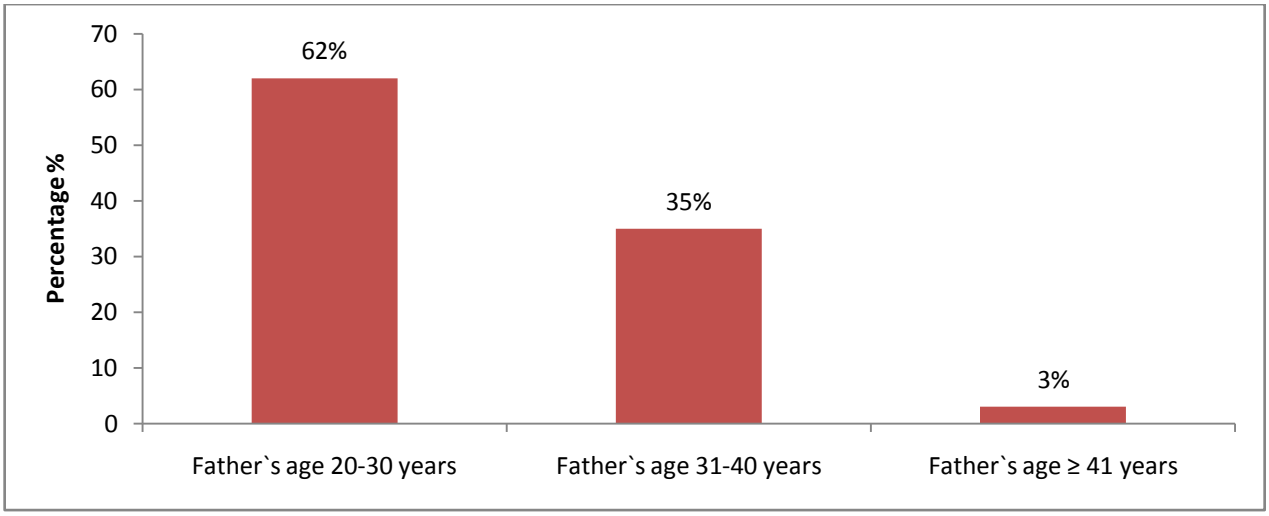

Figure 4.5: Age group of the father of the slum dwelling child.

4.6 Age group of the mother

From the **Figure 4.6** it was found that (57.50%) slum dwelling child`s mothers age ranged between 21-30 years, where (32.50%) mother`s age ≤ 20 years and(10%) mother`s age ranged between 31-40 years.

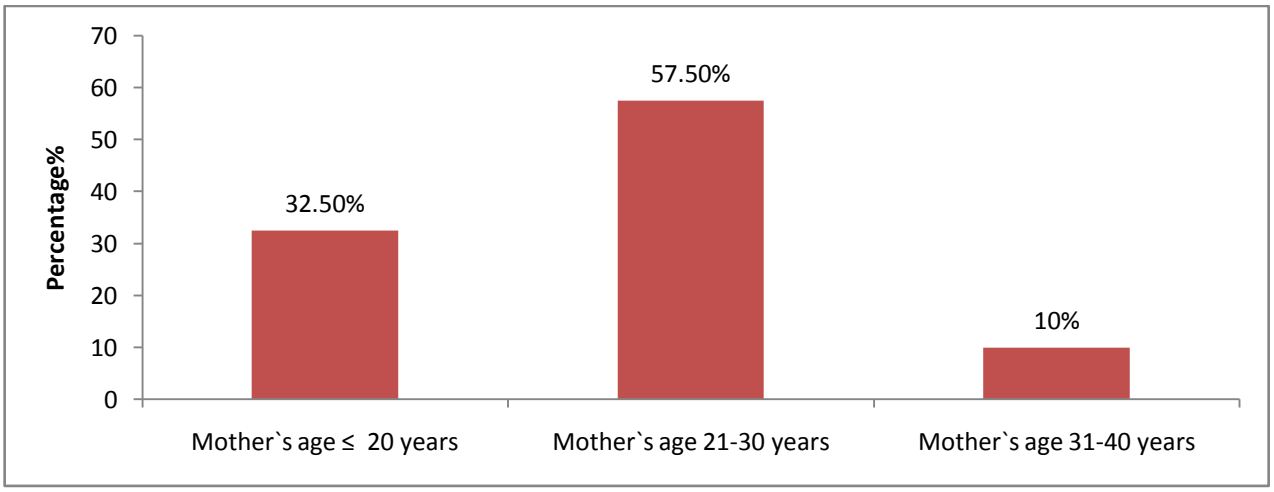

Figure 4.6: Age group of the mother of the slum dwelling child.

4.7 Educational status of the father of slum dwelling child

In this study after interviewing parent or primary caregiver of the child it was found that (33%) slum dwelling child`s father completed primary level education. On the other hand (27%) completed education up to S.S.C level and (13%) completed education up to H.S.C level . At the same time (15%) slum dwelling child`s father were illiterate and (5%) had below primary level education.

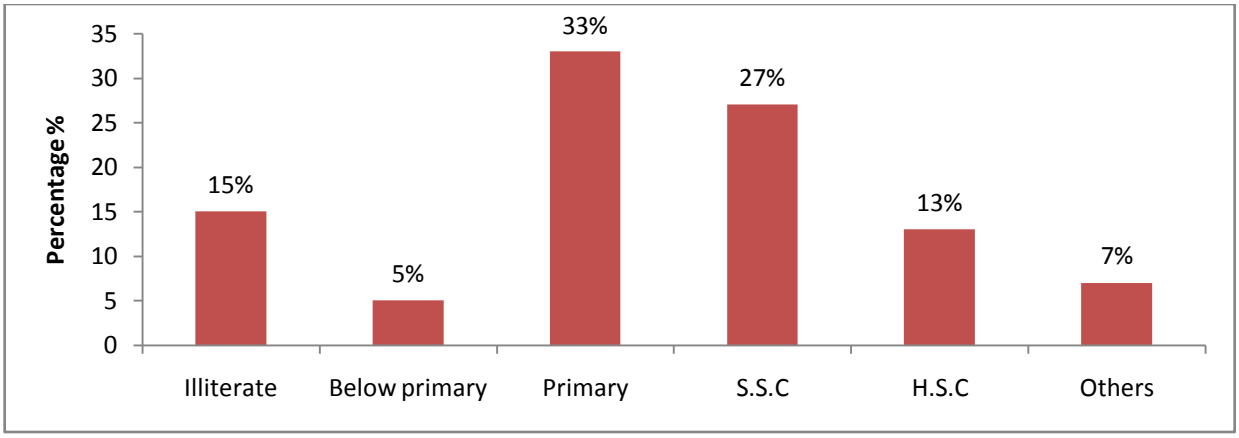

Figure 4.7: Educational status of the father of slum dwelling child.

4.8 Educational status of the mother of slum dwelling child

Majority mother (51.50%) of slum dwelling child completed primary level education .On the other hand (15.50%) mother completed education up to S.S.C and (3%) mother completed education up to H.S.C level. At the same time (12%) slum dwelling child`s mother were illiterate and (11.50%) had below primary level education.

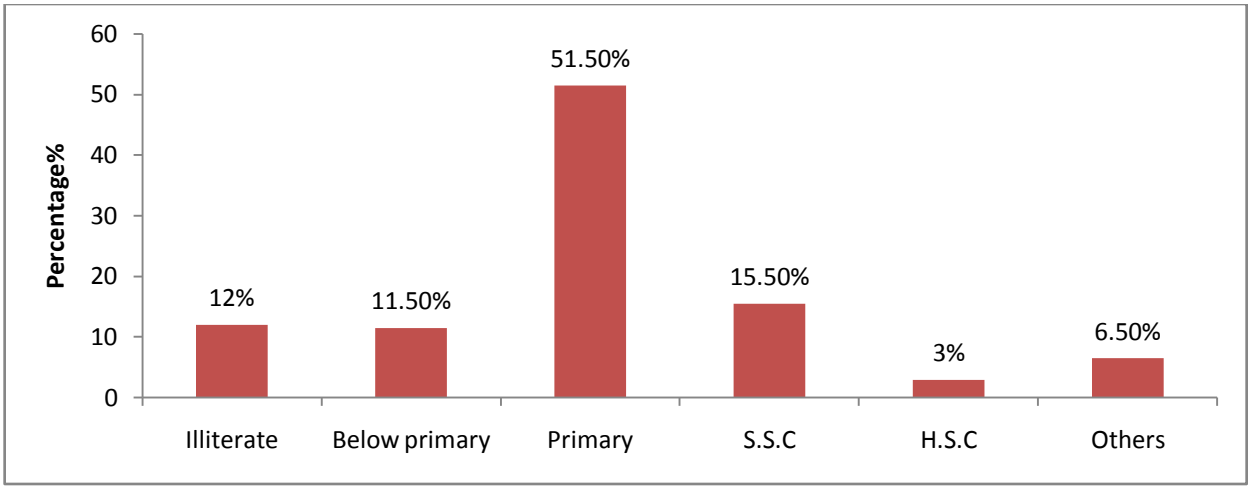

Figure 4.8: Educational status of the mother of slum dwelling child.

4.9 Occupation status of the father of slum dwelling child

In this study after interviewing parent or primary caregiver of the child we observed that (31%) slum dwelling child`s father were garment worker and (25.50%), (16%), (7%) were shop-keeper, day labor ,rickshaw puller respectively. On the other hand (17%) slum dwelling child`s father had other profession and (3%) were unemployed.

