A STUDY TO ASSESS IMMUNIZATION COVERAGE IN BIJAPUR DISTRICT

By

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Under the guidance of

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LIST OF ABBREVIATIONS USED

UIP	: Universal Immunization Programme
WHO	: World Health Organization
EPI	: Expanded Programme on Immunization
VPD	: Vaccine Preventable Diseases
UNICEF	: United Nations Children's Fund
MCH	: Maternal and Child Health
BCG	: Bacillus Calmette and Geurin
DPT	: Diphtheria, Pertussis and Tetanus.
CSSM	: Child Survival and Safe Motherhood.
RCH	: Reproductive and Child Health
NRHM	: National Rural Health Mission
OPV	: Oral Polio Vaccine
NFHS	: National Family Health Survey
DLHS	: District Level Health Survey
CES	: Coverage Evaluation Survey.
UCI	: Universal Child Immunization
Hep B	: Hepatitis B
Hib	: Hemophilus influenza type B
GAVI	: Global Alliance for Vaccine and Immunization
NGO	: Non-Governmental Organization
TT	: Tetanus toxoid
PIP	: Programme Implementation Plan
PHC	: Primary Health Centre
ANM	: Auxiliary Nurse midwife

ASHA	: Accredited Social Health Activist
NID	: National Immunization Days
SEARO	: South East Asian Regional Office of WHO
IEC	: Information, Education and Communication
IMR	: Infant mortality rate
LPV	: Liquid Pentavalent Vaccine
SIA	: Supplementary Immunization Activities
LQAS	: Lot Quality Assurance Sampling
MICS	: Multiple Indicator Cluster Survey
NTAGI	: National Technical Advisory Group on Immunization
MOHFW	: Ministry of Health and Family Welfare
OR	: Odds Ratio
X^2	: Chi-square test
df	: Degree of freedom

ABSTRACT

Background :

The Universal Immunization Programme was launched in the year 1985 with the target of achieving >85% vaccination coverage by the year 1990. Even after 28 years, today we are struggling to meet this target. Previous surveys have shown that the vaccination coverage of Bijapur district has always been lagging behind the national as well as the state's coverage.

Objectives:

This study was taken up with the following objectives:

1. To assess immunization status and document reason for partial/non-immunization among children aged 12-23 months in Bijapur district of Karnataka.
2. To study the socio-demographic profile of the parents as well as their knowledge and perception regarding immunization.
3. To provide recommendations for the planners and policy makers so as to further improve the immunization programme.

Materials and Methods:

A cross-sectional survey was conducted using WHO's 30 cluster sampling technique. A total of 210 children in the age group of 12-23 months were included in the study. After obtaining oral consent, information was collected using a pre-tested questionnaire. Data was analyzed using SPSS v.17 and presented in the form of percentages and figures. Statistical tests such as chi-square test and Z test for difference between proportions was used to test for significance.

Results:

Less than half (46.2%) the children included in our study had an Immunization Card. 68.1% of the children were fully immunized, 29% were partially immunized and 2.9% were unimmunized. The highest coverage for any individual vaccine was for BCG (96.7%) and the lowest coverage was for DPT-3 (78.1%). Most of the children had received their immunization from governmental health facilities. The dropout rate was 18.8% for DPT-1 to DPT-3 and 18.7% for BCG to Measles. The most common reason for immunization failure was lack of information.The main source of information regarding immunization was the health worker (ANM/AWW). Though the mothers had a positive perception regarding immunization their knowledge regarding immunization was dismal.Immunization status was seen to have a statistically significant improvement with increase in maternal age. However, immunization status was not found to have a significant association with gender, religion, socio-economic status, presence of immunization card, source of immunization, parent's education or parent's occupation.

Conclusion:

Though the vaccination coverage of Bijapur district has improved over the years, the coverage is still lagging behind the state's average as well as the UIP target of 85% coverage.It is evident from the BCG and DPT-1 coverage that immunization system access is no longer the reason for the slow progress. What appears to be causing the current scenario is a lack of information and motivation which has consequently led to low immunization system utilization. This is evident from the dropout rates in our study. Health personnel and policy makers must make it their priority to plan and execute IEC activities in a more focused and sustained manner.

Keywords: Immunization, Coverage, Dropout rate, Cluster sampling

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INTRODUCTION

"I shall endeavour still further to prosecute this inquiry, an inquiry I trust not merely speculative, but of sufficient moment to inspire the pleasing hope of it's becoming essentially beneficial to mankind."

~ Edward Jenner
(1749-1823)

One of the most significant contributions of the medical fraternity to mankind is the advent of vaccines. Immunization is one of the most cost effective interventions for disease prevention known to man and it plays a significant role in the reduction of morbidity and mortality due to infectious diseases, especially in developing countries. The eradication of smallpox is symbolic of our victory over disease and this was achieved essentially through vaccination. The imminent eradication of poliomyelitis is another testimony to the power of vaccination in our fight against communicable diseases.

It was the experience with the small pox eradication programme that showed the world the importance of immunization. In May, 1974, the World Health Organization (WHO) launched its "Expanded Programme on Immunization" (EPI) against six, most common, vaccine preventable childhood diseases (VPDs) which include diphtheria, tetanus, pertussis, tuberculosis, poliomyelitis and measles.[1] "Expanded" in the WHO definition meant adding more disease controlling antigens of vaccination schedules, extending coverage to all corners of a country and spreading services to reach the less privileged sectors of society.[2]

The "Health for all" by the year 2000 initiative adopted by WHO in the year 1978 included immunization as one of its key strategies. In the year 1985, while the WHO retained the name of its programme as EPI, United Nations Children's Fund (UNICEF) renamed it as "Universal Child Immunization". The goals of both were the same, i.e. to achieve universal immunization by the year 1990.[2]

The government of India launched its EPI in January, 1978. The UIP was launched on November 19th, 1985 and was dedicated to Lt. Smt. Indira Gandhi. It was

launched with two vital components: immunization of pregnant women against tetanus and immunization of infants against the six EPI target diseases. The aim was to achieve 100% coverage of pregnant women with two doses of tetanus toxoid (or a booster dose) and achieve 85% coverage of infants with one dose of BCG, one dose of measles and three doses each of DPT and Polio by the year 1990.[1]

In the year 1992, the UIP was strengthened by its expansion into the Child Survival and Safe Motherhood Programme (CSSM) that was aimed at intensified MCH services. The UIP was then incorporated into the Reproductive and Child Health Programme (RCH-1) in the year 1997. The UIP was later merged with National Rural Health Mission (NRHM) in the year 2005 and is now currently a part of the second phase of NRHM.[3]

The impact of the UIP is measured in terms of vaccine preventable diseases (VPD) burden. The output of the UIP is measured in antigen coverage and dropout rates. Antigen coverage is a measure of the access to immunization services and dropout rates indicate service utilization.[2]

Current Status

India

Over the years there has been a general decline in the reported number of cases of the six main VPDs. Between 1984 and 2012 the infant mortality rate (IMR) has fallen from 104 to 44 deaths per 1000 live births.[2] Furthermore, India sits on the verge of polio eradication even though the programme was met with harsh skepticism along its course. However, we have failed to accomplish the goal that we set out to achieve at the inception of the programme in 1985, i.e. universal immunization.

The National Family Health Survey (NFHS) shows a marginal improvement in the vaccination coverage over the years. NFHS-1 conducted in 1992-93 reported a vaccination coverage of 35.4% which rose to 42% in NFHS-2 conducted in 1998-99.[4, 5]The latest NFHS-3 conducted in 2005-06 reported a vaccination coverage of 43.5%.[6] The UNICEF Coverage Evaluation Survey (CES) for the year 2009 showed that the immunization coverage had improved to 61%.[7]Nevertheless these figures are way short of the target of 85% coverage.

Vaccination coverage levels in most of the districts have been declining or not been improving for the last many years particularly for DPT which is a serious matter.[6] Various reasons have been cited for the poor performance of the programme. Some of them include a shift of emphasis from UIP to Pulse Polio programme since 1995, immunization sessions not being held regularly in the community, inadequate mobility of the health worker, problems in the delivery of vaccines to outreach session sites, lack of trained manpower and the impact of rumours.[1]

To combat the problems faced in the previous years, the government of India declared the year 2012 as the year of intensification of routine immunization.The key objective of this campaign was to improve full immunization coverage and reach all children, particularly in remote, inaccessible and backward areas as well as in urban slums.[8]

Karnataka

Though the coverage of Karnataka has always been above the national average, it is still short of the 85% coverage target. The district level household survey (DLHS) 1 conducted in Karnataka in 1998-99 showed that the percentage of fully vaccinated children in the age group of 12-23 months was 71.8%.[9]The vaccination coverage dropped by 1percentage point to 71% in DLHS-2 (2002-

04).[10]This improved to 76.7% in DLHS-3 (2007-08)[11]. The CES 2009 report shows that Karnataka has vaccination coverage of 78%.[7]

Bijapur District

According to the DLHS-2 report for Karnataka, Bijapur district with an immunization coverage of 49.2% was one among the six districts in Karnataka that had a coverage of less than 55%.[12] This improved marginally to reach 50.5% full immunization coverage according to DLHS-3.Bijapur district also held the infamous distinction of having the lowest measles and OPV-3 coverage in Karnataka according to the DLHS-3 report.[13]

Hence, we see that Bijapur district is lagging far behind its counterpart districts within the state as well as the national goal of >85% coverage. In the prevailing scenario, it becomes the need of the hour to find out the true picture of immunization coverage in Bijapur district and determine the various reasons for the slow progress made by it over the years.

With this background, the present study was taken up to assess the vaccination coverage and reasons for immunization failure in Bijapur district so as to formulate effective intervention strategies that will help the planners implement the immunization programme in a better way.

OBJECTIVES OF THE STUDY

This study is taken up with the following objectives:

1. To assess immunization status and document reason for partial/non-immunization among children aged 12-23 months in Bijapur district of Karnataka.

2. To study the socio-demographic profile of the parents as well as their knowledge and perception regarding immunization.

3. To provide recommendations for the planners and policy makers so as to further improve the immunization programme.

REVIEW OF LITERATURE

Humans are in constant conflict with various agents that cause disease and discomfort. We are aided in this conflict by a set of intricately designed sophisticated defence mechanisms that work ceaselessly to keep us protected. These host defences against infection are at once local and systemic, non-specific as well as specific, and most often a combination of both humoral and cellular responses. Specific defences come into play once microorganisms have breached local defence mechanisms. By virtue of these defences, the host is able to recognize, destroy and eliminate antigenic material (e.g. bacteria, viruses, proteins, etc.) foreign to its own. These specific defences may be either (a) Active immunity or (b) Passive immunity.[2]

Immunization is the process by which an individual's immune system becomes fortified against an agent (known as the immunogen). When this system is exposed to molecules that are foreign to the body, called non-self, it will orchestrate an immune response, and it will also develop the ability to quickly respond to a subsequent encounter because of immunological memory. This is a function of the adaptive or active immune system. Therefore, by exposing an animal to an immunogen in a controlled way, its body can learn to protect itself: this is called active immunization.[14]

When antibodies produced in one body (human or animal) are transferred to induce protection against disease, it is known as passive immunity.[2]

Immunizing agents may be classified as vaccines which help in active immunization, and immunoglobulins and anti-sera that provide passive immunity.[2]

Vaccine is an immune-biological substance designed to produce specific protection against a given disease. It stimulates the production of protective antibody and other immune mechanisms. Vaccines may be prepared from live modified organisms (BCG, OPV, measles, etc), inactivated or killed organisms (typhoid, rabies, hepatitis B etc.), extracted or cellular fractions (subunit vaccines like the meningococcal vaccine), toxoids (diphtheria and tetanus toxoid) or a combination of these.[2]

Historical Background of Immunization

It is believed likely that some form of inoculation was developed in India or China before the 16th century. Scholar Ole Lund comments: "The earliest documented examples of vaccination are from India and China in the 17th century, where vaccination with powdered scabs from people infected with smallpox was used to protect against the disease. The tradition of inoculation may have originated in India in 1000 BC." The mention of inoculation in the Sact'eya Grantham, an Ayurvedic text, was noted by the French scholar Henri Marie Husson in the journal Dictionaire des sciences médicales.[15]

Almroth Wright, the professor of pathology at Netley, further helped shape the future of vaccination by conducting limited experiments on the professional staff at Netley, including himself. The outcome of these experiments resulted in further development of vaccination in Europe.[15]

The Anatolian Ottoman Turks knew about methods of inoculation. This kind of inoculation and other forms of variolation were introduced into England by Lady Montagu, a famous English letter-writer and wife of the English ambassador at Istanbul between 1716 and 1718, who almost died from smallpox as a young adult

and was physically scarred from it. On her return to England she propagated the Turkish tradition of inoculation and had many of her relatives inoculated. The breakthrough came when a scientific description of the inoculation operation was submitted to the Royal Society in 1724 by Dr. Emmanual Timoni, who had been the Montagu's family physician in Istanbul. Inoculation was adopted both in England and in France nearly half a century before Jenner's famous smallpox vaccine of 1796.However, inoculation or variolation carried the serious risk that the patient would be killed or seriously ill. Even though the immunity provided was considered quite reliable,the death rate from variolation was reported to be around a tenth of that from natural infection with Variola.[15]

Edward Anthony Jenner was an English physician and scientist who was the pioneer of smallpox vaccine. He is often called "the father of immunology", and his work is said to have saved more lives than the work of any other man. Noting the common observation that milkmaids were generally immune to smallpox, Jenner postulated that the pus in the blisters that milkmaids received from cowpox (a disease similar to smallpox, but much less virulent) protected them from smallpox. On 14 May 1796, Jenner tested his hypothesis by inoculating James Phipps, an eight year old boy who was the son of Jenner's gardener. He scraped pus from cowpox blisters on the hands of a milkmaid who had caught cowpox and inoculated Phipps in both arms that day, subsequently producing in Phipps a fever and some uneasiness, but no full-blown infection. Later, he injected Phipps with variolous material, the routine method of immunization at that time. No disease followed. The boy was later challenged with variolous material and again showed no sign of infection.[16]

Louis Pasteur further developed the technique of vaccination during the 19th century, extending its use to killed agents protecting against anthrax and rabies. The method Pasteur used entailed treating the agents for those diseases so they lost the ability to infect, whereas inoculation was the hopeful selection of a less virulent form of the disease, and Jenner's vaccination entailed the substitution of a different and less dangerous disease for the one protected against. Pasteur adopted the name vaccine as a generic term in honor of Jenner's discovery.[15]

Maurice Hilleman was the most prolific of inventors of vaccines. He developed successful vaccines for measles, mumps, hepatitis A, hepatitis B, chickenpox, meningitis, pneumonia and Haemophilus influenzae bacteria.[15]

In modern times, the first vaccine-preventable disease targeted for eradication was smallpox. TheWHO coordinated the global effort to eradicate this disease. The last naturally occurring case of smallpox occurred in Somalia in 1977. [15]

The World Health Organization (WHO) initiated the Expanded Program on Immunization (EPI) in May 1974 with the objective to vaccinate children throughout the world. Ten years later, in 1984, the WHO established a standardized vaccination schedule for the original EPI vaccines: BCG, DPT, oral polio and measles. While the WHO's programme is called EPI, the UNICEF renamed it as "Universal Child Immunization" (UCI). There was absolutely no difference between these two. The goal was the same, i.e., to achieve universal immunization by 1990. EPI is regarded as the instrument of UCI.[2]

Increased knowledge of the immunologic factors of disease led to new vaccines being developed and added to the EPI's list of recommended vaccines: Hepatitis B (HepB), yellow fever in countries endemic for the disease, and

Haemophilus influenzae meningitis (Hib) conjugate vaccine in countries with high burden of disease.[17]

In 1999, the Global Alliance for Vaccines and Immunization (GAVI) was created with the sole purpose of improving child health in the poorest countries by extending the reach of the EPI. The GAVI brought together a grand coalition, including the UN agencies and institutions (WHO, UNICEF, the World Bank), public health institutes, donor and implementing countries, the Bill and Melinda Gates Foundation and The Rockefeller Foundation, the vaccine industry, non-governmental organizations (NGOs) and many more. The creation of the GAVI has helped to renew interest and maintain the importance of immunizations in battling the world's large burden of infectious diseases.[15]

The current goals of the EPI are: to ensure full immunization of children under one year of age, to globally eradicate poliomyelitis, to reduce maternal and neonatal tetanus to an incidence rate of less than one case per 1,000 births, to cut in half the number of measles-related deaths that occurred in 1999, and to extend all new vaccine and preventive health interventions to children in all parts on the world.[17]

Milestones in the history of Immunization[1,2,8,14,15,16,17,18,19]

1796	Master James Phipps was vaccinated by Edward Jenner
1885	Louis Pasteur introduced the term "Vaccination". Development of Rabies vaccine by Louis Pasteur and Emile Roux
1896	Typhoid vaccine developed by Sir Almroth Edward Wright in India
1908-21	BCG developed by Albert Calmette and Camille Guerin at Pasteur Institute, Paris using live attenuated strains of bovine tubercle bacilli