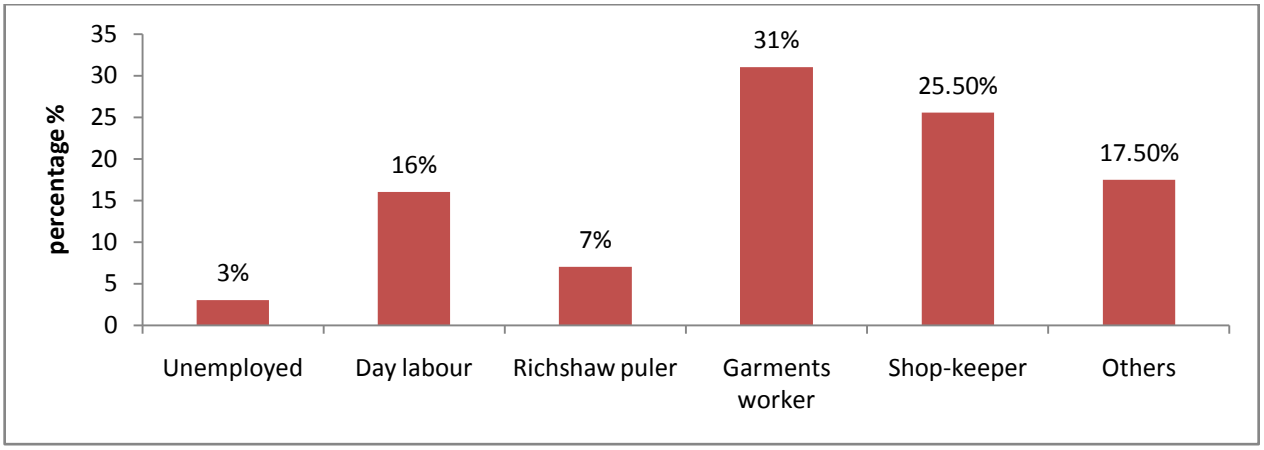

Figure 4.9: Occupational status of the father of slum dwelling child.

4.10 Occupation status of the mother of slum dwelling child

From this study we found that (49.50%) slum dwelling child`s mother were housewife and (25.50%), (9%), (1.50%) mother were garments worker, house maid ,day labor respectively. On the other hand (17%) mother had no profession and (0.50%) mothers were business woman.

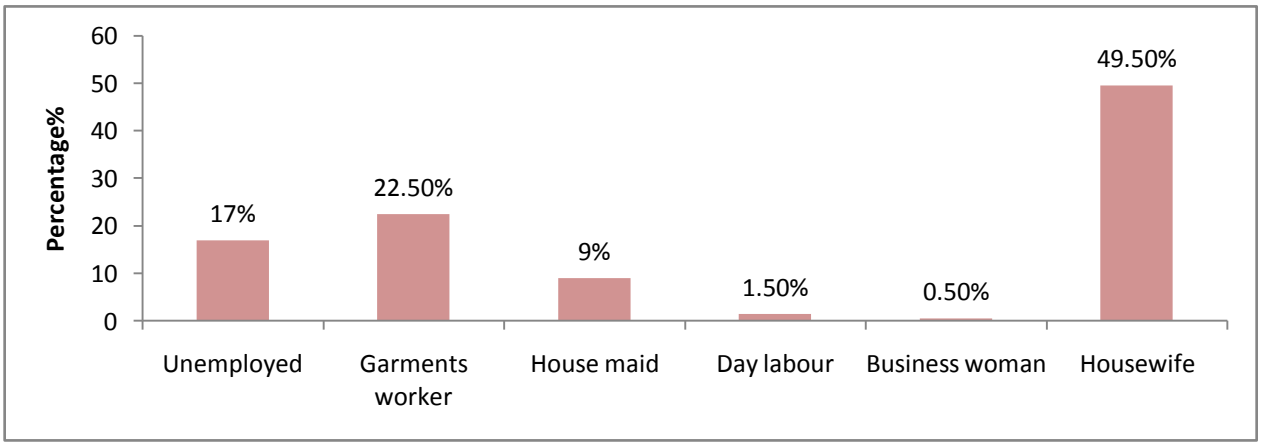

Figure 4.10: Occupational status of the mother the slum dwelling child.

4. 11 Family income

(52%) slum dwelling child`s family income ranged between 10000-15000 tk. and (37%) slum dwelling child`s family income ranged between 5000-10000 tk. . On the other hand (10%) slum dwelling child`s family income were above 15000 tk. and(1%) slum dwelling child`s family income were below 5000 tk.

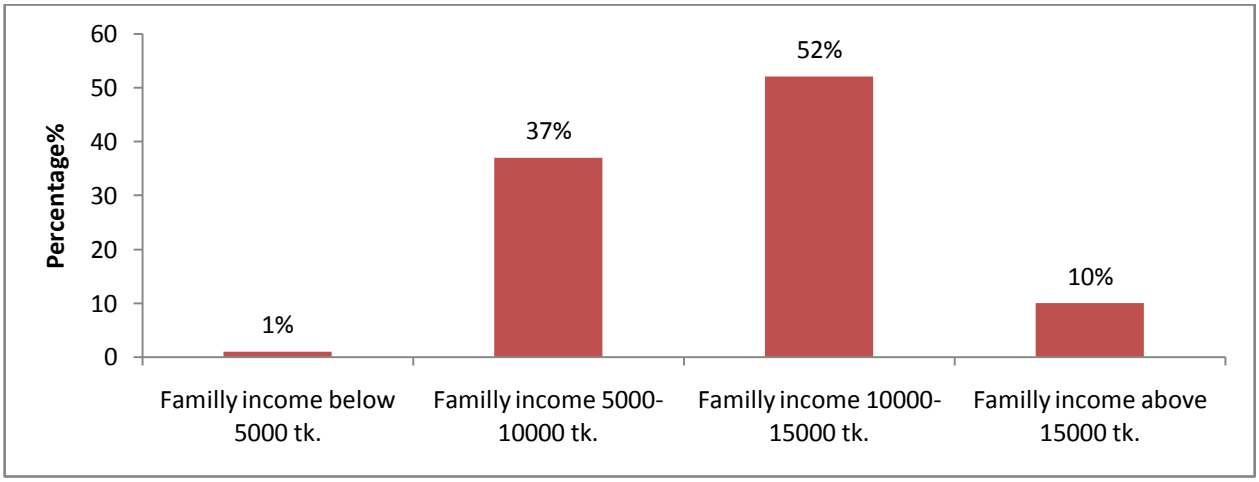

Figure 4.11: Income of the family of slum dwelling child .

4.12 Birth order of the child

It was revealed from the study that among 200 data of slum dwelling child ,(71%) child were first child of the parent ,(18.50%) were second child, (6%) child were third child, (2.50%) were fourth child and (2%) child were fifth child of the parent.

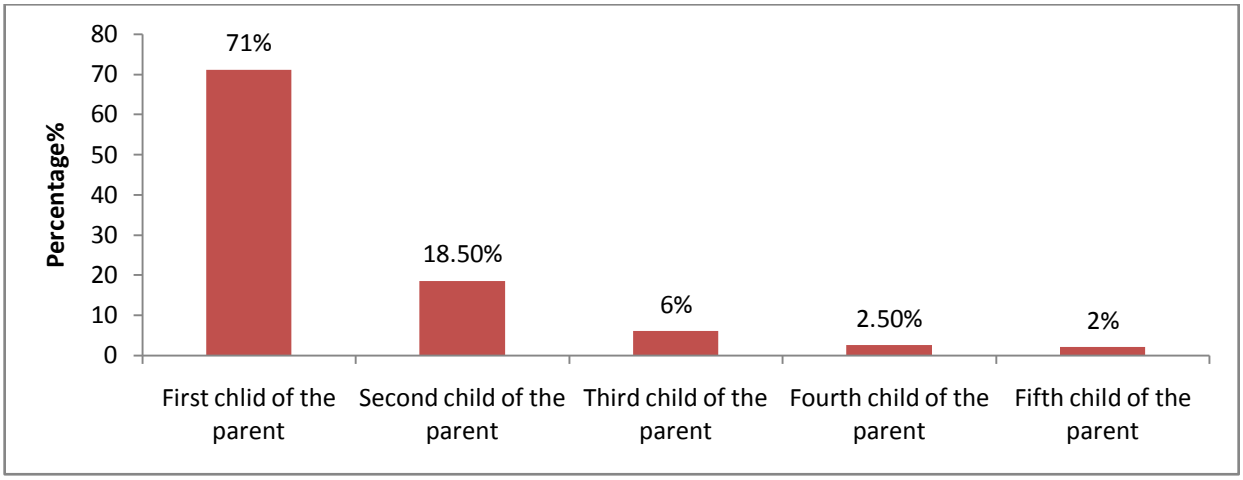

Figure 4.12: Birth order of the slum dwelling child.

4.13 Primary caregiver of the child

(92%) slum dwelling child were looked after by mother and (1.50%) child were looked after by father, On the other hand (6.50%) slum dwelling child were looked after by others people.

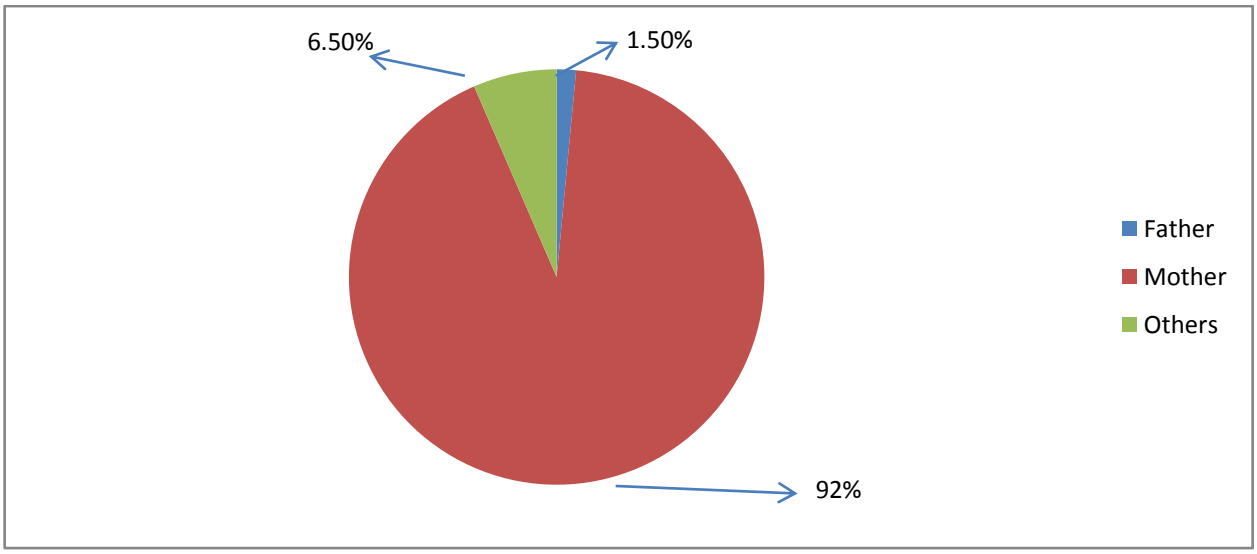

Figure 4.13: Primary caregiver of the slum dwelling child lived.

4.14 Caregiver knowledge about vaccination

Most of the parent or primary caregiver (98%) knew about vaccination, On the other hand (2%) parent or primary caregiver of the slum dwelling child didn`t have any knowledge about vaccination.

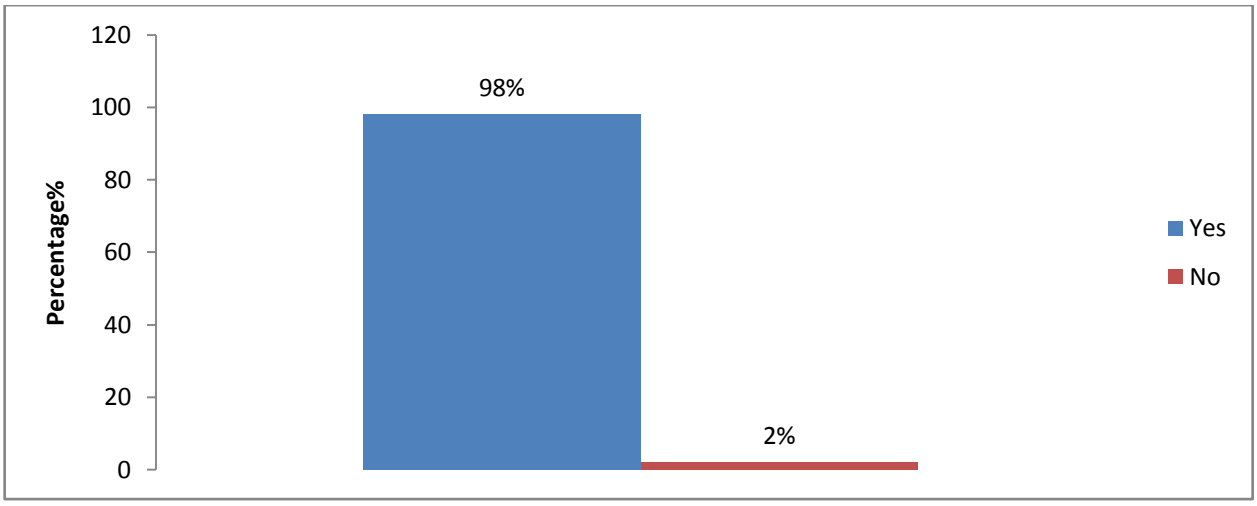

Figure 4.14: Caregiver knowledge about vaccination.

4.15 Source of information

Health care provider was the main source of information for (35.86%) parent or primary caregiver of slum dwelling child ,where (18.14%),(14.77%),(11.81%),(8.02%),(5.91%) and (2.11%) parent or primary caregiver got informed about immunization through neighbors, miking, television, relatives, educational institute and radio. On the other hand (3.38%) got informed about immunization through other sources.

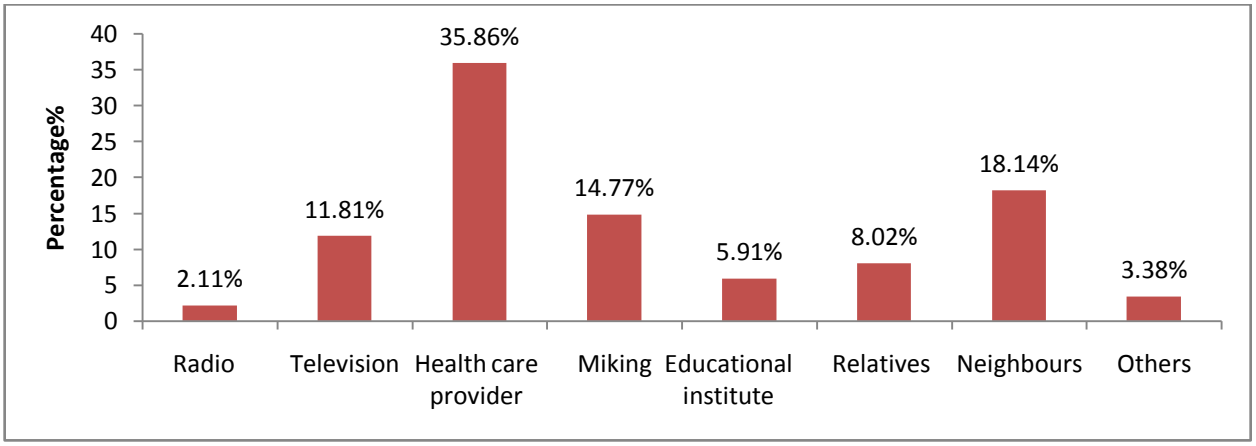

Figure 4.15: Source of information of parent or primary caregiver.

4. 16 Status of vaccination card

It was revealed from the study that (95%) slum dwelling child`s parent or primary caregiver received vaccination card & retained it and (3.50%) received vaccination card but didn`t have it now. On the other hand (1.50%) slum dwelling child`s parent or primary caregiver never received vaccination card.

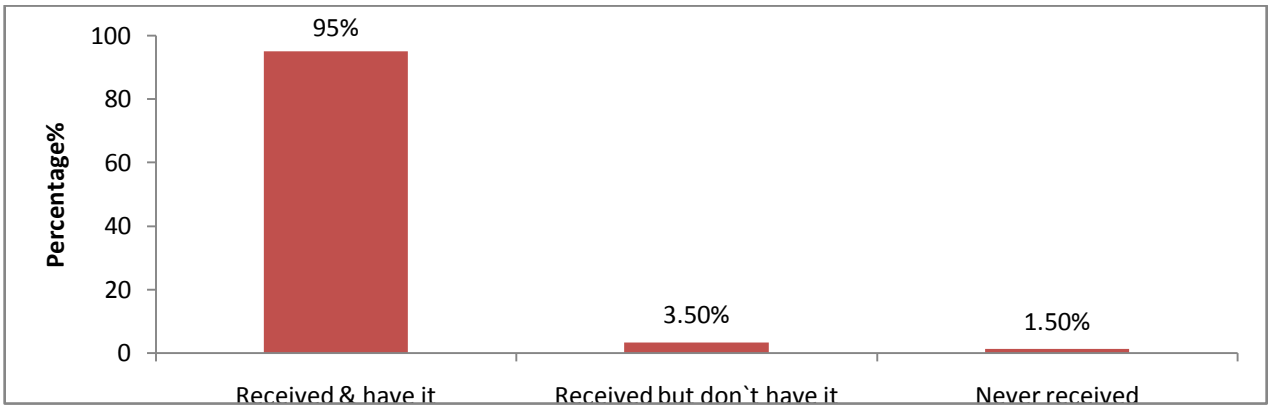

Figure 4.16: Status of the vaccination card.

4.17 Reason(s) behind vaccination (from caregiver`s point of view)

(61.97%) slum dwelling child`s parent or primary caregiver believed that immunization was good for child as a reason behind to get it and (29.11%) , (4.23%) ,(0.47%) said about immunization as a reason to get it that immunization protect from diseases, rule of Govt. or doctor & relative advised them to do respectively. On the other hand (1.50%) said that as other people immunized their baby so they also did that.

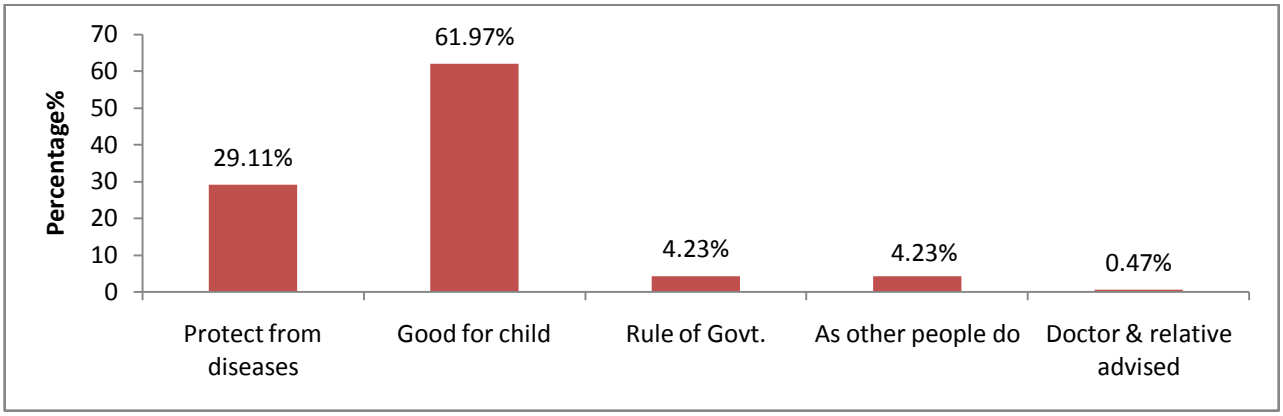

Figure 4.17: Reason(s) behind vaccination.