1923	Diphtheria toxoid developed by Gaston Ramon.
1924	Tetanus toxoid developed by P. Descombey
1925	Pertussis vaccine developed by Thorvald Madsen
1937	Yellow fever vaccine developed by Max Theiler
1943	Influenza vaccine developed by the US military and used in Second World War
1949	Mass BCG vaccine campaign launched in India
1955	Polio vaccine inactivated- developed by Jonas Salk
1955	Diphtheria prophylaxis introduced in Mumbai
1962	Live attenuated Oral Polio vaccine developed by Albert Sabin
1963	Measles vaccine developed by John Franklin Enders
1971	MMR vaccine for Measles, Mumps and Rubella developed by Maurice Hilleman
1974	EPI programme launched globally by WHO
1975	17th May- Last indigenous small pox case in India (Bihar). On 6th July. India was declared free from small pox.
1975	ICDS programme was launched on 2nd October on the occasion of 106th birthday of Mahatma Gandhi
1978	EPI was launched in India
1979	On 23rd April India was declared free from small pox by WHO
1980	On 8th May WHO declared that the global eradication of small pox had been achieved. India discontinued small pox vaccination.
1983	Introduction of aerolized measles vaccine by Sabin
1985-86	UIP launched on 19th November 1985 in India. In Karnataka, Hassan

	and Kolar districts were selected among the 30districts in India for implementation of UIP.
1987	World Health Day Theme- "Immunization, A Chance For Every Child"
1995-96	Pulse Polio Immunization launched in India with an idea to eradicate poliomyelitis by the year 2000 AD
1997	The National Polio Surveillance was established as a joint initiative of the WHO and the Government of India.
1997	UIP was incorporated into the Reproductive and Child Health Programme
2000	Global Alliance for Vaccines and Immunization (GAVI) was established
2005	UIP was incorporated into National Rural Health Mission
2011	13 January 2011- India saw its last case of paralytic polio.
2012	25th February- India was struck off from the WHO list of polio endemic countries.
2012-13	➢ -WHO asks member nations of South East Asian Region to launch Intensified efforts for better coverage of routine immunization ➢ -Ministry of Health and Family Welfare declares the year 2012-13 as the "Year of Intensification of Routine Immunization"
2013	WHO certification process for polio eradication of South East Asian region started

Universal Immunization Programme in India

The vaccination of children against six serious but preventable diseases (tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis, and measles) has been the cornerstone of the child health care system in India. As part of the National Health Policy, the National Immunization Programme was implemented on a priority basis. The Expanded Programme on Immunization (EPI) was initiated by the Government of India in 1978 with the objective of reducing morbidity, mortality and disabilities from these six diseases by making free vaccination services easily available to all eligible children. The programme gained momentum in 1985 and was expanded as Universal Immunization Programme (UIP) to be implemented in phased manner to cover all districts in the country by 1989-90.[4]The UIP was designated as one of the seven Technology Missions and charged with two objectives:

1. To vaccinate at least 85 percent of all of all infants by 1990 against the six vaccine-preventable diseases; and
2. To achieve self-sufficiency in vaccine production and the manufacture of cold chain equipment.[5]

A "Technology Mission on Vaccination and Immunization of Vulnerable Population, especially Children" was set up to cover all aspects of the immunization activity from research and development to actual delivery of services to the target population.[5] Hepatitis B vaccine was made a part of the national immunization schedule in 2010-11.Hepatitis B has been expanded and universalized across the entire country.[1]

The vaccination schedule under the UIP[2] is:

Age	Vaccines
Birth	BCG, OPV-O, Hep B Birth dose
6 weeks	DPT -1, OPV -1, Hep B -1
10 weeks	DPT -2, OPV -2, Hep B -2
14 weeks	DPT -3, OPV-3, HepB -3
9 months	Measles
16-24months	DPT Booster 1, OPV Booster 1, Measles 2nd dose, Japanese Encephalitis*
5 years	DPT Booster 2
10 Years	TT
16 years	TT

*Japanese Encephalitis (JE vaccine) vaccine only in 112 endemic districts.

The immunization services are being provided through the existing public health care delivery system (i.e. MCH centres, primary health centres and subcentres, hospital, dispensaries and Integrated Child Development units). There is no separate cadre of staff for EPI.[2]

Although the target was "universal" immunization by 1990, in practice, no country, even in the industrialized world, has ever achieved 100% immunization in children. "Universal" immunization is therefore best interpreted as implying the ideal that no child should be denied immunization against tuberculosis, diphtheria, whooping cough, tetanus, polio and measles. It is, however, in general agreed that when immunization coverage reaches a figure of 80% or more, then disease transmission patterns are so severely disrupted so as to provide a degree of protection even for the remaining children who have not been immunized as a result of "herd immunity".[2]

To strengthen routine immunization, government of India planned the State Programme Implementation Plan (PIP).[2]It consists of:

a) Support for alternate vaccine delivery from Primary Health Centre (PHC) to sub-centre and outreach sessions;
b) Deploying retired manpower to carry out immunization activities in urban slums and underserved areas;
c) Mobility support to district immunization officer as per state plan for monitoring and supportive supervision;
d) Review meeting at the state level with the districts at 6 monthly intervals;
e) Training of Auxiliary Nurse Midwife (ANM), cold chain handlers, mid-level managers, refrigerator mechanics etc.;
f) Support for mobilization of children to immunization sessions sites by Accredited Social Health Activist (ASHA), women self-help groups, etc.;
g) Printing of immunization cards, monitoring sheets, cold chain vaccine inventory charts etc.
h) Improving public private partnership.[2]

In addition, central government will support in supplies of auto- disposable syringes, downsizing the BCG vial from 20 to 10 doses to ensure that BCG vaccine is available in all immunization session sites, strengthening and maintenance of the cold chain system in the states, and supply of vaccines and vaccine van.[2]

Today, India has the largest immunization programme in the world. It targets around 26 million infants and 30.2 million pregnant women every year through nearly 9 million immunization sessions held annually. There are ~25,000 cold chain points in the country to store vaccine under required temperature. The total financial outlay for

Routine Immunization Programme for 2011-12 was Rs 631.6 crore. This includes cost for vaccine, syringes, cold chain and operational cost provided to the states/Union territories under Project Implementation Plan.[20] Between 1984 and 2012, the infant mortality rate has fallen from 104 to 44 per thousand live births. Over the last 15 years there has also been a general decline in the reported number of cases of the six main VPDs.[1]

Polio Eradication Programme in India

The World Health Assembly passed a resolution in May 1988 to eradicate polio from the face of the earth by the end of the year 2000. The American region was declared polio free in 1994 followed by the Western Pacific Region in 2000 and the European region in June 2002. With the intention to compliment the routine immunization achievements, in 1995, India took a giant step closer to eradicating polio through the strategy of National Immunization Days (NID)- Pulse Polio Immunization.[1] The term "pulse" was used to describe the sudden, simultaneous, mass administration of OPV on a single day to all children in the age group of 0-5 years irrespective of their previous polio immunization status.[2] Delhi adopted the strategy first and then it was adopted by the entire nation. Pulse polio immunization replaces the wild polio virus with the harmless vaccine virus in the community. The effect was maximized if the administration of the vaccine was done in the low transmission period that extends from December to January.[1]

Four strategies were adopted for the swifter eradication of Polio.

1. Strengthening routine immunization such that every child <1 year of age was immunized with atleast 4 doses of OPV (Trivalent vaccine) through the UIP.

2. National Immunization Days (NIDs) / Pulse Polio Immunization Programme/ Sub- National Immunization Days (SNIDs)
3. Surveillance of Acute Flaccid Paralysis in any child less than the age of 15 years.
4. Conducting extensive house- to- house immunization mopping-up campaigns.[1]

In 1988, the total polio cases in the world were more than 350,000 in 125 countries. India used to be the largest polio endemic country in the world and accounted for 40% of the cases globally. Therefore, the progress in India was critical for the success of the global initiative. The eradication effort of the government of India was supported by a reliable international coalition of partners that included Rotary International, United States through the Centre for Disease Control and Prevention and United States agency for International Development, UNICEF, WHO, etc. The National Polio Surveillance was established in 1997 as a joint initiative of the WHO and the Government of India. Since the inception of the programme the polio eradication initiative in India saw a dramatic decline in cases of paralytic polio. The number of cases of paralytic polio dropped from an estimated 35,000 cases annually in 1994-95 to less than 200 cases each year (except in 2002), 2005 onward.[21]

India saw its last case of paralytic polio on 13th January, 2011. Two-year-old Rukhsar, from Panchla Block, Howrah, West Bengal is the last case of paralytic polio to be reported from India. India completed two years without any case of polio on 13th of January, 2013, an unprecedented progress for a country, which until recently(2009) accounted for nearly half the world's polio cases.[22] In view of its progress, India achieved a major milestone in 2012 with the WHO striking it off the list of polio endemic countries on 25th February, 2012, after India completed one year without any

case of polio. With this the process of certification of WHO's South East Asian Region has begun. The certification process will look for absence of wild polio virus for three years in the backdrop of high quality surveillance in India, before declaring the region as polio free in 2014.[21]

However, "the price of freedom is eternal vigilance", as the India Expert Advisory Group said in its March 2012 recommendation. Though the progress made makes India more confident of achieving its goal of eradicating polio, the risk of polio persists. India's close proximity to two polio endemic countries, Pakistan and Afghanistan, puts India at risk of polio virus importation. To mitigate the risk of importation, high population immunity needs to be maintained, especially in the high-risk areas and among the most vulnerable population. The programme has been geared to respond to any case of polio importation, anywhere in the country, as a public health emergency. To help eradicate polio globally, India is now sharing its experiences and best practices with the three remaining polio endemic countries - Pakistan, Afghanistan and Nigeria.[19]

The progress in India, despite huge challenges, is a great credit to the strong commitment of the Government of India. Also, the seamless partnership comprising of the Government, Rotary, WHO and UNICEF, and above all the tireless hard work of millions of frontline workers, the vaccinators, the social mobilizers and the health workers, who continue to implement innovative strategies to rid India of polio.[21]

Year of Intensification of Routine Immunization

In an effort to catalyze immunization stakeholders to address the issues identified as barriers to increase immunization coverage, the Regional Director of the South East Asian Regional Office (SEARO) of WHO organized a one-day high-level Ministerial meeting in New Delhi on 2nd of August, 2011.This meeting drew commitments through the Delhi Call for Action to intensify efforts to achieve high uniform coverage of routine immunization throughout the South-East Asia Region.[23]

Following the High-Level Ministerial meeting, efforts turned to the 64th Regional Committee in September 2011 where a resolution on immunization was passed. Among other things, member states were urged to declare 2012 as "Year of Intensification of Routine Immunization", to develop and implement concrete Plans of Action and to allocate the needed resources to overcome challenges to increasing immunization coverage.[23]

India declared the year 2012 as the year of intensification of routine immunization. The key objective of this campaign was to improve full immunization coverage and reach all children, particularly in remote, inaccessible and backward areas as well as in urban slums. The strategies were deployed include: Updating of Micro plans to cover all villages and hamlets in the country; Special immunization drives in pockets of low immunization coverage; Intensification of immunization activity by observing immunization weeks in low performing states; Information, Education and Communication (IEC) related activities for demand generation towards immunization; Deployment of adequate number of Health workers ; Prioritization of

areas with exclusive strategy for 200 poor performing districts in the country; and Special focus on migrant and mobile populations. [8]

Government of India also expanded the Universal Immunization Programme (UIP) by introducing 2nd dose of Measles, Hepatitis B and Pentavalent vaccination. The target was to vaccinate more than 12 crore children through Supplementary Immunization Activity (SIA) in 14 states.[8]

In order to track every child for assured delivery of immunization services, a web enabled name based tracking system was put in place with a database of more than 10 million children. Parents were sent SMS alerts before the due date of vaccination and health workers are also now receiving the list of children due for vaccination through SMS. This is expected to improve immunization coverage substantially and facilitate real time reporting on immunization coverage.[8]

Introduction of Pentavalent Vaccine in India

Haemophilus influenzae type b (Hib) bacterium is estimated to have caused 8.1 million cases of serious Hib diseases, and 371,000 deaths globally in the year 2000. In India, an annual estimated 2.4 to 3.0 million cases and 72,000 deaths in under-5 children were attributed to Hib diseases. Hib is the most common cause of meningitis and the second largest cause of pneumonia (after streptococcal pneumonae) in India. The case fatality ratio for Hib meningitis and pneumonia is in the range of 10-30%.In addition to mortality, Hib causes a substantial morbidity burden, with 25-30% of Hib meningitis survivors suffering from long term neurological sequalae.[24]

The fastidious nature of the Hib bacterium and poor laboratory infrastructure in developing country settings such as India, makes the diagnosis of Hib diseases and

calculation of disease burden extremely difficult. Moreover, a combination of limited access to health services and poor health-seeking behavior by rural populations results in many affected children never having the opportunity of being correctly diagnosed or receiving appropriate care. Even for those children who do reach health facilities, the increasing prevalence of antibiotic resistance makes treatment difficult.[25]

It has been estimated that control of Hib related diseases will reduce IMR by 4 percentage points. The reduction in IMR will play a vital role for India to achieve its national and international child-health related goals (National Health Policy 2002, National Rural Health Mission and Millennium Development Goal 4).[24]

WHO recommends that Hib vaccines should be included in routine infant immunization programs of all countries. By June 2011, Hib vaccine, in various formulations, was included in the national immunization program of 170 countries in all regions of the world.[25]

India introduced pentavalent vaccine from the Serum Institute of India in the states of Tamil Nadu and Kerala in December 2011. This was followed by expansion of vaccine usage in the states of Goa, Pondicherry, Karnataka, Haryana, Jammu and Kashmir, Gujarat and Delhi during the second half of 2012 through the first quarter of 2013.[26]

The use of combination formulation has certain clear programmatic advantages. Firstly, the number of injections per completed schedule will be less, consequently requiring fewer syringes and generating less potentially hazardous sharps waste. In addition, cold chain space will be saved as a single vial of LPV replaces DPT and Hep B vials. LPV has been recommended for all infants and will be given in a 3-dose schedule. The first dose is given at 6 weeks of age or older,

followed by two doses at an interval of at least four weeks between the doses. The vaccine is offered to all children younger than 1 year of age and the booster dose is not recommended in UIP in India.[25]

To facilitate and ease program implementation, Government of India policy states that LPV will be given to a progressive birth cohort whereby all children who present for their first dose of DPT (DPT 1) will be provided their first dose of LPV (LPV 1). Infants who had already initiated their schedule of DTP + HepB will complete the DPT and HepB vaccines schedule. In addition, monovalent Hepatitis B vaccine will continue to be used for birth-dose and DPT vaccines will continue to be used for 16-24 months and 5-6 years of age booster doses.[24]

Coverage Evaluation

Immunization coverage refers to the proportion of individuals in the target population who have been immunized. An immunization coverage survey examines a small number of individuals to determine their immunization status. It involves visiting homes, examining immunization records and asking the parent or caretaker about immunizations received. This is done in a systematic way so that only a small sample of homes and individuals need to be surveyed in order to obtain valid results for a larger population.[27] Coverage surveys are done for the following reasons:

- To find out how many eligible infants have received right dose at the right time i.e, how well health centres have met their coverage target for immunizing infants. This is important because if a child does not receive the recommended immunizations as early as possible, he/she will not receive the maximum protection from vaccine-preventable diseases.

- To find the reasons for immunization failure, i.e. why people do not come, or do not return for immunization. This is important because it will help to find ways to remove the bottlenecks and improve immunization coverage.[27]
- As supplemental information to compare with administrative coverage reports.
- Providing information for service assessment.
- Assessing the change in coverage over time, geographic areas or population groups.
- Assessing the coverage achieved in a supplemental immunization activity.
- Providing information on immunization coverage demanded by funding and other agencies.
- Immunization coverage estimates can also be used to estimate reductions in morbidity and mortality from vaccine-preventable diseases.[28]

There are several possible ways in which immunization coverage can be calculated in a survey. Coverage can be ascertained by the use of different sources of evidence, considering whether immunization was given on time to provide the maximum possible protection to the child.[27]

Sources of evidence: Evidence for immunization may be based solely on documented sources, such as immunization cards or health-facility records. Coverage estimate based only on immunizations which are documented (cards or other records) is called 'CARD' or 'CARD ONLY'. In settings where immunization cards are used and kept by the parents, or where health facility records are available, the survey may assess immunization coverage based on data from cards only. The survey may also include the child's immunizations based on a parent or caretaker's report of whether the child received the different immunizations. This is called evidence by

'HISTORY'. The disadvantage of this method is that the exact date of immunization may not be remembered. Surveys that count immunizations based on either information from immunization cards or from the child's primary caretaker are called 'CARD OR HISTORY' or 'CARD PLUS HISTORY'.[27]

Validity of doses: There are recommendations for the earliest age at which a vaccine should be given. The earliest recommended age for BCG, OPV and HepB vaccines is at birth. The earliest recommended age for DPT is usually six to eight weeks of age. For measles vaccine it may be six, nine, twelve, or even fifteen months of age,depending on the national recommendation. Vaccines for which multiple doses are recommended, such as DPT, OPV and hepatitis B vaccines, there is a minimum recommended interval of four weeks between the doses. Immunizations that are carried out as per schedule are called 'VALID'. In order to determine whether a dose was valid, information on the date on which the immunization was given is necessary, and hence valid immunization estimates require card evidence. If cards are not available, information on the validity of the doses cannot be determined. In such a situation the coverage estimated will be 'CRUDE' coverage estimation. A dose is considered 'TIMELY' if it is given before 12 months of age. As the survey includes children older than one year of age, some of the immunizations may have been given after their first birthday. Coverage can be calculated for only those doses that are 'TIMELY' or it may include all doses given by the time the survey was conducted ("BY TIME OF SURVEY"). In such situation, coverage survey will be known as "Coverage evaluation by time of survey".[27]

Two calculations for immunization coverage are frequently calculated. The first is to calculate 'CRUDE' immunization coverage based on evidence from either

'CARD PLUS/OR HISTORY'. Calculations based on this method also tend to give the highest estimate of immunization coverage.[27]

The second calculation is for 'VALID' doses based on evidence from 'CARD ONLY'. It requires good records and tends to give the most conservative estimate of coverage. In a situation where not all parents or caretakers retain the cards and where health centre records are not available, this calculation might introduce a bias by selecting only those children whose cards/records are available.[27]

There are two main methods recommended by WHO for the assessment of vaccination coverage. These are:

- The EPI cluster survey (WHO methodology) :Cluster sampling can be defined as any sampling plan that uses a frame consisting of clusters of sampling units. This unit can be geographical or temporal in nature. Typically, the population is divided into mutually exclusive and exhaustive clusters. Since only a subset of the clusters will be observed, each sampled cluster has to be "representative" of other non-sampled clusters, and the total variation within the population has to be reflected in the overall estimate.[28]
- The Lot Quality Assurance Sampling (LQAS) technique: It is a rapid survey method to assess the quality of vaccination coverage following supplementary immunization activities (SIA) in pre-defined areas such as a health district (known as "lots"), using a small sample size.[29]

Current Coverage

National and State Surveys:

The Universal Immunization programme was launched in the year 1985 with the main objective of obtaining immunization coverage of at least 85% by the year 1990. 23 years later we are still far behind the 85% coverage mark. The immunization coverage of India has been assessed regularly through various surveys.

Some of the surveys include

1. National Family Health Survey (NFHS) conducted by the Ministry of Health and Family Welfare (MOHFW) of the government of India. Three National Family Health Surveys have been conducted till date. NFHS-1 was conducted in 1992-93, NFHS-2 in 1998-99 and NFHS-3 in 2004-05.
2. District Level Household and Facility Survey (DLHS) also conducted by the MOHFW. DLHS-1, DLHS-2, DLHS-3 were conducted in 1998-99, 2002-04 and 2007-08 respectively.
3. Multiple Indicator Cluster Surveys (MICS) and Coverage Evaluation Surveys (CES) conducted by United Nations Children's Fund (UNICEF).

The NFHS-1 of 1992-93 reported vaccination coverage of India as just 35.4%.[4] NFHS-2 and NFHS-3 reported vaccination coverage of 42% and 43.5% respectively.[5, 6]Though the coverage has steadily increased from this level to 61% coverage according to the latest available data by CES-2009 [7], we are still short of the 85% coverage target. We also see conflicting reports of various government survey data conducted in the same years. For example, we see that NFHS-2 and DLHS-1, though conducted in the same time period i.e. 1998-99, document very different immunization coverage of 42% and 54.2% respectively.[5, 9]

The coverage of Karnataka has always been higher compared to the national average over the years. The coverage reported by NFHS-1, NFHS-2 and NFHS-3 is 52.2%, 60% and 55%.[4, 5, 6] DLHS-1, DLHS-2 and DLHS-3 reported a higher coverage 71.8%, 71.3% and 76.7% respectively.[9, 10, 11] However, with exception of the CES 2005 report[30], the vaccination coverage has always been below the target of 85%. The coverage of Karnataka was reported to be 78% by the latest CES report of 2009.[7]

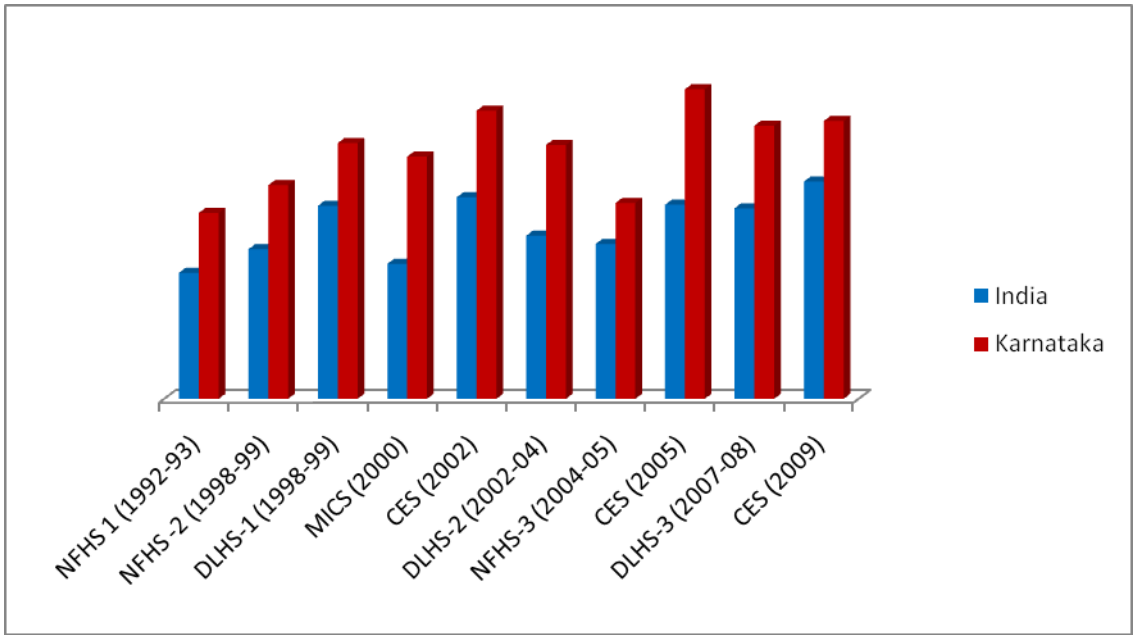
Summary of Immunization status of children aged 12-23 months according to various national and state surveys.

S. No.	Survey	Period of Survey	India			Karnataka		
			FI* (%)	PI** (%)	UI*** (%)	FI (%)	PI (%)	UI (%)
1	NFHS 1[4]	1992-93	35.4	34.6	30.0	52.2	32.6	15.2
2	NFHS 2[5]	1998-99	42.0	43.6	14.4	60.0	32.3	7.7
3	DLHS 1[9]	1998-99	54.2	27.0	18.5	71.8	22.5	5.7
4	MICS[31]	2000	37.9	36.7	25.4	68.0	25.3	6.7
6	CES 2002[32]	2002	56.6	23.6	19.8	80.9	14.7	4.4
7	DLHS 2[10,12]	2002-04	45.8	34.4	19.8	71.3	24.0	4.7
8	NFHS 3[6, 33]	2004-05	43.5	51.4	5.1	55.0	38.1	6.9
9	CES 2005[30]	2005	54.5	14.5	31.0	86.9	-	-
10	DLHS 3[11, 13]	2007-08	53.5	41.9	4.6	76.7	22.6	0.7
11	CES 2009[7]	2009	61.0	-	-	78.0	-	-

*FI- Fully Immunized (one dose of BCG, three doses each of DPT and OPV and one dose of Measles vaccine), **PI – partially immunized (received some vaccination), ***UI- Unimmunized (received no vaccination)

In general, we see a steady increase in the immunization coverage at the national and state level. The figure below shows the trend of immunization coverage in India and Karnataka over the years.

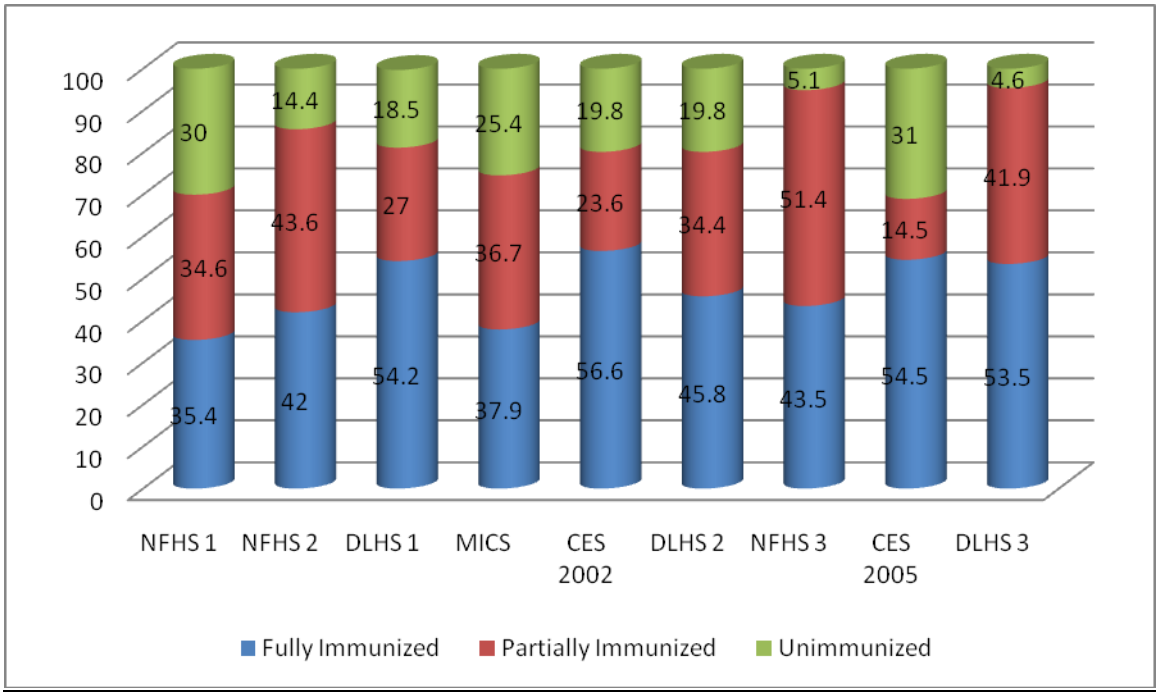
Trend of vaccination coverage in India and Karnataka



Source: 4, 5, 6, 7, 9, 10, 11, 12, 13, 30, 31, 32, 33

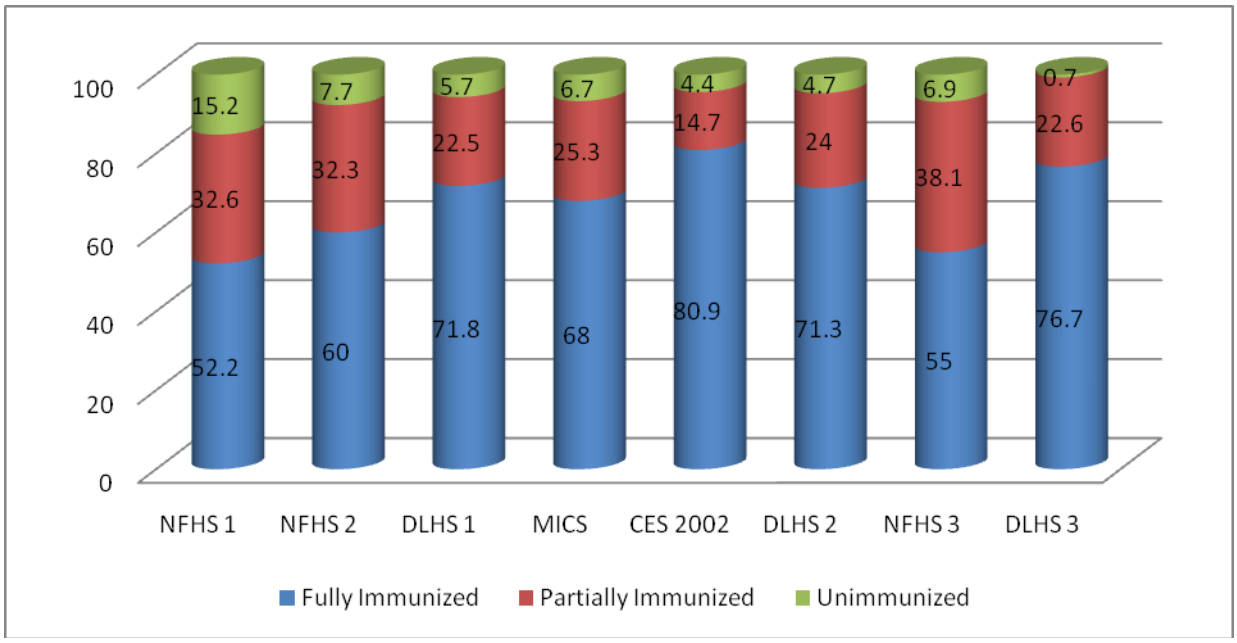
The figures below depict the proportion of fully immunized, partially immunized and unimmunized children in each of the surveys for India and Karnataka. It is seen that the proportion of unimmunized children has decreased over the years. The proportion of partially immunized children on the other hand has increased over the years. This can be attributed to the high dropout rates.

Immunization status of children aged 12-23 months in India



Source: 4, 5, 6, 7, 9, 10, 11, 12, 13, 30, 31, 32, 33

Immunization status of children aged 12-23 months in Karnataka



Source: 4, 5, 6, 7, 9, 10, 11, 12, 13, 30, 31, 32, 33

Related Articles

Rashmi Sharma *et al* (2000), in a study to assess the immunization status in slums of Surat by multi indicators cluster survey technique, found that only 25% of the children aged 12-23 months were fully immunized. Coverage was highest for BCG (75%) and lowest for measles (29.9%).[34]

Overall full vaccination coverage in a study conducted in Miraj, Maharashtra, by VS Tapare and PS Borle (2004) was 87.5%.[35]

A study by SK Jain *et al* (2004) to evaluate the MCH services in rural areas of Rajasthan using 30 cluster technique found that less than one third (28.9%) of children aged 12-23 months were fully immunized and around a quarter (26.5%) had not received even a single vaccination.[36]

A study conducted in Alwar district of Rajasthan by RS Gupta *et al* (2005) to assess MCH services found that vaccination coverage of the 30 clusters selected was 50%. Fully immunized children were more in urban areas (82.1%) as compared to rural areas (45.1%).[37]

A study conducted in Bangalore City by Punith K *et al* (2005) to evaluate primary immunization coverage using cluster sampling revealed that the percentage of completely immunized, partially immunized and unimmunized children was 84.09%, 14.09% and 1.82%, respectively. With LQAS it was 92.11%, 6.58% and 1.31%, respectively. They also found that immunization coverage levels as evaluated by cluster sampling technique were not statistically different from the coverage value as obtained by LQAS technique.[38]

S Yadav *et al* (2005) had conducted a study to evaluate immunization coverage in urban slums of Jamnagar City, Gujarat. They found that the percentage

for fully immunized children was 73.3%. Coverage with BCG vaccine was maximum (94.7%) followed by OPV3 (84.7%), DPT3 (81.4%) and that of measles was least (75.7%).[39]

Bholanath *et al* (2005) conducted a study on children aged 12-23 months in the urban slums of Lucknow district, Uttar Pradesh. In this study they found that 44% of the children were fully immunized.[40]

In a study done in urban slums of Ahmedabad city, Gujurat, by Kadri AM *et al* (2006), they found that 70.3% of the children were fully immunized with coverage highest for BCG, DPT1 and OPV1 (83.3%)and lowest for measles vaccine (71.7%).[41]

Only 37.2% children were fully immunized and 37.6% children were unimmunized in a study done in Agra district, Uttar Pradesh, by M Chaturvedi *et al* (2007). Only 43.6% had received measles vaccine.[42]

Coverage of BCG was found to be 94%, DPT 1/OPV1 was 91%, DPT3/OPV3 was 79% and Measles was 69% in a study done in Surat, Gujarat, by Sangita Trivedi *et al* (2007). Full vaccination coverage was found to be 73.7% in this study.[43]

A study done by Gulati RK et al in Kota, Rajasthan (2007) found that 85.71%, 12.38% and 1.9% children were found to be fully immunized, partially immunized and unimmunized, respectively.[44]

In the 30 cluster survey done by Ahmad Imteyaz *et al* (2005-07) in the urban slums of Delhi, they found that 50.4% of the children were fully immunized, 41.9% were partially immunized and 7.6% were not immunized.[45]

Of the 325 children studied, 58 (17.84%) were completely immunized, 156 (48%) were partially immunized and 111 (34.15%) were unimmunized in a study done in a tertiary-care hospital of North India by Kumar D *et al* (2007).[46]