4. 18 Adverse effect after taking immunization dose

After interviewing parent or primary caregiver of the child it was revealed that (35.14%) slum dwelling child experienced fever after taking immunization dose and (18.15%), (12.36%), (3.86%) experienced abcess, pain, hypersensitivity after taking immunization dose respectively .On the other hand (29.34%) slum dwelling child experienced no adverse effect and (1.16%) experienced others effect.

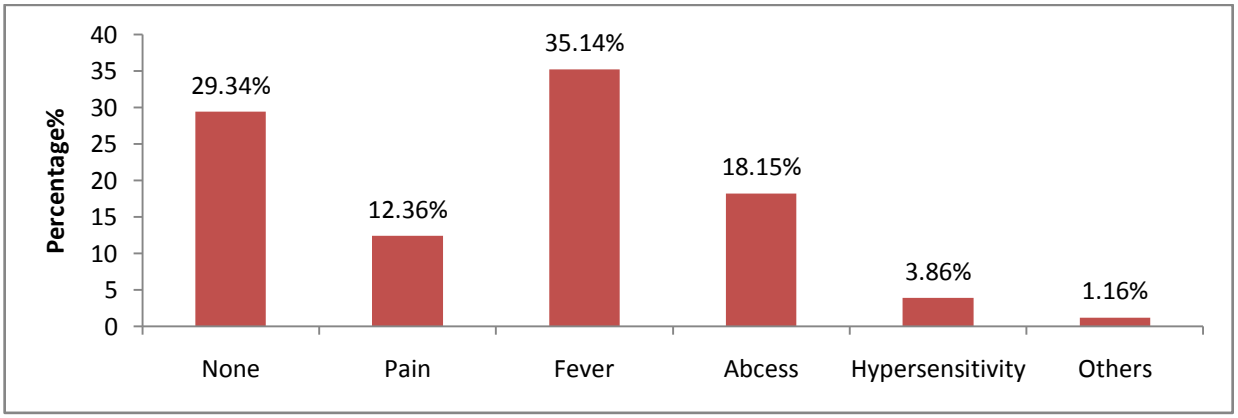

Figure 4.18: Adverse effect after taking immunization dose.

4.19 Status of the recipient on the basis of receiving immunization doses

In this study we profoundly observed that (48.50%) slum dwelling child were valid dose recipient where dropout recipient were (40%), invalid dose recipient were (10.50%) and left out recipient were (1%).

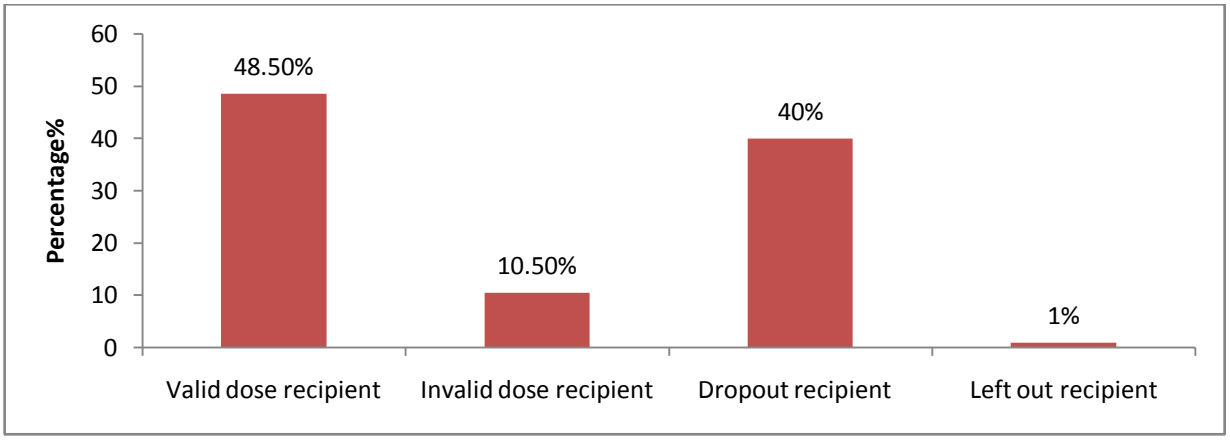

Figure 4.19: Status of the recipient on the basis of receiving immunization doses.

4.20 Cause of dropout

Major cause of dropout of immunization, was lack of concern of parent or primary caregiver (57.5%) , where other cause of dropout were, not informed about time schedule (8.75%), too busy (8.75%), child was sick(7.5%), lost vaccination card(6.25%), not informed about place (3.75%), cultural & religious hindrance (3.75%), fearing side effect(2.5%) and distant place (1.25%).

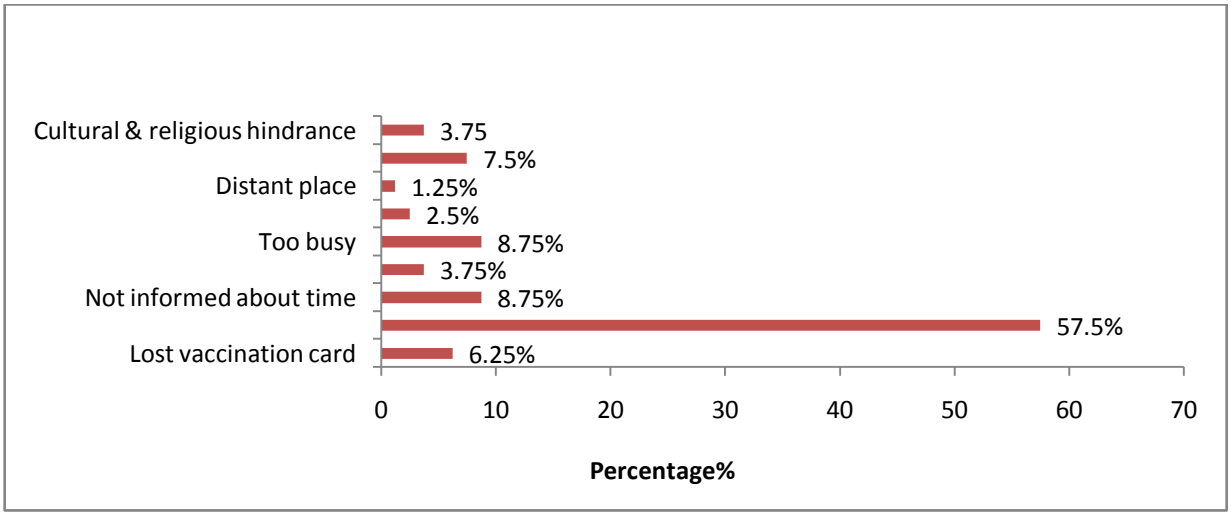

Figure 4.20: Cause of dropout.

4.21 Preferred time schedule of the caregiver to vaccinate the child

From the **Figure 4.21** we found that (81.50%) slum dwelling child`s parent or primary caregiver preferred morning session (8am - 2pm) to vaccinate the child convincingly and (29.11%) preferred evening session (2- 5 pm) to vaccinate the child . On the other hand (11%) slum dwelling child`s parent or primary caregiver preferred any time and (0.50%) preferred others time to vaccinate the child .

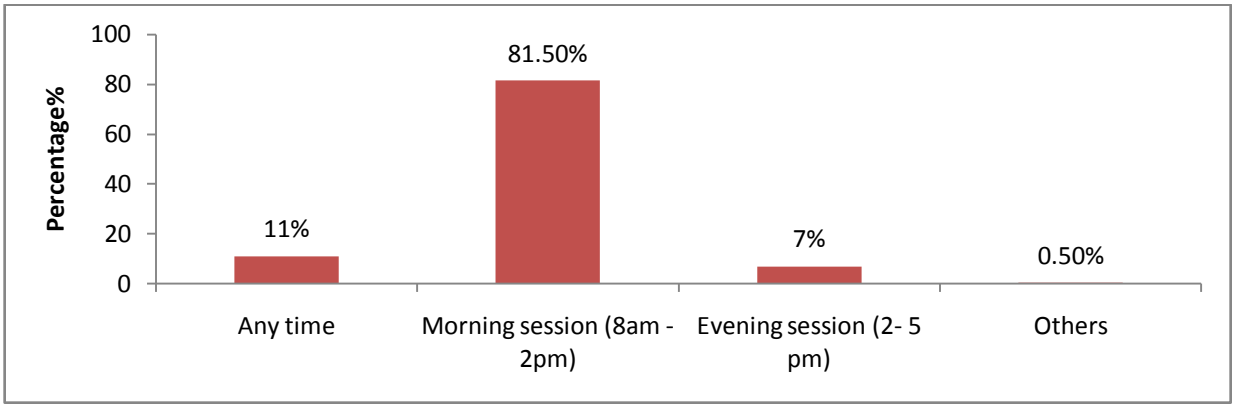

Figure 4.21: Preferred time schedule of the parent or primary caregiver to vaccinate the child.

4.22 Reasons behind for preferring morning session

Most the parent or primary caregiver preferred morning session (8am - 2pm) to vaccinate the child because, household activities could be done later after obtaining immunization (37%), pain would remove early in the next day (30%), and others reason to prefer morning session (16%).