A study to assess immunization coverage in children of Assam (2007) by Phukan RK *et al* found that 62.2% of the children were fully immunized.[47]

In a study done to assess the immunization coverage in an urban slum of Mumbai by Kulkarni SV *et al* (2007-08) found that the overall coverage of immunization was 88.07 %.[48]

In a study done to assess the vaccine coverage in rural Gandhinagar, Gujarat, Sheth Jay *et al* (2008) found that the coverage for BCG, OPV3, DPT3 and measles was 92.04%, 85.23%,83.71% and 82.2%, respectively. The proportion of fully immunized children was 79.55%. Unimmunized children were 4.16%.[49]

In a study done on an urban population in Tamil Nadu by Govindrajan PK *et al* (2009), only 56% of the children were immunized completely.[50]

In a 30 cluster survey of children aged 12-23 months in Bareilly district of Uttar Pradesh by Joshi HS *et al* in 2009, they found that 50% of children were fully immunized while 27.5% were partially immunized and 22.5% were not immunized at all. Immunization coverage was highest for BCG (62.5%) and lowest for measles (39.2%).[51]

In a study done by Ranjit *et al* (2010) in Kancheepuram district of Tamil Nadu they found that 71.9% of the children were fully immunized, one child was unimmunized and 27.62% were partially immunized.[52]

A study done in Bareilly city, Uttar Pradesh, by Varsha Choudhary *et al* (2010) found that 61.9% were found to be fully immunized. Immunization coverage was highest for BCG (92.68%) and lowest for Measles (62.38%).[53]

Of the 210 children enrolled in a study done in rural Chandigarh by Vikram Assija *et al* (2010) to assess coverage and quality of immunization services, 69% were fully immunized, 15% were partially immunized and 16% were unimmunized.[54]

Only around 31% of children were found to be fully immunized while around 24% were partially immunized and 45% were not immunized at all, in a study done by Masood A *et al* in Allahabad, Uttar Pradesh (2011).[55]

Out of 500 children enrolled, 303(60.6%) were fully immunized, 190(38.0%) were partially immunized and 7(1.4 %) were non-immunized in a study done by Dulipala P *et al* in Nellore City of Andhra Pradesh (2011).[56]

In a study by Pankaj Kumar Gupta *et al* (2011) to evaluate immunization coverage in rural Pune, Maharashtra, they found that of the 210 children studied 86.67% were fully immunized.[57]

Proportion of fully immunized was 74%, while that of partially immunized was 26% in a study done in rural Ahmedabad, Gujarat, by Govani KJ *et al* (2011).[58]

Singh CM *et al* (2011) in a study done to assess the immunization coverage in Etawah (a border district of Uttar Pradesh) found that the percentage of completely immunized children was 40%. 79% of the children were immunized against BCG and 42.4% were immunized against measles.[59]

In a study done by Sreedhar M *et al* in Guntur town of Andhra Pradesh (2012), it was found that only 38.57% were fully immunized. 60.47% children were partially immunized while 0.96% children were unimmunized.[60]

In a study done Mahyavanshi DK *et al* to evaluate immunization coverage in Surendranagar city (2013), Gujarat, out of the 210 surveyed children 70.47% were fully immunized. Coverage was highest for BCG (95.71%) followed by OPV3 (82.85%), DPT3 (79.25%) and lowest for measles (75.23%).[61]

Other Indicators:

Dropout Rates

NFHS-1 reported a dropout rate of 22% for DPT1 to DPT3 and 20% for OPV1 to OPV3.[4] MICS 2000 report shows a DPT1 to DPT3 dropout rate of 25% and OPV1 to OPV3 dropout rate of 16.7%.[31]Decline in dropout rate was observed as per CES 2002 report that showed a dropout rate of 9.5% and 9.1% for DPT1 to DPT3 and OPV1 to OPV3, respectively.[32] The Coverage evaluation survey report of 2009 showed a dropout rate of 13 % for DPT1 to DPT3 and 15% for BCG to Measles. The highest dropout rate was for BCG to DPT3 (18%).[7]

In the study conducted by SK Jain *et al* in Rajasthan, though nearly two-third (66.8%) were covered with first dose of DPT and OPV, about one third of these children dropped out of third dose of DPT and OPV.[36] RS Gupta *et al* in a study conducted in Alwar district, Rajasthan, found that dropout rate in rural areas for DPT (25.3%) and OPV (23.2%) was higher as compared to urban areas (7.7% each).[37]

In the study done by Joshi *et al* in Bareilly, Uttar Pradesh, the dropout rates were 37.3%, 19.7% and 18.2% for BCG to measles, DPT1 to DPT3 and OPV1 to OPV3, respectively.[51] Dropout rate for complete immunization was 48.1% in a study done by Singh CM *et al* Etawah district, Uttar Pradesh.[59]

MC Singh *et al* in the study conducted in Wardha district, Maharashtra, found that the dropout rate from the second to third dose of DPT/OPV was 5.3% and from third to booster dose was 36.96%.[62] Drop-out rates between DTP1 and DTP3 and between DTP1 and measles immunization were 13.8% and 28.7%, respectively, in a study conducted in east Delhi by Sokhey J *et al*.[63]

The dropout rates in a study done by Rashmi *et al* in Surat, Gujarat, was 60.2%, 31.9% and 31.5% for BCG to measles, DPT1 to DPT3 and OPV1 to OPV3, respectively.[34] In the study done by Mahyavanshi DK *et al* in Surendranagar city, Gujarat, the dropout rates was 21.39%, 10.21% and 9.37% for BCG to measles, DPT1 to DPT3 and OPV1 to OPV3, respectively.[61] Dropout rates in the study done by S Yadav *et al* in Jamnagar city, Gujarat, were found to be 10.4% and 10.1% for DPT and OPV, respectively.[39] Dropout rates in a study done by Sheth JK *et al* in rural Gandhinagar, Gujarat, were 9.05% for BCG to DPT3, 10.69% for BCG to measles and 7.53% for DPT1to DPT3.[49]

The dropout rate for both OPV and DPT were observed to be 2.5% in a study done in urban Mangalore by Madhav S M *et al.*[64] In a study done by Jha RK *et al* in Kancheepuram district of Tamil Nadu, while 98.1% of the children were covered with the first dose of DPT only 88.57% received the third dose.[52]

Reasons for Immunization failure

DLHS 3 reports that the main reason for immunization failure among partially immunized and unimmunized children was that the mother was unaware of the need for immunization (45.4%).[11] CES 2002, CES 2005 and CES 2009 report also cites the reason of being unaware of the need for vaccination as the main cause of immunization failure (57.6%, 33.1% and 28.2%, respectively).[32, 30, 7] The other important reasons for non-immunization were place of immunization too far (16.5% in DLHS-3) [11], unaware of place/time of immunization (27.5% in CES 2002)[32] and did not understand benefits of immunization (12.5% in CES 2005)[30].

In the study done by Joshi *et al* in Bareilly, the most common reason for not immunizing the child in both rural (78.7%) and urban areas (28.6%) was lack of

awareness of the need for vaccination.[51] Similar results were also observed by SK Jain *et al* in rural Rajasthan where they found that the main reason for drop-out or non-immunization was "lack of information about the immunization programme" (41.3%).[36]

The commonest reason for non-vaccination was ignorance of parents about the seriousness of the disease and the need of vaccination according to a study conducted by VK Desai *et al* in the slums of Surat city.[65]

RS Gupta *et al* in the study conducted in Alwar district found that immunization failure in rural areas was mainly due to unawareness of need for immunization (35.4%), mother too busy in 16.8%, place and time not known in 9.7%, place for immunization too far in 8.8% and 7.1% each for unaware of need to return for subsequent doses, fear of side reactions and vaccinator absent.[37]

In the study by Mahyavanshi DK *et al,* conducted at Surendranagar city, amongst the various reasons, main reasons for dropout or unimmunized status of children were ignorance in about 64% and lack of information regarding time, place and schedule (21%).[61]

In the study done in rural Pune by Pankaj Kumar *et al*, they found that the most common cause for partial immunization was that the time of immunization was inconvenient (36%).[57] The main reason for dropout or unimmunized status of children and mothers were ignorance in about 80% and inconvenience in the rest of the 210 children surveyed in a study done in Jamnagar city by Yadav s *et al*.[39]

The main reason for both partial immunization and non-immunization were found to be ignorance (50%) and fear of side effect (28.78% and 42.85%) in a study done in Bareilly city by Chaudhary V *et al*.[53] Lack of information (10%) was the

major reason given by the parents of most of partially or unimmunized children in a study done in Kota, Rajasthan by Kulkarni SV *et al*.[44]

The most common reasons for not immunizing the child in a study done in an urban slum of Mumbai by Kulkarni SV *et al* were: due to visit to native place/ village (14%), child was ill hence not brought (8.25), unaware of need to return for second and third dose (5.7%), and mother too busy (5%).[48]

In the study done by Chaturvedi M *et al* in Agra district, the most common reasons for unimmunized status was obstacles (46%), followed by lack of motivation (22.6%), and lack of information (19.4%).[42]

In a study done by Patel TA *et al* in a rural area of Anand district of Gujurat, the reasons for missed vaccination were prior reminder not given (32.9%), mother's forgetfulness (26.6%) and unavailability of vaccine.[66]

Immunization Card

According to NFHS-1 report, only 31% of the respondents had an immunization card.[4] Similar findings were seen in both NFHS-2 and NFHS-3 (33.7% and 37.5%, respectively).[5, 6] 31% of children had an immunization card in DLHS-2 and 42.9% had a card in DLHS-3.[10, 11] 52.8% and 53.7% of children in Karnataka possessed an immunization card according to NFHS-3 and DLHS-3, respectively.[33,13] CES report of 2009 shows that 61% of children in India and 78% of children in Karnataka possessed an immunization card.[7]

SK Jain *et al* found that though nearly all (more than 98%) of the children were immunized through government established centres, immunization card/ documents were made available only to 27.6% of children.[36]

76% of the mothers knew the use and maintenance of immunization card in a study done in Wardha district by MC Singh *et al*.[62] RS Gupta *et al* in their study conducted in Alwar district found that only 27.8% of the 510 children studied possessed an immunization card.[37]

Pankaj Kumar *et al* in their study in a rural area of Pune, found that immunization card was available with 60.95% of the subjects.[57] Immunization card was available for 74.28% of the 210 surveyed children in the study done in Jamnagar city by S Yadav*et al*.[39]

A study done by Gulati RK *et al* in Kota, Rajasthan revealed that 67.6% parents were careful in preserving the immunization cards. Of their children, 91.54% and 8.45% were fully and partially immunized, respectively.[44]In the study conducted by Chaturvedi M *et al* in Agra district only 41.5% of the children had their immunization cards.[42] However in studies conducted in Miraj and rural Ahmedabad a higher number of children (81.25% and 83% respectively) had their immunization cards.[35, 58]

Source of Immunization

68.2% of the children received their immunization from the government sector in DLHS-2. The next major site of receiving immunization was from the private sector (13.7%).[10] Similar trends were seen in Karnataka according to DLHS-2, where 74.3% and 14.3% received their immunization from the government and private sector, respectively.[12]

In DLHS-3, 66.9% of the children received their immunization from a government health facility and 9.9% from private sector.[11] In Karnataka it was 79.7% and 12.1% in government and private sector, respectively.[13]

CES 2002 showed the major source of immunization as "mostly government" (36.5%) and Outreach site (32%).[32] In CES 2005, Government hospital and Outreach site were the main sources (21.9% and 29% respectively).[30] CES 2009 reported Outreach site as the source for 54% of the immunizations and fixed site as the source for 24% of the immunizations.[7]

A study done by Gulati RK *et al* in Kota, Rajasthan revealed that anganwadi centres and health centre of the village were found to be the major source for getting vaccinations for most of the children (66.6% and 14.2% respectively). Less than one percent of children received their vaccination at hospital.[44]The major source of immunization was PHC (53%) in a study done in rural Ahmedabad by Govani KJ *et al*.[58] In a study done by Govindrajan PK *et al* in an urban population of Tamil Nadu, private institutions were used by 76% of the parents for immunization.[50]

Source of information and knowledge regarding immunization

The main source of information regarding immunization among the mothers in CES 2005 was the anganwadi worker/auxiliary nurse midwife/lady health visitor (53%). The next main source of information was the government doctor (30.5%). The other major sources were husband/ family (22.6%), friends/neighbor (21.8%), radio/television (19.8%) and private doctor (16.9%).[30]

In a study done by Rachna Kapoor *et al* to assess the awareness and knowledge of mothers of under five children regarding immunization in Ahmedabad they found that 83% of the literate mothers had some knowledge about vaccine preventable diseases (VPD). 85% of the respondents knew about poliomyelitis and

only 15% knew about Hepatitis B. Main sources of information of mothers about VPDs was the anganwadi worker (47%) and television (35%).[67]

In a study done by Shamila Hamid *et al* to assess the knowledge, attitude and practices about immunization among mothers of children aged 1-2 years in a rural area of North Kashmir, they found that all 300 mothers that were studied knew that vaccination was beneficial and protects their children from diseases. 39% knew OPV protects from polio while only 1% were aware of protective role of BCG.[68]

MC Singh *et al* found that mothers had a fair knowledge regarding need for immunization but a poor knowledge regarding the diseases prevented and the doses of the vaccines. Health workers were the major source of information among the mothers interviewed.[62] The ANM/ Health staff (56.4%) and family members (27.0%) were main source of information for mother for the need of mother and child immunization in the study done by RS Gupta *et al*.[37]

Polio and measles were the most heard diseases in a study done by Mandal S *et al* to assess parent's knowledge and practice on routine immunization in a rural community of West Bengal. One third of the care-givers knew the correct dose of measles vaccination whereas only 4.8% and 7.1% had the right knowledge of three doses for OPV and DPT. Fever (54.3%) and diarrhea (24.8%) were cited as the main side effects of vaccination.[69]

Immunization status and Gender

NFHS-1, NFHS-2 and NFHS-3, all show that males had a higher chance of being fully vaccinated than females. The percentage of fully vaccinated male children was 36.7%, 43.1% and 45.3% in NFHS-1, NFHS-2 and NFHS-3 respectively while the corresponding coverage for female children was 34.1%, 40.9% and 41.5%.[4, 5, 6]

DLHS-1 reported coverage among male children as 53.3% while for female children it was slightly lower (53%).[9]DLHS-2 and DLHS -3 also showed a higher coverage among male children than female children.[10, 11]The situation is similar in Karnataka, where all NFHS and DLHS reports show a higher coverage among male children than in female children.[4, 5, 33, 9, 12, 13] The CES 2005 report however showed a higher coverage among females (55.1) than in males (53.9%).[30]

Mahyavanshi *et al* in their study conducted in Surendranagar city of Gujurat found that males had a higher coverage of 76.03% compared to female children (65.17%). The percentage of unimmunized children were also higher among females (5.62%) compared to males (3.31%).[61]

A study done by Pankaj Kumar *et al* in rural Pune showed that the proportion of fully immunized children was marginally higher in males (87.61%) than in females (85.57%).[57] A study done by Imteyaz A *et al* in urban slums of Delhi also revealed that the coverage of full immunization was more in male children.[45]

However, RS Gupta *et al* in their study conducted in Alwar district found that immunization coverage was more for females than for males (48.4% for males and 52.3% for females).[37]

In a study done by Sreedhar M *et al* in Guntur town of Andhra Pradesh, coverage for BCG, DPT3and OPV3 were significantly higher for male children while it was higher for Measles in female children.[60]

Immunization status and Religion

NFHS1 reported that the highest vaccination coverage rates were for Jain children (74%). Hindu children (36%) had higher vaccination coverage as compared to Muslim children (26.3%).[4] NFHS-2 report shows similar vaccination coverage for both Hindu and Muslim children (82%).[5]

DLHS-2 and DLHS-3, both showed that Hindu children (71% and 54.8% in DLHS 2 and DLHS-3, respectively) had higher vaccination coverage when compared to Muslim children (69.1% and 44.5%).[10, 11] This is the same scenario that prevails in Karnataka according to these reports.[4,5,6,9,12,13]

CES-2005 reports a higher coverage in Hindu children (55.4%) than in Muslim children (45.5%).[30]

Bholanath *et al* in their study done in Lucknow district found that, after applying Multinomial logistic regression, Muslim religion was a significant independent predictor for partial immunization and unimmunized status.[40]

A study done in urban slums of Delhi by Imteyaz A *et al,* observed that non immunized rates in Hindus were 6.8% compared with 9.6% in Muslims. The coverage of full immunization was also more in Hindus than in Muslims in this study.[45]

The study done in Bareilly City by Varsha *et al* also revealed that religion was found to be significantly affecting the immunization status of the child, with Hindu

children having higher chances of being fully immunized as compared to Muslim children.[53]

Immunization coverage was significantly higher among Hindus (48.84%) in a study done in Guntur, Andhra Pradesh by Sreedhar M *et al*.[60]

Immunization status and Parent's Education

NFHS-1 report showed that the vaccination coverage improved as the educational status of the parents increased. The coverage for children of illiterate mothers was 24% whereas the coverage was 70% for children of mothers whose education was high school and above.[4] Similar findings are seen in NFHS-2 and NFHS-3 reports, that show a higher coverage among the children whose mothers have completed high school education. [5, 6]

DLHS-1 reported a higher coverage in children whose mothers who had studied for ten years or more (84.2%).[9] DLHS-2 and DLHS-3 also report an increase in coverage with increase in the educational status of the mother.[10, 11]

Bholanath *et al*, after applying multinomial logistic regression, found that illiteracy of the mother was a significant independent predictor of partial immunization with an odds ratio of 4.0.[40]

A study conducted in the urban slums of Delhi by Ahmad *et al* found that there was a discernible bias in favor of children with mothers having a high school or higher level education. There were significant associations between the coverage levels of immunization of the children with mother's level of education.[45] Mother's education was found to be significantly related to immunization status using logistic

regression in a study done in a tertiary care hospital of North India by Kumar D *et al.*[46]

A study done by Chaudhary V*et al* in Bareilly city revealed that the immunization status of children was significantly associated with both the father's as well as the mother's education.[53]

A study done by Gulati RK *et al* in Kota, Rajasthan, also found that with increase in paternal literacy there was an increase in the immunization status of their children, but it was statistically not significant, while immunization status of children had a highly significant relation with maternal literacy.[44]

Immunization coverage was significantly higher in children of literate guardians (45.29%) in a study done by Sreedhar M *et al* in Guntur town of Andhra Pradesh.[60]

Immunization status and Socio-economic status

NFHS-2 reports a higher coverage of 64.7% among the children with high standard of living compared to the children with medium or low standard of living.[5] Similar findings were seen in NFHS-3 report, where children in the highest category of wealth index had a higher coverage (71%) compared to the children in the lower categories of the wealth index.[6]

DLHS-2 reports a higher coverage of 70.3% among the children with high standard of living compared to the children with medium or low standard of living (31.3%).[10]DLHS-3 report shows children in the highest category of wealth index had a higher coverage (73.1%) compared to the children in the lower categories of the

wealth index.[11] CES-2009 shows vaccination coverage in the highest wealth quintile (75.5%) was higher compared to the coverage in the other wealth quintiles.[7]

Bholanath *et al* found that low socioeconomic status with an odds ratio of 10.8 was a significant predictor of unimmunized status after application of multinomial logistic regression.[40]

In the study conducted by Mahyavanshi DK *et al* in Surendranagar city of Gujurat they found that the percentage of fully immunized children was higher for children belonging to class 1, 2 and 3(82.93%) as compared to children belonging to class 4 and 5 (52.87%).[61]

A study done by Gulati *et al* in Kota, Rajasthan found that with increase in the economic status of the parents, the immunization status of their children increased significantly [100% fully immunized children in I income group, 66.7% in IV income group].[44]

Bijapur District

The coverage of Bijapur district has always been way below the state as well as the national average. The MICS 2002 report of Bijapur district, shows that only a little over one fourth of the children were fully immunized (25.8%). The state's fully vaccinated figure was more than two and a half times higher than the district. The survey also showed that, though the coverage of individual vaccines was high, the fully immunized status was low due to the high dropout rates.[70]

In the DLHS-2 report of 2002-04, Bijapur district, with vaccination coverage of 49.2%, was one of the six districts in the state to have coverage of less than 55%.

The other districts with low coverage were Bagalkot (41%), Koppal (42%), Raichur (43%), Gulbarga (45%) and Belgaum (50%).[12]

The DLHS-3 report of 2007-08 shows vaccination coverage in Karnataka ranging from 45.2% in Raichur to 96.4% in Chikmagalur District. The coverage of Bijapur district was 50.5%. Bijapur district had the dubious distinction of having the lowest OPV3 (73.3%) and Measles vaccine (67.4) coverage. Raichur district had the lowest coverage of DPT3 (53.4%). All districts had BCG coverage of more than 90%.[13]

Immunization card was seen in only 14% of children in MICS 2002 report of Bijapur district.[70] DLHS-3 reported that 34.5% of the children had an immunization card.[13]

Summary of Coverage of Individual Vaccines and Immunization status of Children aged 12-23 months in Bijapur District according to previous surveys.

S. No.	Survey	Year	BCG	DPT1	DPT3	OPV1	OPV3	Measles	FI*	PI	UI
1	**MICS**[70]	**2002**	72.8	64.6	40.8	73.5	60.5	46.9	25.8	55.8	18.4
2	**DLHS-2**[12]	**02-04**	88.6	-	64.2	-	67.7	64.1	49.2	46.3	4.5
3	**DLHS-3**[13]	**07-08**	91.3	-	68.2	-	73.7	67.4	50.5	45.4	4.1

*FI- Fully immunized, PI-Partially Immunized, UI- Unimmunized.

According to the MICS 2002 report of Bijapur district, dropout rate from BCG to measles was the highest (39.2%). The dropout rate from DPT1 to DPT3 was 36.8%, from OPV1 to OPV3 was 17.6% and from DPT1 to measles was 34.7%. The

dropout rate for male children was higher compared to female children for all except OPV1 to OPV3.[70]

64.8% of the children reported having taken BCG vaccine. Of these only 79.8% of the children had a BCG scar, showing faulty injection technique being employed for vaccine administration.[70]

Hence, we see that Bijapur district is lagging behind its counterparts in the state as well as at the national level with regards to immunization coverage. The situation is further worsened by the high dropout rate, the apathy of authorities and the ignorance among parents.

MATERIALS AND METHODS

STUDY SETTING

The study was conducted in 30 clusters (villages/ wards) of Bijapur district selected by cluster sampling technique.

STUDY POPULATION

Seven children in the age group of 12-23 months from each of the 30 clusters were included in the study.

STUDY DESIGN

A community based, observational, cross sectional study was designed. 30 cluster technique approved by WHO under the Universal Immunization Programme Coverage- Revised Survey Manual was used to assess the immunization coverage.[28]

DURATION OF STUDY

The study was conducted over a period of one year extending from the 1st of December, 2011 to 31st of November, 2012

ETHICAL CLEARANCE

The study protocol was submitted to the ethical committee of Shri B.M. Patil Medical College and clearance was obtained before commencement of study. (Annexure II)

PILOT SURVEY

A village was selected and pilot survey was conducted in 75 houses in November, 2011.Information regarding socio-demographic characteristics of the family, knowledge regarding immunization and main source of information were recorded. Immunization history and reason for partial/no immunization was recorded

using the WHO EPI coverage survey manual questionnaire.[28]Based on practical findings, the proforma for survey was redesigned.(Annexure-I)

CLUSTER SELECTION

A list of all the villages and wards (excluding the village in which pilot survey was done) in Bijapur and their respective populations was made using the 2001 census data.[71] The cumulative population was calculated by adding the population of the next village/ward to the combined total of all populations in preceding villages. The final cumulative population was the total population of Bijapur district i.e. 1,806,918.

The sampling interval was calculated using the following formula:

$$\text{Sampling Interval} = \frac{\text{Total Population to be surveyed}}{\text{30 clusters}} = \frac{1,806,918}{30} = 60230.6 = 60231$$

A random number was chosen from the table of random numbers in WHO EPI coverage manual[28] i.e. 23392.

The first cluster was chosen by locating the first community listed in which the cumulative population equals or exceeds the random number. The second cluster was chosen by locating the cluster whose cumulative population equaled or exceeded the number calculated by addition of the sampling interval and the random number. Clusters 3 – 30 were located by the formula:

(Number which identified the previous cluster + sampling interval)

The cluster chosen was the cluster whose cumulative population was either equal to or exceeded the number calculated using the above formula. A list of the 30 villages selected by the above technique was made. (Annexure IV) Seven children in the age group of 12-23 months were taken from each of the 30 clusters. Hence the

final sample size was 210. This sample size will give us the immunization coverage with an accuracy of ±10% at confidence level of 95%.

SELECTION OF STARTING HOUSEHOLD

A central location in the village or town, such as a market, a mosque or temple was selected. One direction from the centre was randomly chosen. The last digit of the serial number of a randomly selected currency note was used to select the starting household.

SELECTION OF SUBSEQUENT HOUSEHOLD

The next household visited would be the one whose front door was closest to the front door of the household just visited.

DATA COLLECTION

After explaining the purpose of the study and obtaining oral consent from the parent/ responsible guardian, oral interviews were administered to record information regarding the various variables in the pre-tested proforma.

The 12–23 month age group was chosen for analysis because both international and Government of India guidelines specify that children should be fully immunized by the time they complete their first year of life.

If a card was available, the dates when the child received vaccinations against each disease was verified to be within the child's 1st birthday. If the mother could not show a vaccination card, the mother's report that the vaccination was or was not given was accepted. If BCG was reported to be given, the child was checked for BCG scar on left upper arm. For DPT and polio, information was obtained on the number of doses of the vaccine given to the child. Mothers were not asked the dates of vaccinations. To distinguish Polio 0 (polio vaccine given at the time of birth) from

Polio 1 (polio vaccine given about six weeks after birth), mothers were asked whether the first polio vaccine was given just after birth or later. Polio doses given on national immunization days were not included.Hepatitis B vaccine history was excluded as it was included in the national immunization schedule only in 2010 -11 and WHO recommends that new vaccines should be included in the survey only if it has been a part of the national immunization schedule for a minimum period of two years.

In households where there were two or more eligible children, information was taken only for the youngest eligible child as this yields the most recent information. The survey was carried out in each cluster until seven children in the age group of 12 – 23 months were found and their parents/ responsible guardian were interviewed.

Since immunization cards were not commonly available and the dates of vaccination were not available for most children, the study calculated 'CRUDE' immunization coverage based on evidence from either 'CARD PLUS/OR HISTORY'.

Types of outcome measures: The primary outcome measure was 'complete vaccination/immunization' or fully immunized defined as per the 1998 World Health Organization (WHO) guideline *viz.* receipt of one dose of BCG vaccine, three doses of DPT and OPV vaccines, and one dose of measles vaccine by children in the age group 12-23 completed months. Secondary outcome measures were (*i*) 'no vaccination/immunization' or unimmunized defined as failure of a child 12-23 months old to receive even a single dose of the vaccines listed above, and (*ii*) 'partial /incomplete vaccination/immunization' or partially immunized defined as receipt of vaccine doses between 'no vaccination' and 'complete vaccination'.[28]

STATISTICAL ANALYSIS

SPSS v.17 (Statistical Package for Social Sciences) was used to analyze data. Data was presented in the form percentages, graphs and figures. Statistical tests such as Z test for difference between two proportions, Chi square test and Chi square test for trend was applied to the data. A p value of < 0.05 was considered to be significant.

INCLUSION CRITERIA

- Children aged 12-23 months with a responsible person for key information regarding immunization.
- Children who are permanent residents of the study area.

EXCLUSION CRITERIA

- Children whose mothers are not permanent residents of the study area.
- Children whose parents/guardians are not willing to participate in the study.
- Children whose parents/ guardians could not be contacted even after three visits.

RESULTS

The study was conducted on a total of 210 children, seven children from each of the 30 selected clusters. A total of 1014 households were surveyed.

A. Socio-demographic Profile

Table 1: Distribution of children based on gender and religion

S. No.	Socio-demographic Factors	Frequency (n = 210)	Percent
1.	Sex		
	a) Male	107	51.0
	b) Female	103	49.0
2.	Religion		
	a) Hindu	166	79.0
	b) Muslim	44	21.0

Of the 210 children studied, 107 (51%) were males while 103 (49%) were females. 166 (79%) of the children were Hindu and the remaining 44 children (21%) were Muslims.

Table 2: Distribution of children based on Socio-economic status (Economic status as per Prasad's updated criteria[72]- Annexure II)

S. No.	Socio-economic status	Frequency (n=210)	Percent
1.	Class I	10	4.8
2.	Class II	48	22.9
3.	Class III	106	50.5
4.	Class IV	40	19.0
5.	Class V	6	2.8
Total		210	100

With regards to socio-economic status, majority of the children belonged to middle class families (48(22.9%) in Class II and 106 (50.5%) in Class III). 10(4.8%) children belonged to upper class families (Class I). The remaining children belonged to lower socio-economic status families (40(19%) in Class IV and six (2.8%) in Class V).

Table 3: Distribution of children based on Mother's age, education and occupation

S. No.	Socio-demographic factor	Frequency (n=210)	Percent
1.	Mother's age		
	a) ≤ 20 years	38	18.1
	b) 21- 25 years	136	64.8
	c) 26-30 years	33	15.7
	d) > 30 years	3	1.4
2.	Mother's Education		
	a) Illiterate	83	39.5
	b) Primary School	19	9.0
	c) Secondary School	88	41.9
	d) Pre-University	18	8.6
	e) Degree	2	1.0
3.	Mother's Occupation		
	a) Housewife	146	69.5
	b) Agriculture	43	20.6
	c) Unskilled labour	15	7.1
	d) Skilled labour	3	1.4
	e) Business	3	1.4

136 (64.8%) of the mothers were in the 21-25 years age group. 38 (18.1%) mothers were less than or equal to 20 years of age and 36(17.1%) were 26 years of age or above.

Regarding education of the mother, majority of the mothers [88 (41.9%)] had studied up to secondary school. 83(39.5%) mothers were illiterate, 19(9%) had attended primary school, 18(8.6%) had been to pre-university and only two (1%) had a degree.

In our study most of the mothers were housewives [146(69.5%)]. While 43(20.6%) were involved in agricultural pursuits, 15(7.1%) were involved in unskilled labour and three (1.4%) each were involved in skilled labour and business.

Table 4: Distribution of children based on father's education and occupation

S. No.	Socio-demographic factor	Frequency (n=205)*	Percent
1.	Father's Education		
	a) Illiterate	74	36.1
	b) Primary School	19	9.3
	c) Secondary School	71	34.6
	d) Pre-University	25	12.2
	e) Degree	16	7.8
2.	Father's Occupation		
	a) Unemployed	4	2.0
	b) Agriculture	69	33.7
	c) Unskilled labour	46	22.4
	d) Skilled labour	64	31.2
	e) Business	22	10.7

*Fathers of five children had expired.

In the present study, most of the fathers were illiterate [74(36.1%)]. 19(9.3%) had been to primary school, 71(34.6%) had attended secondary school, 25(12.2%) had been to pre-university and 16(7.8%) had a professional degree.

With regards to the father's occupation, it was seen that most of the fathers were involved in agricultural pursuits [69(33.7%)]. Four (2%) were unemployed,

46(22.4%) were involved in unskilled labour, 64(31.2%) in skilled labour and 22(10.7%) in business.

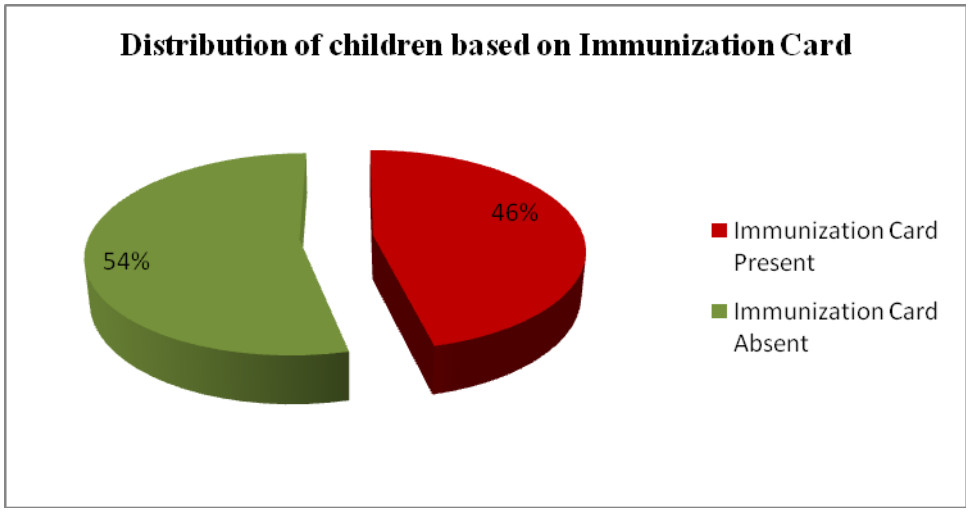
B. Details regarding immunization.