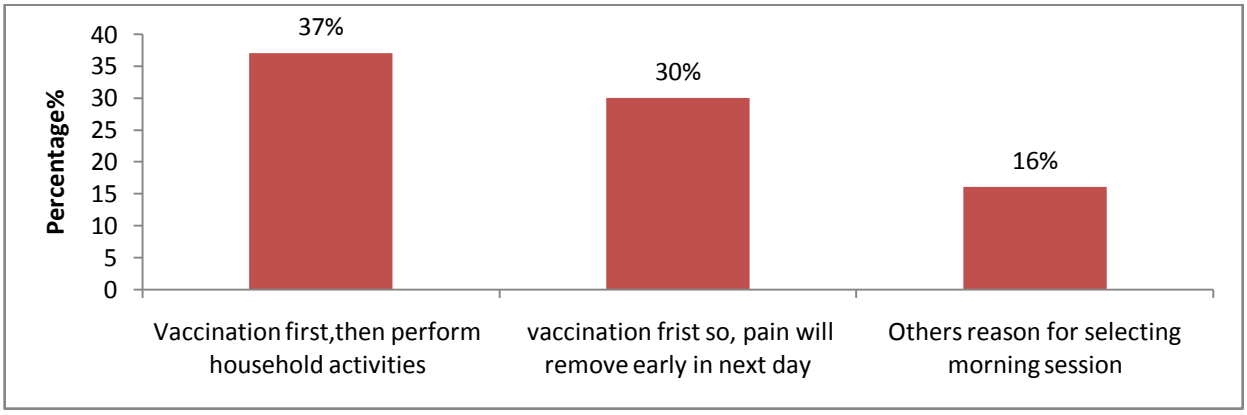

Figure 4.22: Reasons behind preferring morning session to vaccinate the child.

4. 23 Reasons behind preferring evening session

From the study we found that reasons behind for preferring evening session (2- 5 pm) to vaccinate the child were, garments going mother could vaccinate their child in their lunch break (3%), comparatively less gathering in evening session (3%) and Others reason for selecting evening session (2%).

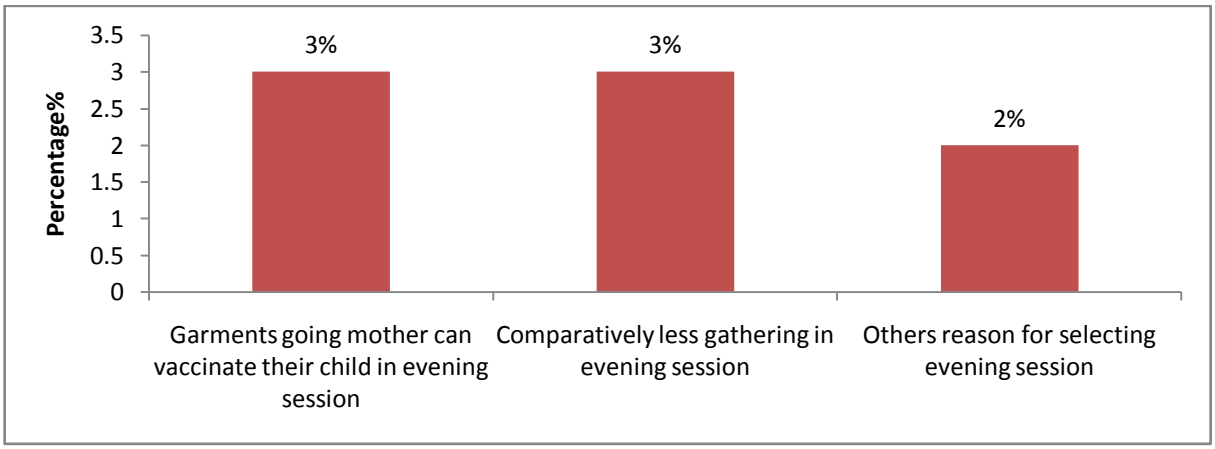

Figure 4.23: Reasons behind preferring evening session to vaccinate the child.

4. 24 Choice of vaccination place

After profound interview of parent or primary caregiver of the child, we noticed that (56.93%) slum dwelling child`s parent or primary caregiver preferred vaccination center as a choice of vaccination place and (30.20%), (8.42%) preferred hospital, NGO center as a choice of vaccination place respectively .On the other hand (4.46%) slum dwelling child`s parent or primary caregiver preferred own house to vaccinate their child.

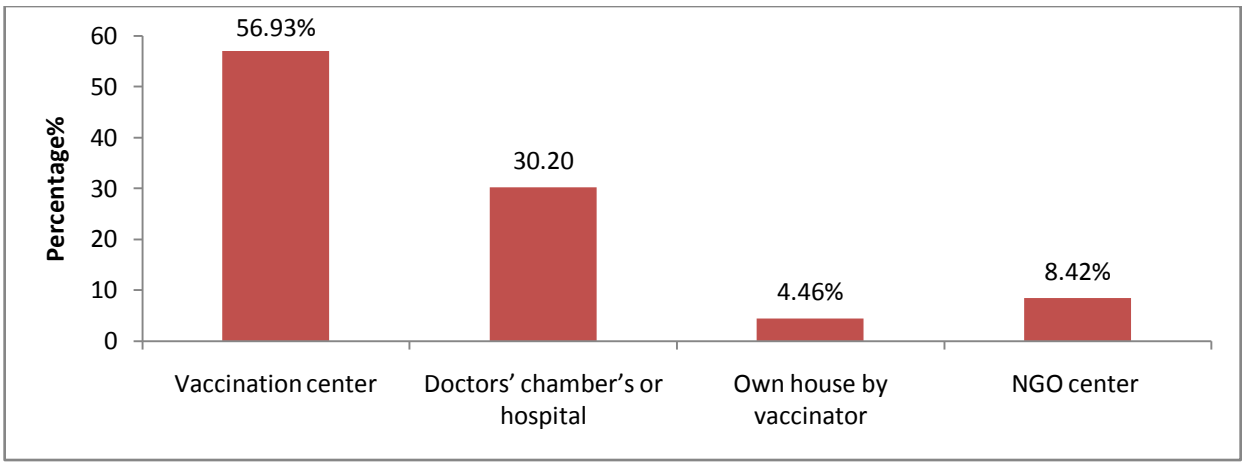

Figure 4.24: Choice of vaccination place.

4.25 Common problem faced during vaccination of the child

Long waiting time (17.48%) was the most common problem faced by slum dwelling child`s parent or primary caregiver during vaccination of the child where unofficial fee (11.17%), shortage of vaccine (7.77%), loss of card making respondent upset (0.98%), others problem (3.40%). On the other hand (59.22%) parent or primary caregiver mentioned that they do not face any problem to vaccinate their child.

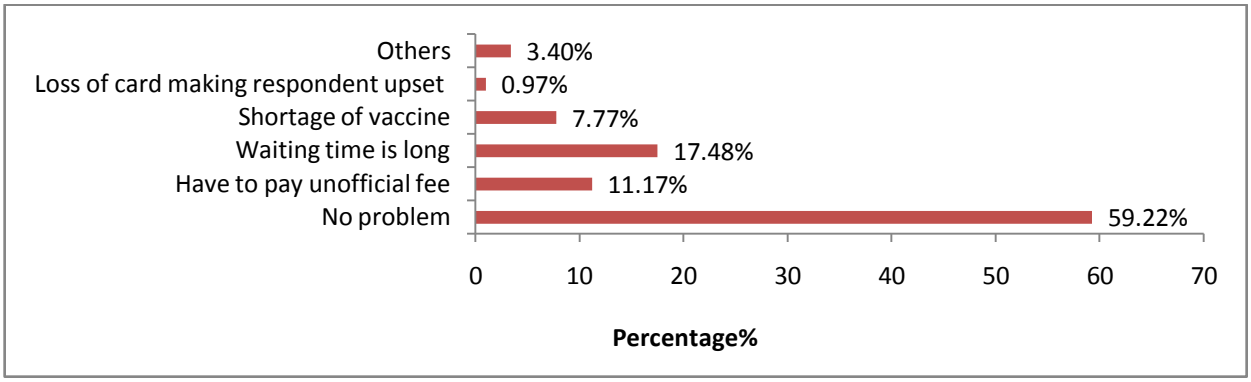

Figure 4.25: Common problem faced during vaccination of the child.

4.26 Suggestion to achieve full immunization

In this study we noticed that most common suggestion of slum dwelling child`s parent or primary caregiver to achieve full immunization was, inform about session day and center previously (47.60%) ,where provide vaccines at home (37.98%), find dropout cases & ensure immunization (6.73%), provide sufficient EPI support group & training (2.88%), provide medicine for side-effect (2.40%) .On the other hand (2.40%) parent or primary caregiver suggested other method to achieve full immunization of their child.

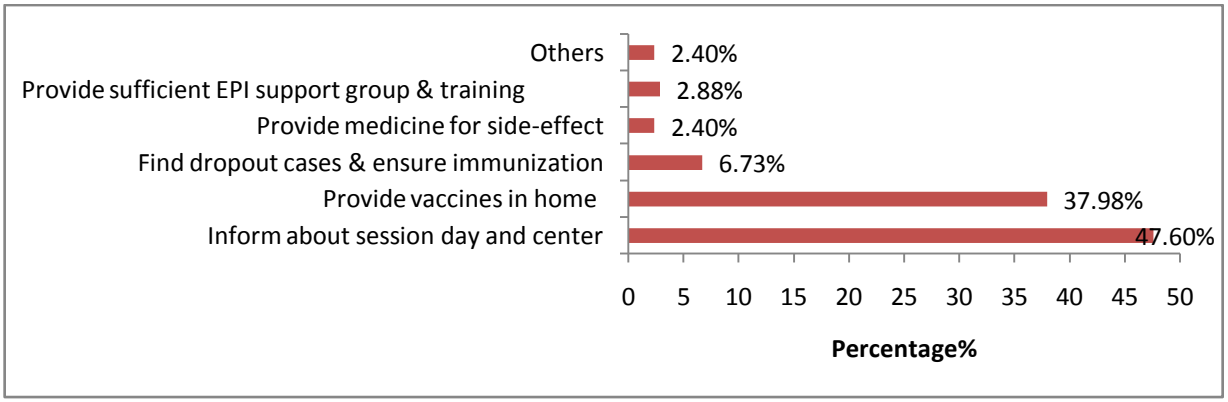

Figure 4.26: Suggestion of the parent or primary caregiver to achieve full immunization.

4.27 Childhood immunization status of the mother

After interviewing mother of slum dwelling child we observed that (57.50%) mother were immunized where not immunized (3.50%), partially immunized (13.50%), and could not remember or did not know about it (25.50%).