Table 5: Distribution of children based on immunization card and its relationship with gender

S. No.	Immunization Card	Male (n= 107)		Female (n= 103)		Total (n=210)	
		No.	Percent	No.	Percent	No.	Percent
1	Yes	50	46.7	47	45.6	97	46.2
2	No	57	53.3	56	54.4	113	53.8
Total		107	100	103	100	210	100
Z= 0.16, p= 0.873							

In the present study, it was seen that more than half the children did not have an immunization card [113(53.8%)]. 50(46.7%) of the male children and 47(45.6%) of the female children had an immunization card. There was no statistically significant difference between males and females with regards to immunization card (Z value= 0.16; p= 0.873)

Graph 1: Distribution of children based on immunization card



Graph 2: Immunization card and Gender

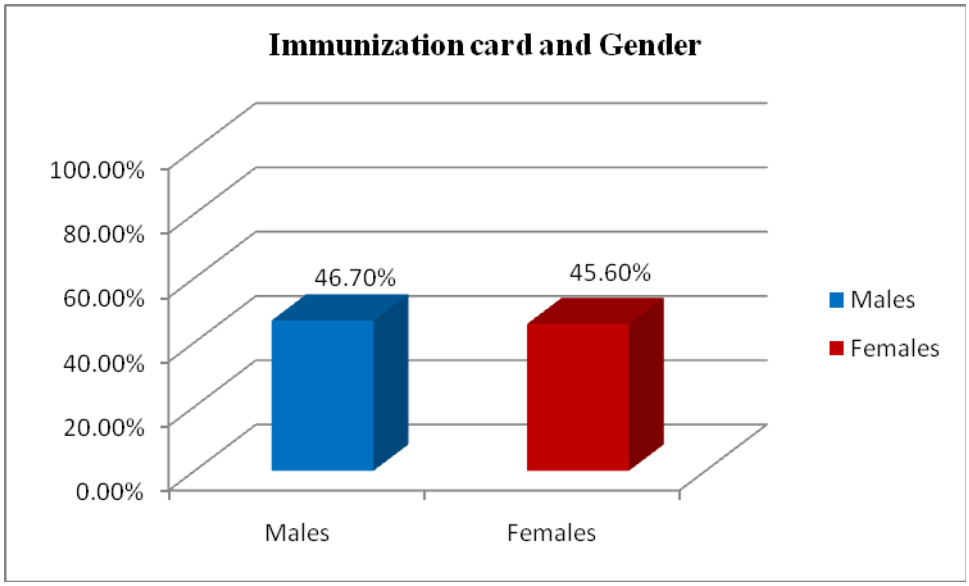


Table 6: Distribution of children based on immunization status and its relationship with gender

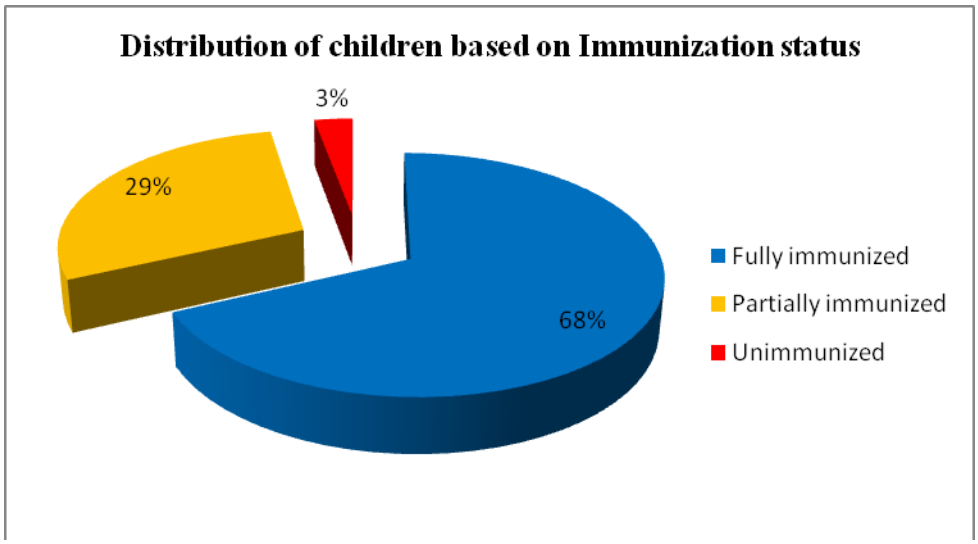
S. No.	Immunization Status	Male (n= 107)		Female (n= 103)		Total (n=210)	
		No.	Percent	No.	Percent	No.	Percent
1.	Fully immunized[a]	69	64.5	74	71.8	143	68.1
2.	Partially immunized	36	33.6	25	24.3	61	29.0
3.	Unimmunized	2	1.9	4	3.9	6	2.9
Total		107	100	103	100	210	100

Z= -1.15, p=0.251

In the present study, the percentage of fully immunized children was found to be 68.1%. The percentage of partially immunized children was 29%. 2.9% of the children had received no immunization.

The percentage of fully immunized among female children was found to be 71.8%. 24.3% of female children were partially immunized and 3.9% were found to be unimmunized. The percentage of male children that were fully immunized was found to be 64.5%. 33.6% were partially immunized and 1.9% had received no immunization. Though the percentage of fully immunized children was slightly higher for females than for males, this difference was found to be statistically insignificant (Z= -1.15; p= 0.251).

Graph 3: Distribution of children based on immunization status



Graph 4: Immunization status and Gender

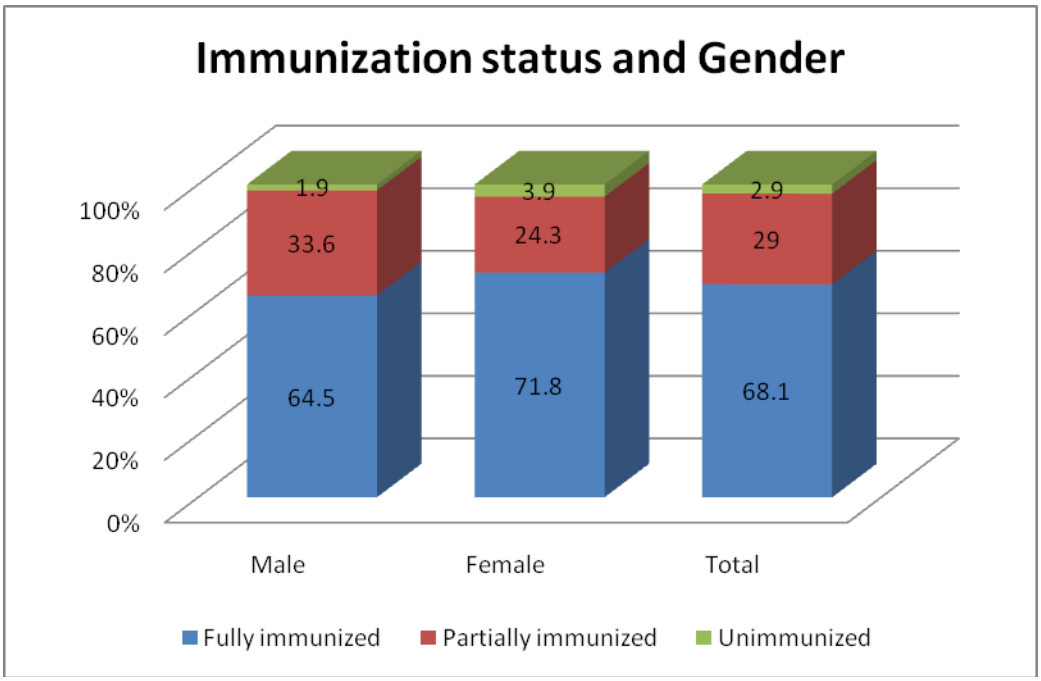


Table 7: Coverage of individual vaccines.

S. No.	Vaccine	Male (n= 107)		Female (n= 103)		Total (n=210)		Test
		No.	Percent	No.	Percent	No.	Percent	
1	BCG	105	98.1	98	95.1	203	96.7	Z= 1.20, p= 0.231
2	DPT-1	105	98.1	97	94.2	202	96.2	Z= 1.49 , p= 0.136
3	DPT-2	100	93.5	93	90.3	193	91.9	Z= 0.84 , p= 0.401
4	DPT-3	84	78.5	80	77.7	164	78.1	Z= 0.15 , p= 0.884
5	OPV-1	105	98.1	97	94.2	202	96.2	Z= 1.49 , p= 0.136
6	OPV-2	102	95.3	95	92.2	197	93.8	Z= 0.93 , p= 0.353
7	OPV-3	87	81.3	83	80.6	170	81	Z= 0.13 , p= 0.893
8	Measles	83	77.6	82	79.6	165	78.6	Z= -0.36 , p= 0.718

In the present study it was seen that the coverage of BCG vaccine was 96.7% (98.1% for males and 95.1% for females). Coverage for DPT-1 was 96.2% (98.1% for

males and 94.2% for females), coverage for DPT-2 was 91.9% (93.5% for males and 90.3% for females) and coverage for DPT-3 was 78.1% (78.5% for males and 77.7% for females). The coverage of OPV was slightly better than DPT, with OPV-1 having coverage of 96.2% (98.1% for males and 94.2% for females), OPV-2 coverage being 93.8% (95.3% for males and 92.2% for females) and OPV-3 coverage of 81% (81.3% for males and 80.6% for females). The coverage for Measles vaccine was 78.6% (77.6% for males and 79.6% for females)

The coverage for individual vaccines was found to be slightly higher among males when compared to females with the exception of measles immunization. However, none of these differences were found to be statistically significant.

Graph 5: Coverage of individual vaccines

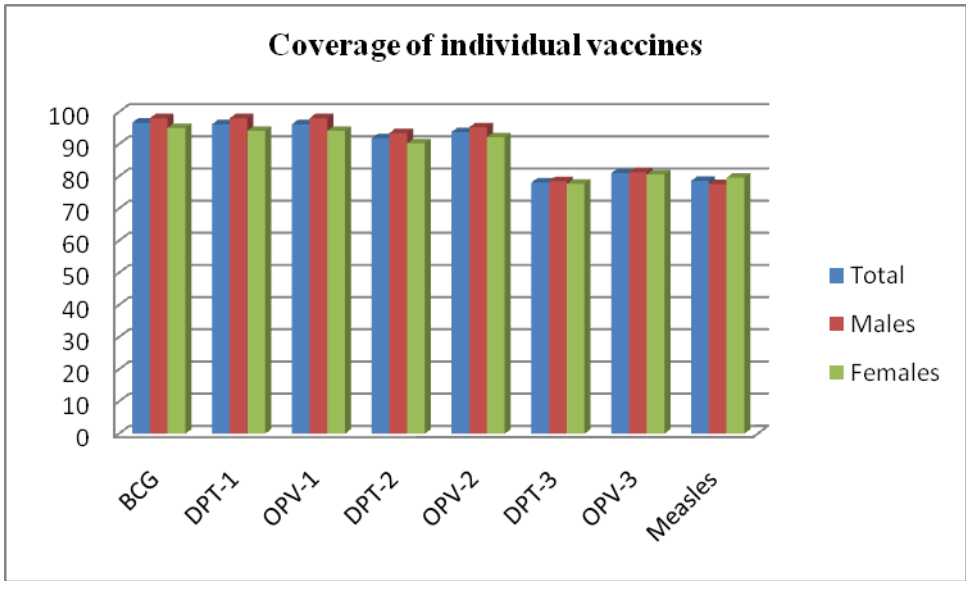


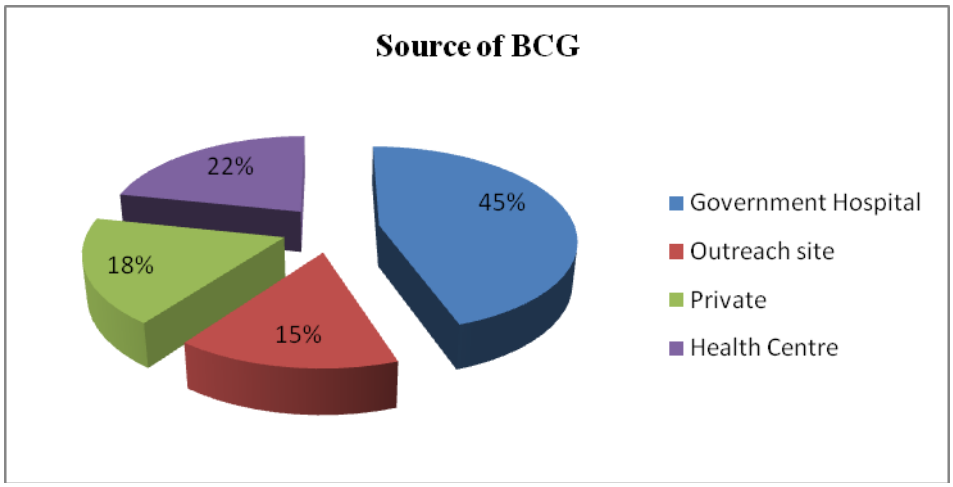
Table 8: Source of immunization

S. No.	Source	Source of BCG (n=203)*		Source for remaining vaccines (n= 202)#	
		No.	Percent	No.	Percent
1.	Government Hospital	91	44.8	16	7.9
2.	Outreach	31	15.3	146	72.3
3.	Private	37	18.2	19	9.4
4.	Health Centre	44	21.7	21	10.4
Total		203	100	202	100

*No. of children that reported BCG was 203.

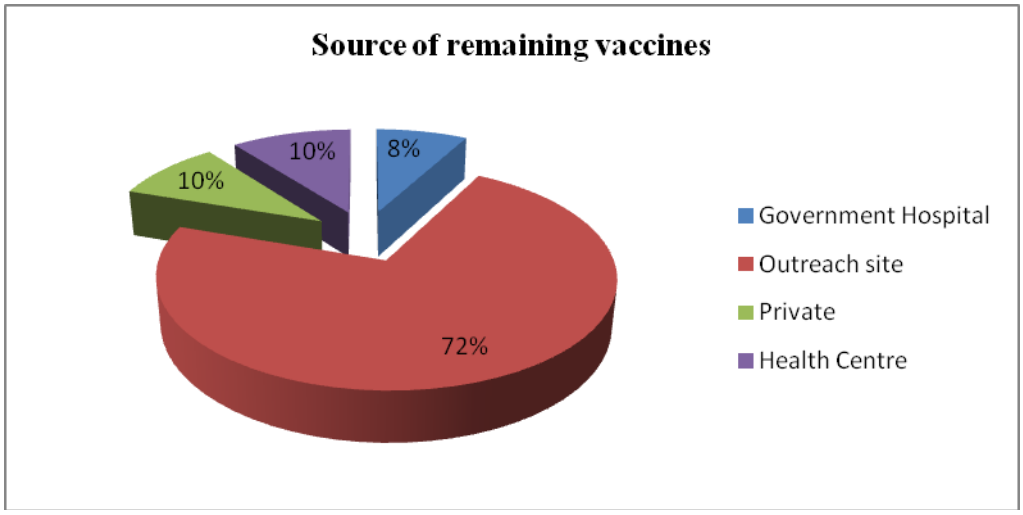
#No. of children that received any of the remaining vaccines was 202.

Graph 6: Source of BCG vaccine



We observed that the source of BCG immunization was mainly from government hospitals [91(44.8%)]. This was followed by Health Center [44(21.7%)], private establishments [37(18.2%)]and Outreach site [31(15.3%)].

Graph 7: Source of remaining vaccines



It was found that the source of the remaining vaccines was mainly from the Outreach site [146(72.3%)] followed by Health center [21(10.4%)], private establishments [19(9.4%)] and government hospitals [16(7.9%)].

Table 9: Reasons for immunization failure

S No	Reasons for Failure	Immunization Status				Total (n= 67)	
		Partially Immunized (n= 61)		Unimmunized (n= 6)			
		No.	Percent	No.	Percent	No.	Percent
A.	**LACK OF INFORMATION**						
	1. Unaware of need for immunization	3	4.9	4	66.7	7	10.4
	2. Unaware of need to return for 2nd or 3rd dose	20	32.9	0	0	20	29.9
	3. Place and/ or time of immunization unknown	1	1.6	0	0	1	1.5
	TOTAL (Lack of information)	24	39.4	4	66.7	28	41.8
B.	**LACK OF MOTIVATION**						
	1. Fear of side reactions	8	13.1	0	0	8	11.9
	2. Postponed until another time due to lack of motivation.	11	18.0	1	16.7	12	17.9
	3. No faith in immunization	3	4.9	1	16.7	4	6.0
	TOTAL (Lack of motivation)	22	36	2	33.4	24	35.8
C.	**OBSTACLES**						
	1. Place of immunization too far	3	4.9	0	0	3	4.5
	2. Mother too busy	2	3.3	0	0	2	3.0
	3. Child ill- not brought	10	16.4	0	0	10	14.9
	TOTAL (Obstacles)	15	24.6	0	0	15	22.4

In the present study it was seen that the main reason for immunization failure was the lack of information (41.8%). A lack of motivation was seen in 35.8% and obstacles were the reason for immunization failure in the remaining 22.4%.

The single most common reason for immunization failure was unawareness among the mothers to return for the second or third dose of DPT/OPV [20(29.9%)].

12(17.9%) lacked the motivation to complete the schedule and postponed it until another time. 10(14.9%) mothers said that the child was ill hence not brought.The fear of side reactions was the reason given by eight (11.9%) of the mothers. Seven (10.4%) mothers were unaware of the need for immunization.Four (6%) of the mothers said that they had no faith in immunization. Three (4.5%) mothers said the place of immunization was too far. Two (3%) mothers said they were too busy to take their child for immunization. One (1.5%) did not know the time/ place of immunization.