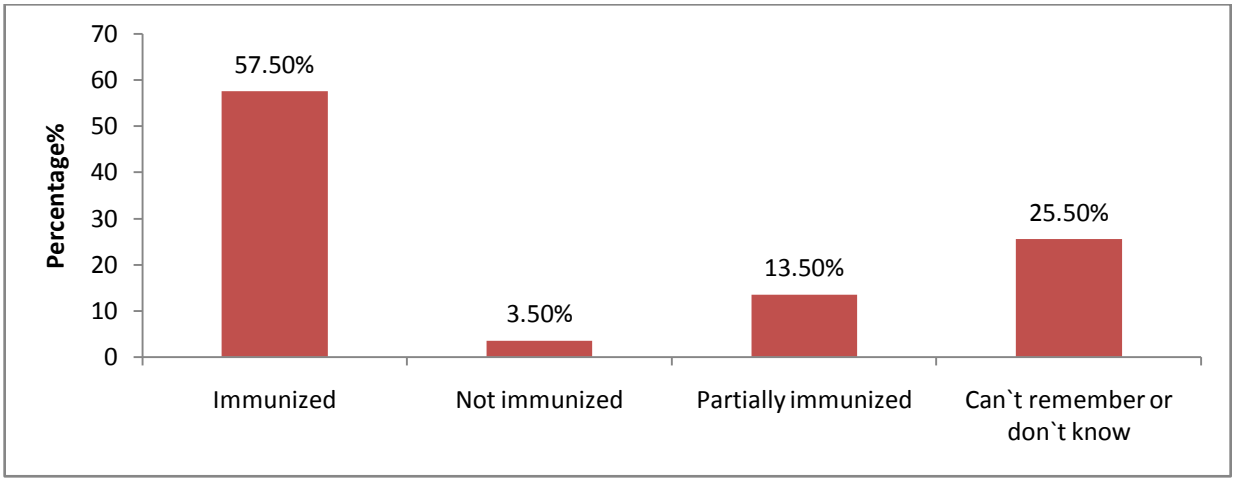

Figure 4.27: Childhood immunization status of the mother.

4. 28 Tetanus immunization status of the mother

It was revealed from the study that (60.50%) slum dwelling child`s mother received tetanus immunization during their pregnancy, where mother were tetanus non immunized (29%) , don`t know or can`t remember about their immunization status (10.50%).

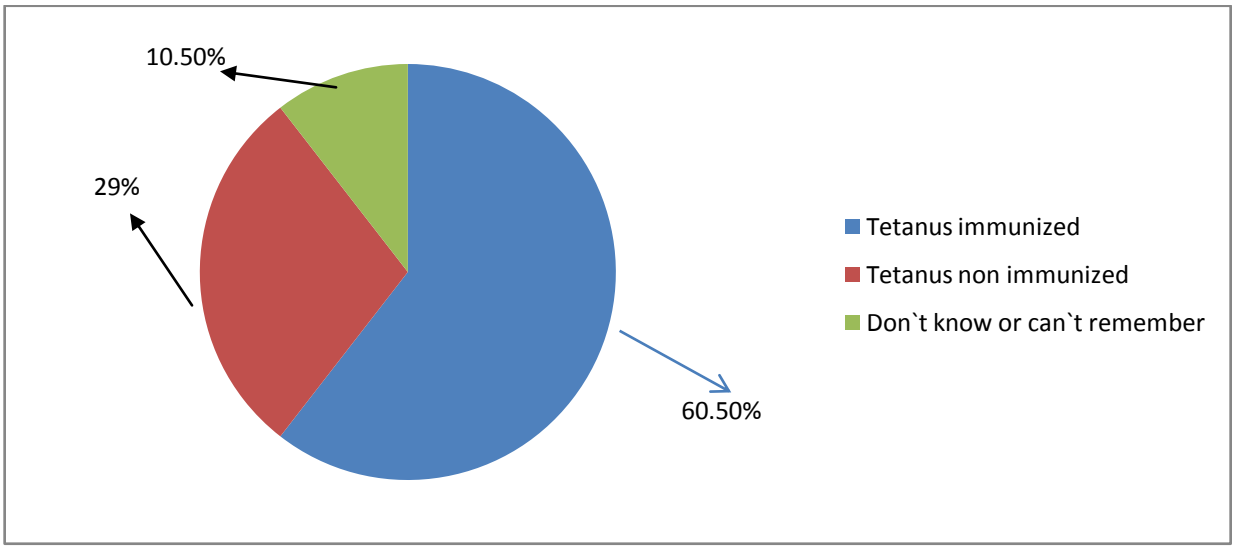

Figure 4.28: Tetanus immunization status of the mother.

4. 29 Adult immunization status of the mother

Most of the mother of slum dwelling child were not immunized with adult vaccine (86.50%) while (13.50%) mother had no idea about it.

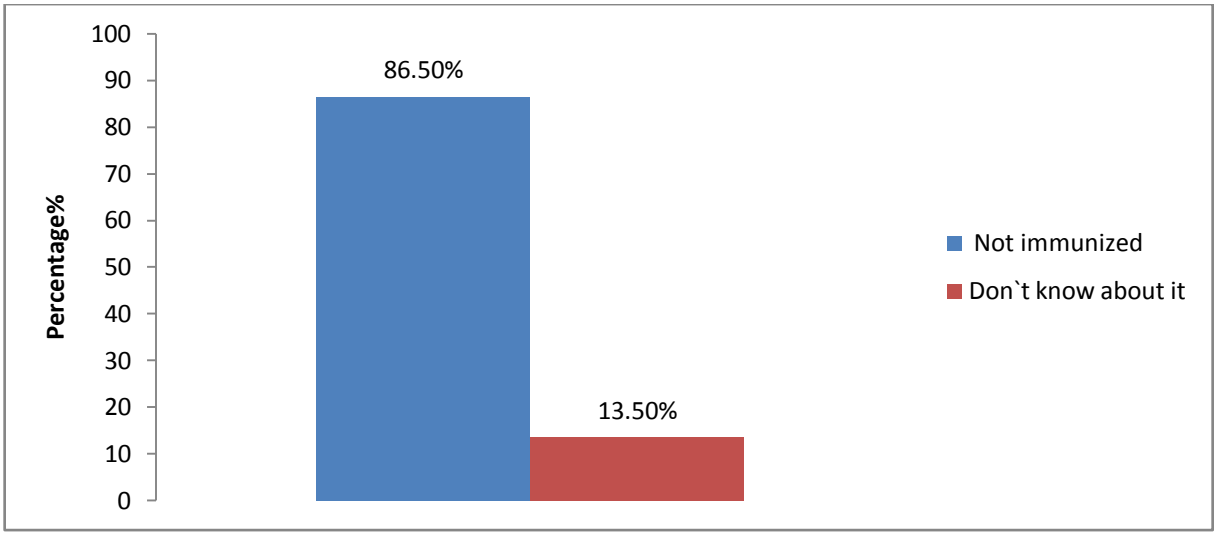

Figure 4.29: Adult immunization status of the mother.

4. 30 Childhood immunization status of the father

After interviewing father of slum dwelling child we noticed that (46%) slum dwelling child`s father were immunized with childhood vaccine where not immunized (3%), partially immunized (1%), and could not remember or did not know about it (50%).

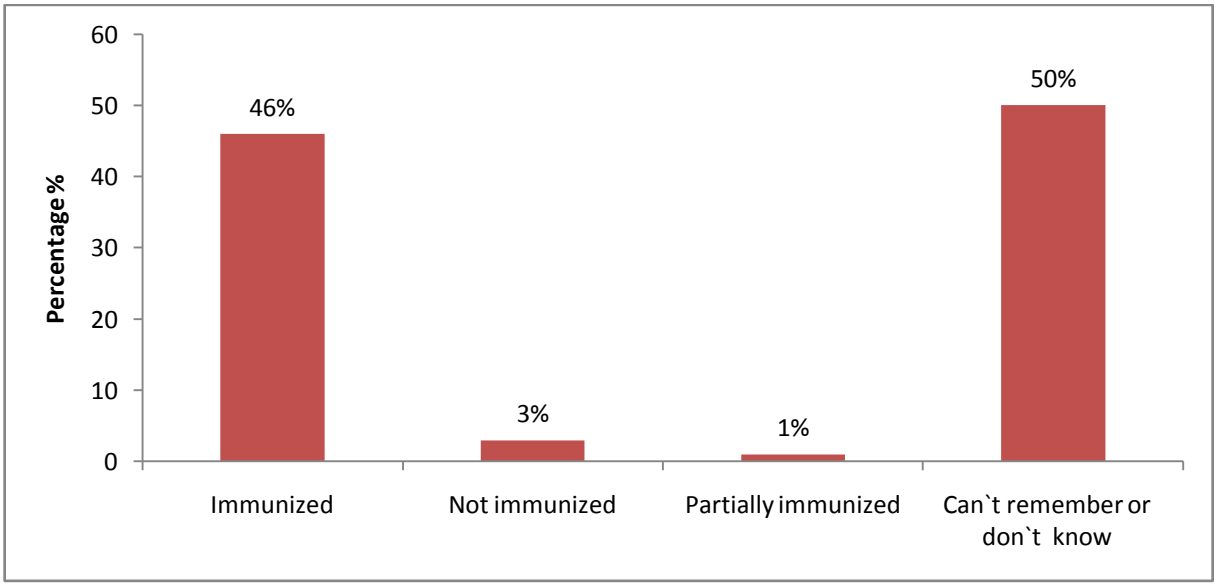

Figure 4.30: Childhood immunization status of the father.

4.31 Adult immunization status of the father

From the **Figure 4.31** we observed that (65.50%) slum dwelling child`s father were not immunized with adult vaccine where (34.50%) father had no idea about it.