The main reason for partial immunization was the unawareness to return for second or third dose of DPT/OPV [20(32.9%)] and the main reason for non-immunization was the unawareness of the need for immunization [4(66.7%)].

Graph 8: Reasons for Immunization failure

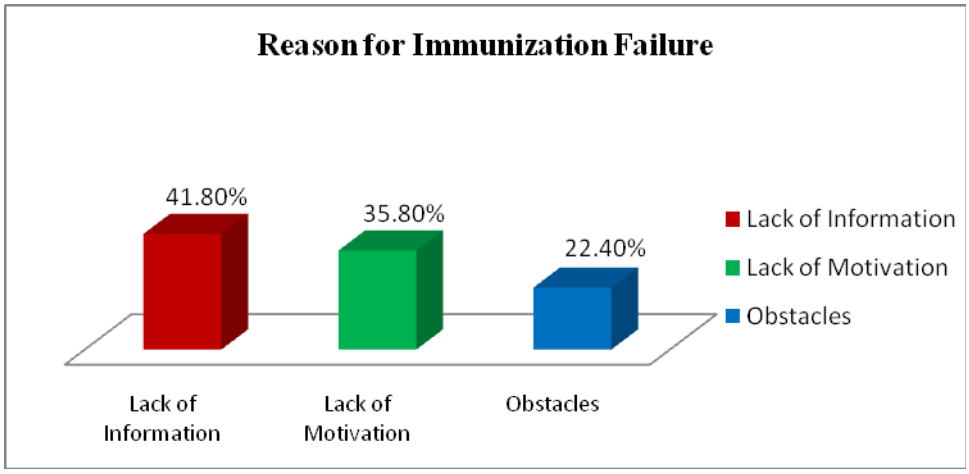


Table 10: Presence of BCG scar among children reporting BCG immunization with immunization card evidence

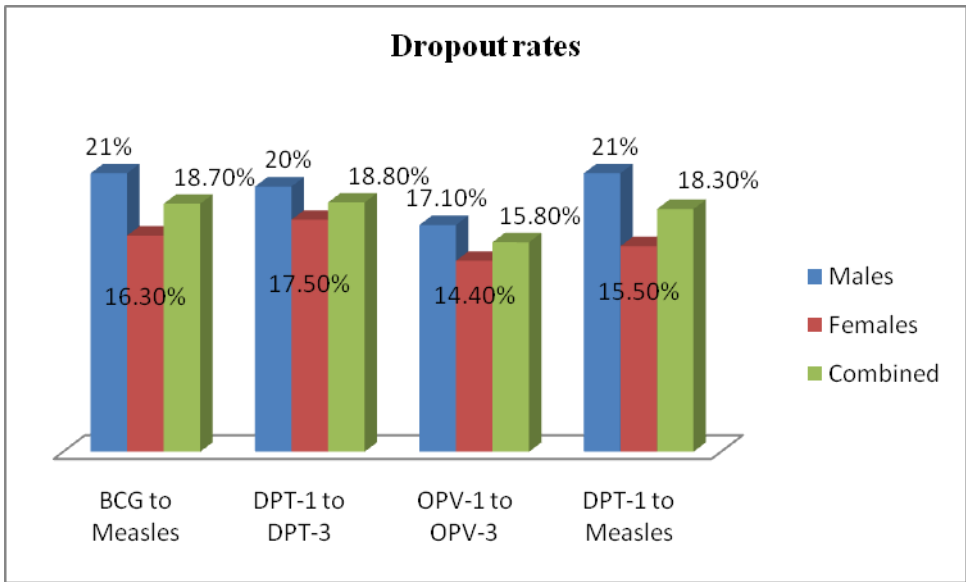
S. No.	BCG Scar	BCG reported (n= 96)	
		No.	Percent
1.	Present	94	97.9
2.	Absent	2	2.1
Total		96	100

Absence of BCG scar in children that report BCG immunization with immunization card evidence is an indicator of faulty injection technique. It was observed that of the 96 children with immunization card reporting BCG immunization, 94 (97.9%) had a BCG scar. The remaining 2 children (2.1%) did not have a BCG scar.

Table 11: Dropout rates

S. No.	Dropout rates	Males	Females	Combined
1.	BCG to Measles	21%	16.3%	18.7%
2.	DPT1 to DPT3	20%	17.5%	18.8%
3.	OPV1 to OPV3	17.1%	14.4%	15.8%
4.	DPT1 to Measles	21%	15.5%	18.3%

Graph 9: Dropout rate and Gender



The dropout rate of BCG to Measles was observed to be 18.7%. Dropout rates for DPT and OPV was observed to be 18.8% and 15.8%, respectively. The dropout rate for DPT-1 to Measles was 18.3%.

The dropout rate for boys was seen to be higher for male children compared to female children. The dropout rate for BCG to Measles was 21% for boys as compared to 16.3% for girls. The dropout rates for DPT and OPV were 20% and 17.1% for boys, respectively. The corresponding dropout rates for DPT and OPV for female children was found to be17.5% and 14.4%, respectively. The dropout rate for DPT-1 to Measles was found to be 21% for male children while it was only 15.5% for female children.

Mother's knowledge and perception regarding immunization

Table 12: Source of information regarding immunization amongst mothers of immunized children (Partially or fully immunized children)

S. No.	Source of Information	Frequency (n= 204)*	Percent
1.	Health Worker (ANM/AWW)	154	75.5
2.	Doctor	47	23.0
3.	Media	3	1.5
Total		204	100

*Six children were unimmunized.

It was seen that the main source of information regarding immunization for the mothers was the health worker (Auxiliary nurse midwife (ANM)/ Anganwadi worker (AWW)) [154(75.5%)]. Doctors [47(23%)] were the next main source of information. Media such as newspapers, television, radio and the internet was the main source of information in only three (1.5%) of the mothers.

Graph 10: Source of information regarding immunization.

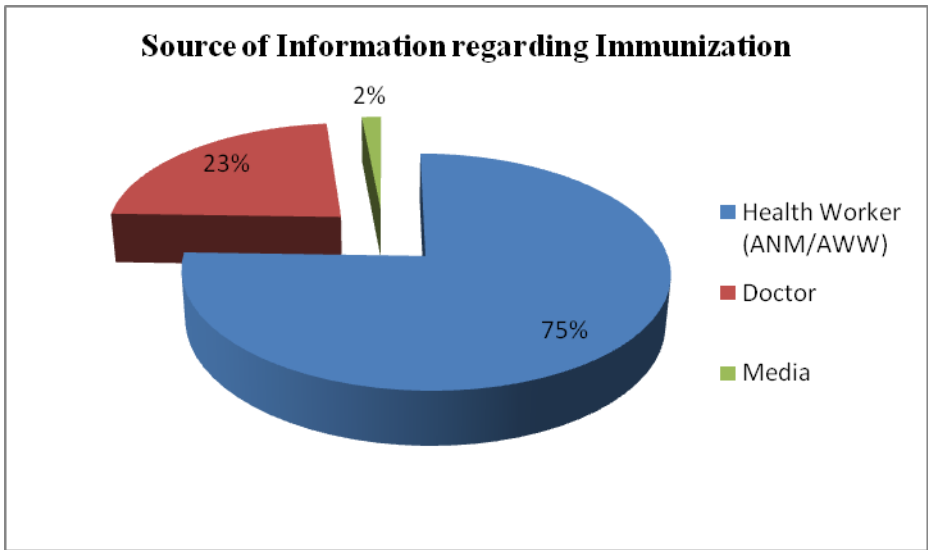


Table 13: Mother's perception and knowledge regarding immunization

S. No.	Question pertaining to perception/knowledge	Frequency (n= 210)	Percent
1.	Can diseases be prevented by immunization?		
	a) Yes	203	96.7
	b) No	3	1.4
	c) Don't know	4	1.9
2.	Is it important to give all doses of the vaccine?		
	a) Yes	129	61.4
	b) No	2	1.0
	c) Don't know	79	37.6
3.	What are the diseases that can be prevented by immunization?		
	a) One disease named	19	9.1
	b) Two diseases named	15	7.1
	c) Don't know	176	83.8
4.	Do you know when to take your child for immunization?		
	a) Knows	5	2.4
	b) Don't know	205	97.6

On checking the mother's perception regarding immunization, it was seen that majority of the mothers [203(96.7%)] believed that diseases could be prevented by immunization. Three (1.4%) mothers said that diseases cannot be prevented and four (1.9%) said that they did not know whether immunization protected their children from diseases.

129(61.4%) mothers opined that it was important to give all doses of the vaccine. Two (1%) said it was not necessary to give all doses while the remaining 79(37.6%) did not know whether it was important or not.

While studying the mother's knowledge regarding immunization it was seen that 176(83.8%) of the mothers could not name even one disease that immunization protected their children from. 19(9.1%) could name one disease and 15(7.1%) could name two diseases that their child was protected from due to immunization. The most common diseases named were polio and measles.

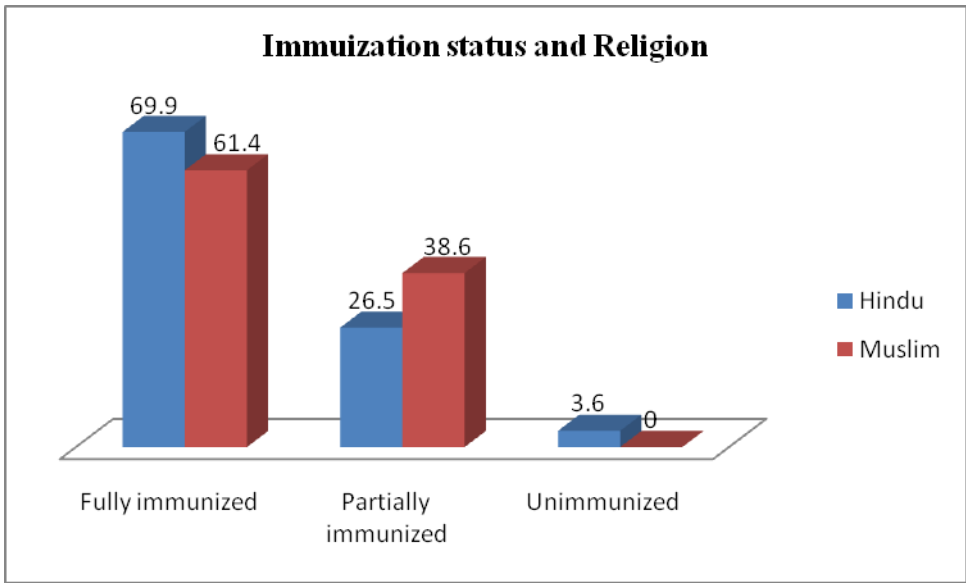
On testing their knowledge regarding the immunization schedule it was seen that only five (2.4%) of the mothers knew when the doses were to be given. The remaining 205(97.6%) mothers were unaware about the timing of the doses and took their child for immunization only if and when they were called by the health worker.

C. Other factors influencing immunization status.

Table 14: Relationship between religion and immunization status

S. No.	Immunization Status	Hindu (n=166)		Muslim (n=44)		Total (n=210)	
		No.	Percent	No.	Percent	No.	Percent
1	Fully immunized	116	69.9	27	61.4	143	68.1
2	Partially immunized	44	26.5	17	38.6	61	29.0
3	Unimmunized	6	3.6	0	0	6	2.9
Total		166	100	44	100	210	100
Pooled $\chi 2 = 1.161$; df = 1; p=0.2813							

Graph 11: Immunization status and Religion



It was seen that the proportion of fully immunized was higher for Hindu children [116(69.9%)] as compared to Muslim children [27(61.4%)]. The proportion of partially immunized children was higher among Muslim children [17(38.6%)] as compared to Hindu children [44(26.5%)]. It was observed that none of the Muslim children were unimmunized in contrast to Hindu children where six (3.6%) children were unimmunized. However, there was no significant relationship found between immunization status and religion of the child.

Table 15: Relationship between immunization card and immunization status

S. No.	Immunization Status	Immunization card present (n= 97)		Immunization card absent (n= 113)		Total (n=210)	
		No.	Percent	No.	Percent	No.	Percent
1	Fully immunized[a]	72	74.2	71	62.8	143	68.1
2	Partially immunized[b]	25	25.8	36	31.9	61	29.0
3	Unimmunized	0	0	6	5.3	6	2.9
Total		97	100	113	100	210	100
[a]Z= 1.79 , p= 0.073; [b]Z= -0.98 , p= 0.329							

It was seen that the proportion of fully immunized children was higher among the children who had an immunization card (74.2%) as compared to the children who did not have one (62.8%), but this difference was found to be statistically insignificant. The proportion of partially immunized children was higher among the children that did not have an immunization card, but this difference was also found to be statistically insignificant. None of the unimmunized children had an immunization card.

Table 16: Relationship between mother's age and immunization status

S. No.	Immunization Status	Mother's Age				Total
		< 20 years	21-25 years	26- 30 years	> 30 years	
1	Fully immunized	24 (63.2%)	93 (68.4%)	25 (75.8%)	1 (33.3%)	143 (68.1%)
2	Partially immunized	12 (31.6%)	40 (29.4%)	8 (24.2%)	1 (33.3%)	61 (29.0%)
3	Unimmunized	2 (5.2%)	3 (2.2%)	0 (0%)	1 (33.3%)	6 (2.9%)
Total		38 (100%)	136 (100%)	33 (100%)	3 (100%)	210 (100%)
$\chi 2$ test for trend = 14.08 ; df = 1 ; p= 0.002(Significant)						

It was observed that the proportion of fully immunized children increased with increase in mother's age. The proportion of fully immunized children was 63.2%, 68.4% and 75.8% for <20 years, 21-25 years and 26-30 years age groups, respectively. The proportion of partially immunized children decreased with increase in mother's age. The proportion of partially immunized children was 31.6%, 29.4% and 24.2% for <20 years, 21-25 years and 26-30 years age groups, respectively. Only three children had mothers above the age of 30 years of which one was fully immunized, one was partially immunized and one was unimmunized. Two children who were unimmunized had mothers aged less than 20 years and three unimmunized

children had mothers aged 21-25 years. The increasing trend of fully immunized status with maternal age was found to statistically significant.

Graph 12: Mother's age and Immunization Status

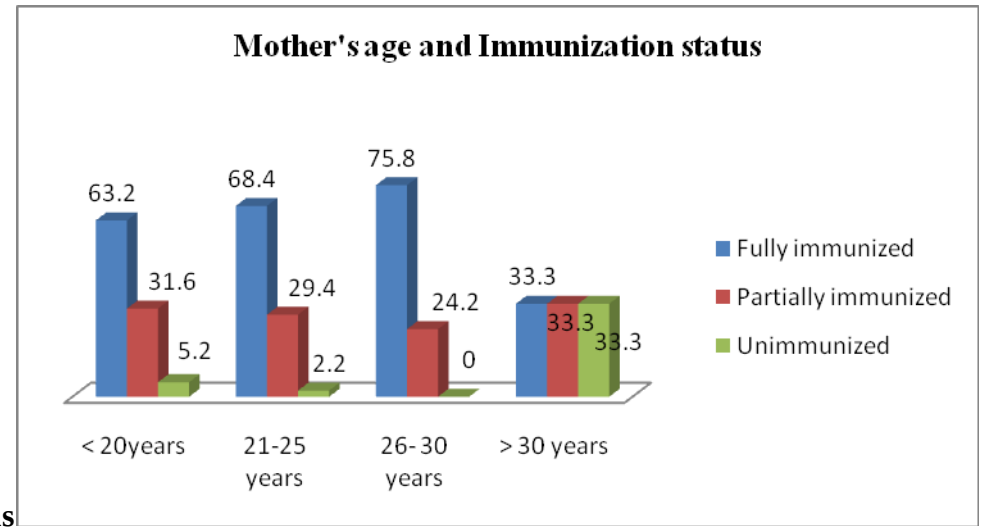


Table 17: Relationship between mother's education and immunization status

S. No.	Immunization Status	Mother's Education					Total
		Illiterate	Primary school	Secondary school	Pre-University	Degree	
1	Fully immunized	54 (65.1%)	13 (68.4%)	59 (67.0%)	16 (88.9%)	1 (50.0%)	143 (68.1%)
2	Partially immunized	24 (28.9%)	5 (26.3%)	29 (33.0%)	2 (11.1%)	1 (50.0%)	61 (29.0%)
3	Unimmunized	5 (6.0%)	1 (5.3%)	0 (0%)	0 (0%)	0 (0%)	6 (2.9%)
Total		83 (100%)	19 (100%)	88 (100%)	18 (100%)	2 (100%)	210 (100%)
Pooled $\chi 2 = 3.03$; df = 3 ; p= 0.387							

Of the 83 children who had illiterate mothers, 54(65.1%) were fully immunized, 24(28.9%) were partially immunized and 5(6%) were unimmunized. Among the 19 children who had mothers with education up to primary school, 13(68.4%) were fully immunized, 5(26.3%) were partially immunized and one (5.3%) was unimmunized. Of the 88 children who had mothers with secondary school

education, 59(67%) were fully immunized, 29(33%) were partially immunized and none were unimmunized. 16(88.9%) of the 18 children having mothers with pre-university education were fully immunized while the remaining two children (11.1%) were partially immunized. Of the two children whose mothers had a professional degree one was fully immunized while the other one was partially immunized. There was no statistically significant relationship between immunization status and mother's education.