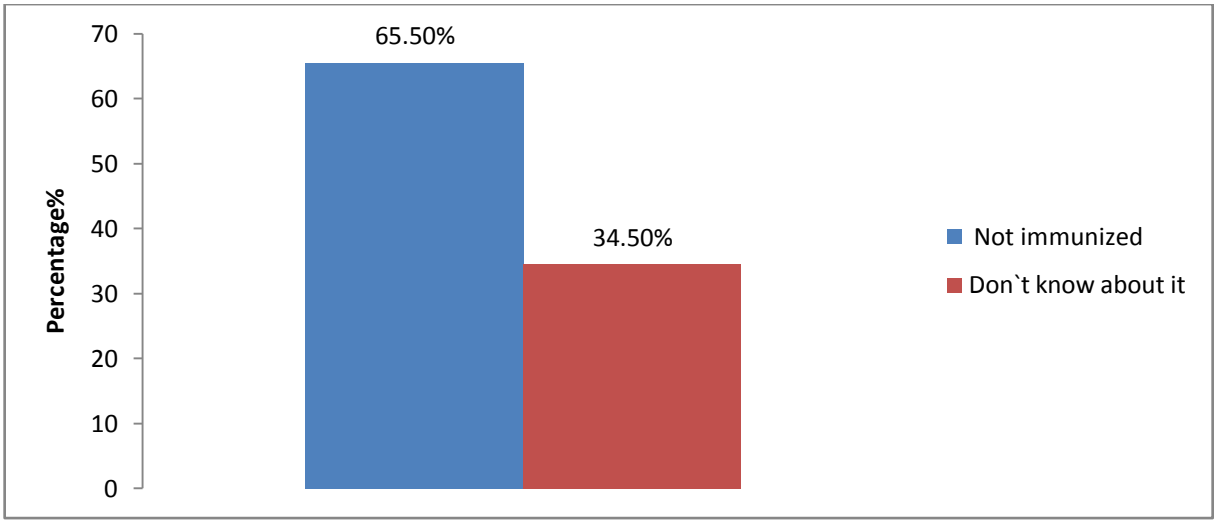

Figure 4.31: Adult immunization status of the father.

4. 32 Immunization status of the immediate sibling

(19%) parent or primary caregiver of slum dwelling child completed immunization for sibling child, where immunization partially completed for sibling child (10.50%). On the other hand (2.50%) parent or primary caregiver did not complete immunization for sibling child , when (68%) had no sibling child.

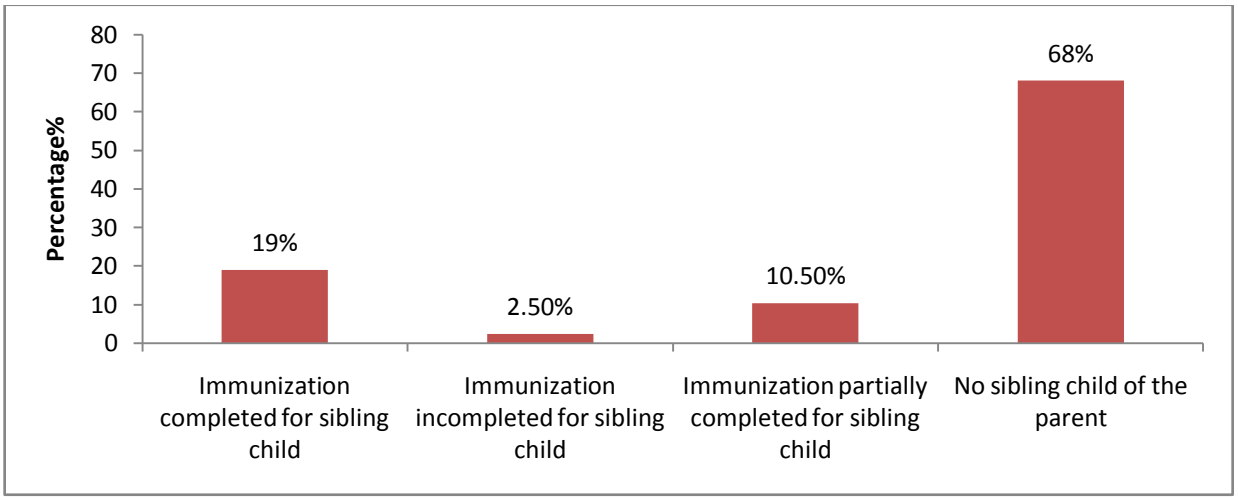

Figure 4.32: Status of immunization of the immediate sibling.

4. 33 Relation between vaccination card retention and immunize child with valid dose

From the **Figure 4.33** we observed that (48.42%) parent or primary caregiver received vaccination card for their child and at the same time their child were valid dose recipient when (11.05%) parent or primary caregiver received vaccination card still their child were invalid dose recipient. On the other hand (40.53%) parent or primary caregiver received vaccination card but their child were dropout recipient.

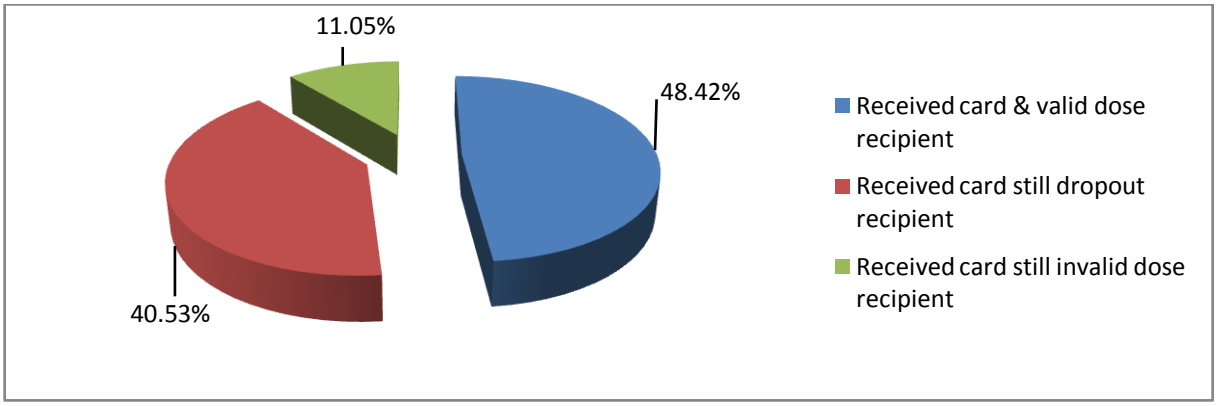

Figure 4.33: Relation between vaccination card retention and immunize child with valid dose.

4. 34 Relation between mother`s education and immunize child with valid dose

In this study we noticed that among valid dose recipient child, (83.51 %) mother were literate. On the other hand among valid dose recipient child only (16.49 %) mother were illiterate.

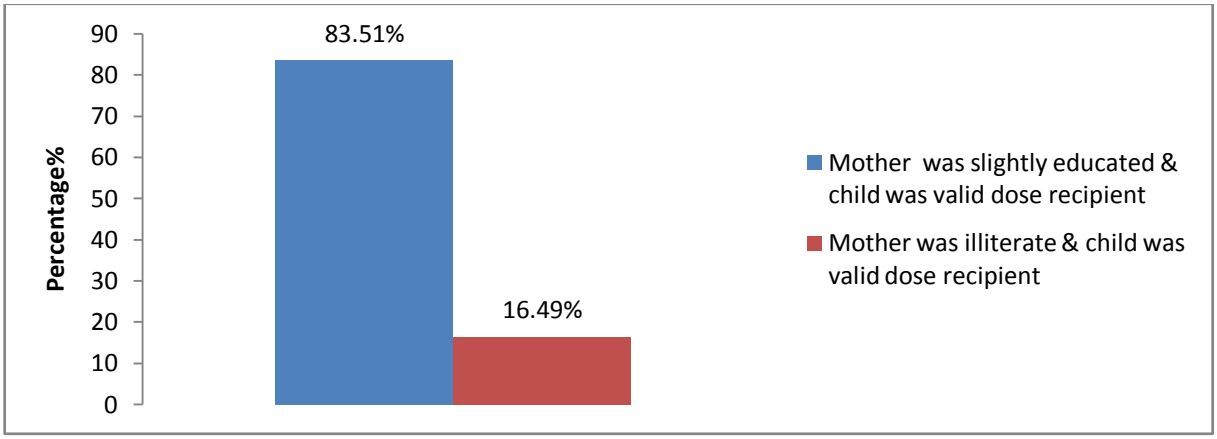

Figure 4.34: Relation between mother`s education and immunize child with valid dose.

4. 35 Relation between mother`s age and immunize child with valid dose

Among valid dose recipient child, (88.66 %) mother`s age of those child ranged between 18-30 years .On the other hand only (11.34 %) mother`s age ranged above 30 years.

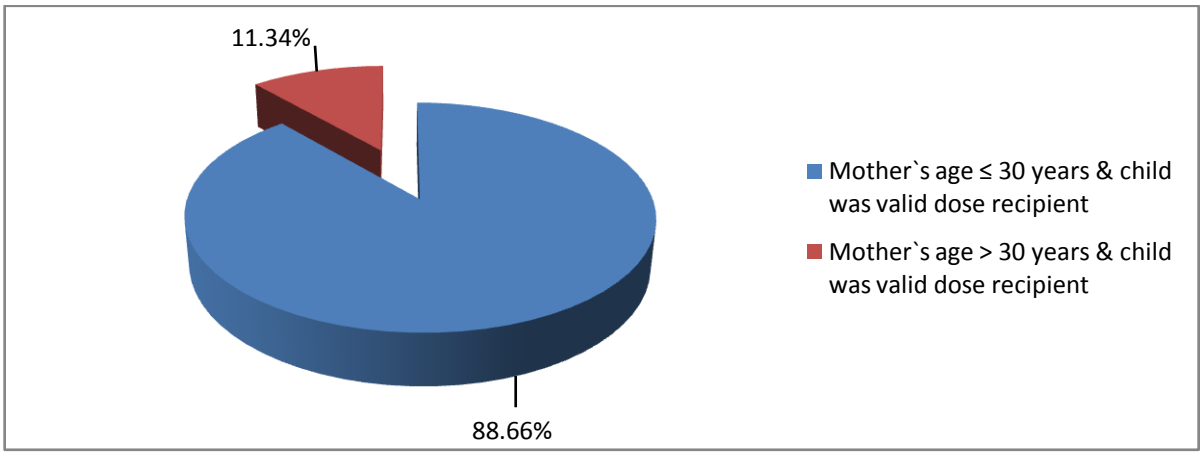

Figure 4.35: Relation between mother`s age and immunize child with valid dose.

4.36 Relation between tetanus immunization status of the mother and immunize child with valid dose

Among valid dose recipient child, 67.01% mother of those child received ≥ 2 tetanus immunization dose during their pregnancy. Where (23.71%) mother who did not receive tetanus immunization dose during their pregnancy. On the other hand (9.28%) mother who did not know about tetanus immunization.

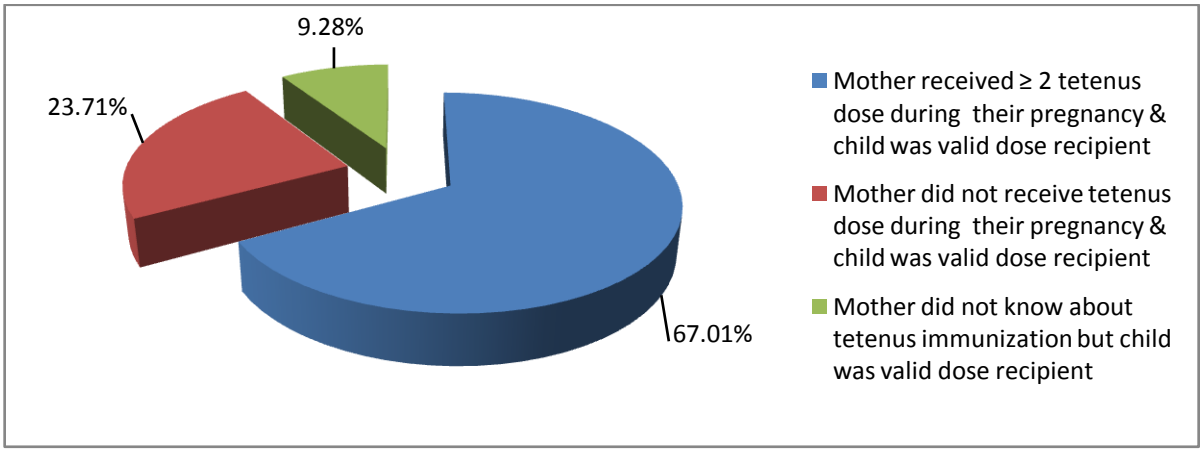

Figure 4.36: Relation between tetanus immunization status of the mother and immunize child with valid dose.

CHAPTER–FIVE

DISCUSSION

Discussion

In Bangladesh immunization is essential to achieve the Millennium Development Goals (MDGs) by reducing child mortality rates. Although in Bangladesh there are few study on immunization and they were performed many years ago and no study held directly on overall immunization status of slum dwelling child, parent and sibling child .So we have conducted a survey with 200 parent or primary caregiver of slum dwelling child. Here, we will mainly focus on present immunization status of slum dwelling child, parent and immediate sibling child. The study also attempted to understand the reasons that extremely poor people do not obtain immunizations for their child and formulate recommendations for designing an appropriate programme for improving the immunization coverage. At the same time identify the impact of mother`s age, education, tetanus immunization and birth order of the child on immunization of their child with valid dose. This study was done in 6 slum area of Gazipur, Bangladesh.

From this study we found that (48.50%) slum dwelling child were valid dose recipient where dropout recipient were (40%), invalid dose recipient were (10.50%) and left out recipient were (1%). According to a study conducted in slum areas of Dhaka city showed that in that time proportion of fully-immunized children aged ≤ 12 months was only 54%, drop-outs rate was 33%, invalid doses rate 22%, left out recipient rate (2%) and card retention rate was 64% (Quaiyum *et al*., 2008) . By comparing two study we can say that ,we found the almost same result for valid dose recipient and left out recipient. But two study did not match for dropout recipient, invalid dose recipient and card retention .

According to Bangladesh demographic and health survey (1999- 2000) boys immunization coverage were 63.4% and girls coverage were 57.1%. But in our study we did not observe any major discrimination between male child and female child of slum area where male child coverage were (51%) and female child coverage were (49%).

Study conducted by Jamil *et al*. (1999) mentioned that mother who had completed primary level education were 1.8 times more likely to be immunized than individual who have no schooling. In our study we also noticed that among valid dose recipient child (83.51 %) mother of those child had received some schooling.

Again according to Jamil *et al.* (1999) younger & more educated mother 40% more likely to be immunized than woman who are 30 years old or more older. In our study, we also observed the same thing, where among valid dose recipient child (88.66 %) mother`s age of those child ranged between 18- 30 years. So it is clarified from above data that, younger mother are more interested to immunize their child than others.

Meanwhile it was revealed from a study that where health worker were present, pregnant woman were 50% more likely to be immunized than the area where health worker was not present (Jamil *et al.,*1999). From our study we found that (98%) parent or primary caregiver of the slum dwelling child knew about vaccination and in fact it was also revealed from our

study that most of the parent or primary caregiver of slum dwelling child got informed about immunization through health care provider (35.86%).

In the study of Quaiyum *et al.* (2008) which was performed in hoar area where knowledge and perceptions of the mothers about completion of vaccination were judged, and (88%) mother said that incomplete vaccination had no benefit to protect children, but in our study (61.97%) slum dwelling child`s parent or primary caregiver believed that immunization good for child , so it is clearly indicating that slum dwelling mother does not possess the right knowledge of vaccination, because immunization prevent only vaccine preventable diseases.

According to a study mothers of dropout child were asked why they did not obtain all the recommended vaccinations. The most frequently-mentioned responses were lack of knowledge about the time, place or need for immunization, fear of side-effects, mother was too busy and absence of the vaccinator (Chowdhury, J.H. *et al*., 1991). On the other hand according to study of Quaiyum *et al. (*2008) mother of drop out child were asked about the reason for not vaccinating children and (55%) mother or primary caregiver answered that they did not give importance. When in our study we found the same result where (57.5%) cause of dropout of slum dwelling child were ,lack of concern of parent or primary caregiver.

Again from the study of Quaiyum *et al*. (2008) we found that after implementation of modified strategies on EPI service schedules where mothers were aware of afternoon or evening sessions were asked if they took their children to afternoon or evening sessions for vaccination, 65% gave affirmative answer, and 99% visited afternoon EPI centres of NGOs. But in our study we found that (81.50%) slum dwelling child`s mother or primary caregiver prefer morning session (8am - 2pm) to vaccinate the child because (37%) slum dwelling child`s parent or primary caregiver thought that if vaccinate in morning session, household activities could be done later on and(30%) slum dwelling child`s parent or primary caregiver thought that if vaccinate in morning session, pain would remove early in next day, when (56.93%) slum dwelling child`s parent or primary caregiver preferred vaccination center as a choice of vaccination place.

Moreover study carried out by Cutts *et al*. (1990) in Conakry, an urban area of Guinea in that study parents complained about the long- waiting times, lack of rapport with health workers and high fees. On the other hand in another study carried out by Perry H *et al*. (2008) where out of 287 comments, 119 respondent said that unofficial fee was major barrier in obtaining immunization. But in our study we noticed that long waiting time (17.48%) and unofficial fee (11.17%) were most common problem faced by slum dwelling child`s parent or primary caregiver during vaccination.

Again according to study of Cutts, *et al*. (1990) parents complained that abscesses was major complications after taking immunization dose but in our study we observed that (35.14%)

slum dwelling children experienced fever after taking immunization dose, followed by abscesses (18.15%) .

From our study we found that (57.50%) slum dwelling child`s mother were immunized with childhood vaccine where not immunized with childhood vaccine (3.50%).On the other hand (86.50%) slum dwelling child`s mother were not immunized with adult vaccine when (13.50%) mother had no idea about adult vaccine. Again in the study of Perry, H. *et al. (*1998) it was mentioned that 85% of women with a child under 1 year of age had received two TT immunizations during their pregnancy . But in our study we noticed that (60.50%) slum dwelling child`s mother received two TT immunizations dose during their pregnancy and among valid dose recipient child (67.01%) mother of those child received proper tetanus immunization dose during their pregnancy

Again in our study we have also observed that (46%) slum dwelling child`s father were immunized with childhood vaccine when (50%) father could not remember their childhood immunization status or did not know about it. It was also confirmed from the study that (65.50%) slum dwelling child`s father were not immunized with adult vaccine when (34.50%) father had no idea about it. In case of sibling we noticed that (19%) parent or primary caregiver completed immunization for sibling child ,when (68%) had no sibling . On the other hand among valid dose recipient child (71.13%) child were first child of the parent.

CHAPTER–SIX

CONCLUSION

Conclusion

From the study we found that only half of the child of the total population were valid dose recipient when most of the parent or primary caregiver knew about vaccination and card retention rate was good. On the other hand major cause of drop out was lack of concern of the parent or primary caregiver and common problem faced during vaccination was long waiting time. so, to increase awareness mass media and health campaign can play a vital role. At the same time govt. should come forward to minimize long waiting time, unofficial fee and shortage of vaccine by ensuring sufficient number of center, health care provider and quality vaccine. Furthermore in this study immunization status of the parent were assessed on verbal basis, sample size was limited and vitamin- A immunization status were not assessed so if the number of participant, area could be increased and include vitamin- A immunization into our study it would definitely help us to get a better view of childhood immunization status.

CHAPTER–SEVEN

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