Graph 13: Mother's Education and Immunization status

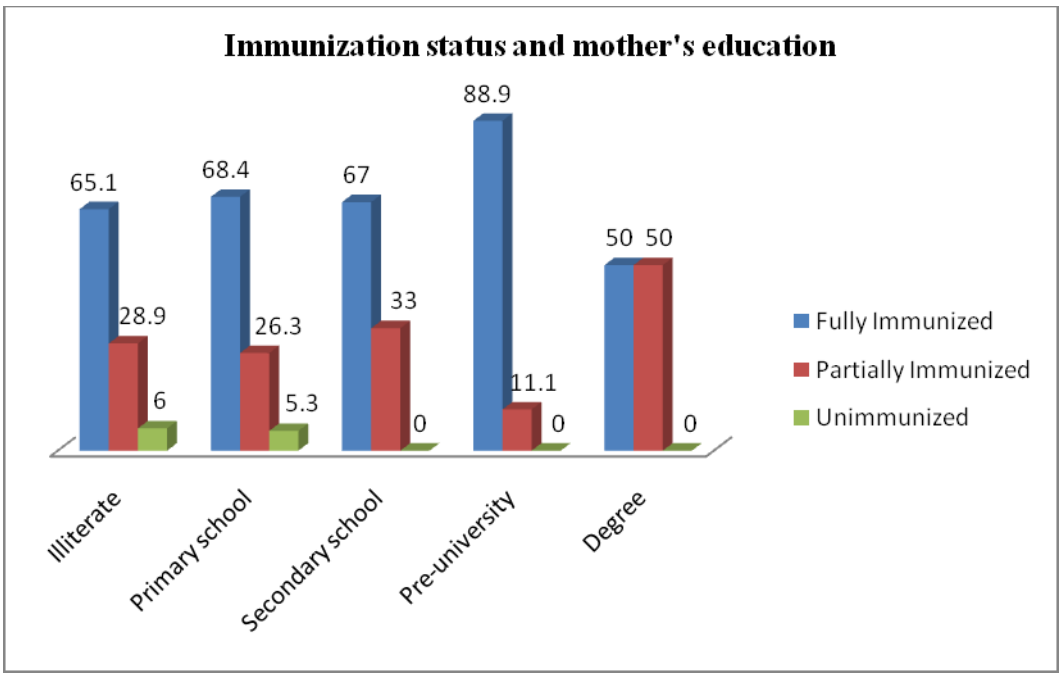


Table 18: Relationship between mother's occupation and immunization status

S. No.	Immunization Status	Mother's Occupation					Total
		Housewife	Agriculture	Unskilled labour	Skilled labour	Business	
1	Fully immunized	99 (67.8%)	32 (74.4%)	8 (53.3%)	3 (100%)	1 (33.3%)	143 (68.1%)
2	Partially immunized	45 (30.8%)	10 (23.3%)	4 (26.7%)	0 (0%)	2 (66.7%)	61 (29.0%)
3	Unimmunized	2 (1.4%)	1 (2.3%)	3 (20.0%)	0 (0%)	0 (0%)	6 (2.9%)
Total		146 (100%)	43 (100%)	15 (100%)	3 (100%)	3 (100%)	210 (100%)
Pooled $\chi 2 = 2.31$; df = 3 ; p= 0.511							

Of the 146 children whose mothers were housewives, 99(67.8%) were fully immunized, 45(30.8%) were partially immunized and two (1.4%) were unimmunized. Among the 43 children whose mothers were engaged in agricultural pursuits it was observed that 32(74.4%) were fully immunized, 10(23.3%) were partially immunized and one (2.3%) was unimmunized. The proportion of fully immunized children among the 15 children whose mothers were involved in unskilled labour was found to be 53.3%, while four (26.7%) were partially immunized and three (20%) were unimmunized. All three children whose mothers were involved in skilled labour were fully immunized. Of the three children whose mothers were involved in business, one was fully immunized and two were partially immunized. There was no statistically significant relationship seen between immunization status and mother's occupation.

Graph 14: Mother's occupation and Immunization status

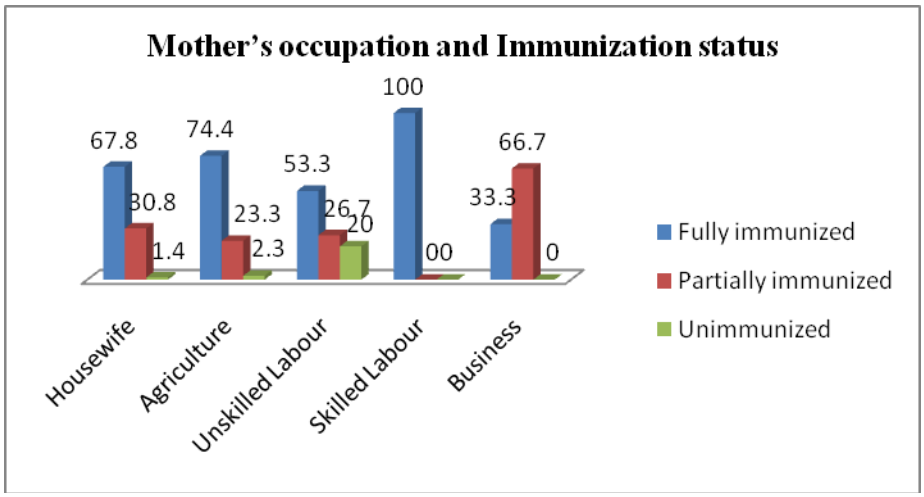


Table 19: Relationship between father's education and immunization status

S. No.	Immunization Status	Father's Education						Total
		Illiterate	Primary school	Secondary school	Pre-University	Degree	*Father Expired	
1	Fully immunized	49 (66.2%)	11 (57.9%)	53 (74.7%)	12 (48.0%)	13 (81.2%)	5 (100%)	143 (68.1%)
2	Partially immunized	20 (27.0%)	8 (42.1%)	17 (23.9%)	13 (52.0%)	3 (18.8%)	0 (0%)	61 (29.0%)
3	Unimmunized	5 (6.8%)	0 (0%)	1 (1.4%)	0 (0%)	0 (0%)	0 (0%)	6 (2.9%)
Total		74 (100%)	19 (100%)	71 (100%)	25 (100%)	16 (100%)	5 (100%)	210 (100%)
Pooled $\chi 2 = 3.29$; df = 3 ; p= 0.349 *excluded while applying chi square test								

While comparing father's education with immunization status it was seen that of the 74 children whose fathers were illiterate, 49(66.2%) were fully immunized, 20(27%) were partially immunized and 5(6.8%) were unimmunized. Of the 19 children whose fathers had primary school education, 11(57.9%) were fully immunized, eight (42.1%) were partially immunized and none were unimmunized. Of

the 71 children whose fathers had studied up to secondary school, it was observed that 53(74.7%) were fully immunized, 17(23.9%) were partially immunized and one (1.4%) was unimmunized. Of the 25 children whose fathers had education up to pre-university, 12(48%) were fully immunized and the remaining 13(52%) children were partially immunized. Of the 16 children whose fathers had a professional degree, 13(81.2%) were fully immunized and the remaining three children (18.8%) were partially immunized. No statistically significant relationship was seen between immunization status and father's educational status.

Graph 15: Father's education and Immunization status

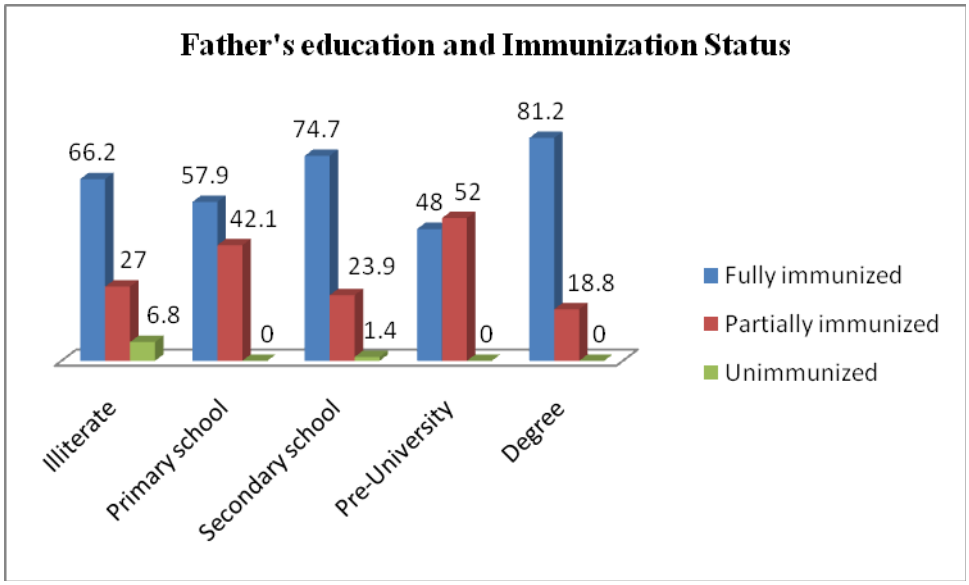


Table 20: Relationship between father's occupation and immunization status

S. No.	Immunization Status	Father's Occupation						Total
		Un employed	Agriculture	Unskilled labour	Skilled labour	Business	*Father Expired	
1	Fully immunized	4 (100%)	50 (72.5%)	30 (65.2%)	40 (62.5%)	14 (63.6%)	5 (100%)	143 (68.1%)
2	Partially immunized	0 (0%)	18 (26.1%)	11 (23.9%)	24 (37.5%)	8 (36.4%)	0 (0%)	61 (29.0%)
3	Unimmunized	0 (0%)	1 (1.4%)	5 (10.9%)	0 (0%)	0 (0%)	0 (0%)	6 (2.9%)
Total		4 (100%)	69 (100%)	46 (100%)	64 (100%)	22 (100%)	5 (100%)	210 (100%)
Pooled $\chi 2 = 3.68$; df = 4 ; p= 0.452								
*excluded while applying chi square test								

On studying the relationship between father's occupation and immunization status it was seen that all four children whose fathers were unemployed were fully immunized. Among the 69 children whose fathers were engaged in agricultural pursuits, it was observed that 50(72.5%) were fully immunized, 18(26.1%) were partially immunized and one (1.4%) was unimmunized. The proportion of fully immunized children whose fathers were involved in unskilled labour was found to be 65.2%, while 11(23.9%) were partially immunized and five children (10.9%) were unimmunized. Of the 64children whose fathers engaged in skilled labour, 40(62.5%) were fully immunized while the remaining 24(37.5%) were partially immunized. Of the 22 children whose fathers were involved in business, 14(63.6%) were fully immunized and eight (36.4%) were partially immunized. There was no statistically significant relationship seen between immunization status and father's occupation.

Graph 16: Father's Occupation and Immunization status

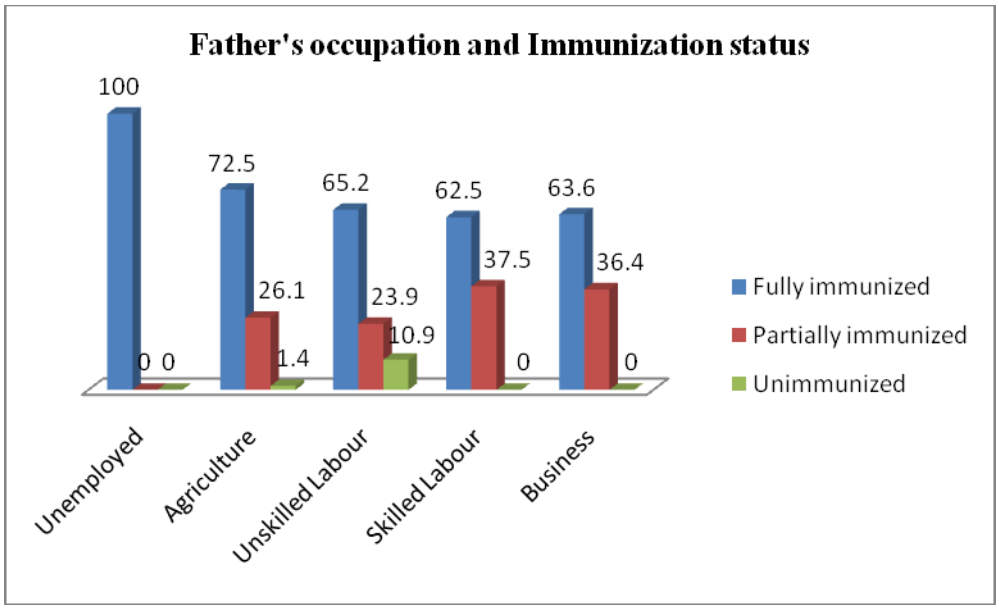


Table 21: Relationship between socio-economic status and immunization status

S. No.	Immunization Status	Socio-economic status					Total
		Class I	Class II	Class III	Class IV	Class V	
1	Fully immunized	7 (70.0%)	34 (70.8%)	70 (66.0%)	28 (70.0%)	4 (66.7%)	143 (68.1%)
2	Partially immunized	3 (30.0%)	14 (29.2%)	35 (33.0%)	8 (20.0%)	1 (16.7%)	61 (29.0%)
3	Unimmunized	0 (0%)	0 (0%)	1 (1.0%)	4 (10.0%)	1 (16.7%)	6 (2.9%)
Total		10 (100%)	48 (100%)	106 (100%)	40 (100%)	6 (100%)	210 (100%)
Pooled $\chi 2 = 0.432$; df = 2 ; p= 0.806							

While studying the relationship between socio-economic status and immunization status, it was observed that the proportion of fully immunized children was similar in all classes. Of the 10 children belonging to class I socio-economic status, seven (70%) were fully immunized while the remaining three (30%) were partially immunized. Of the 48 children belonging to class II socio-economic status,

34(70.8%) were fully immunized while the remaining 14(29.2%) were partially immunized. In class III socio-economic status, the proportion of fully immunized, partially immunized and unimmunized children was 66%, 33% and 1%, respectively. 28(70%) children of class IV socio-economic status were fully immunized, while eight (20%) were partially immunized and four (10%) were unimmunized. Of the six children belonging to class V socio-economic status, four were fully immunized, while one was partially immunized and one was unimmunized. No statistically significant relationship was seen between immunization status and socio-economic status.

Graph 17: Socio-economic Status and Immunization status

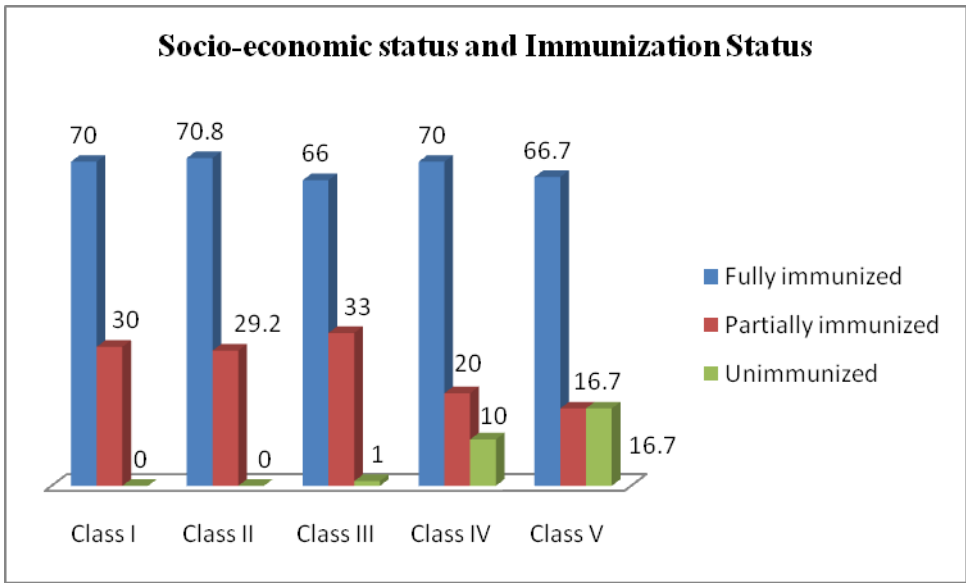


Table 22: Relationship between immunization status and source of immunization (excluding BCG dose)

S. No.	Immunization Status	Source of immunization after BCG dose			
		Government Hospital	Outreach	Private	Health Centre
1	Fully immunized	14 (87.5%)	100 (68.4%)	13 (68.4%)	16 (76.2%)
2	Partially immunized	2 (12.5%)	46 (31.6%)	6 (31.6%)	5 (23.8%)
Total		16 (100%)	146 (100%)	19 (100%)	21 (100%)
Pooled $\chi 2 = 0.362$; df = 2 ; p= 0.835					

On studying the relationship between immunization status and the source of immunization other than BCG, it was observed that the percentage of fully immunized children among those who received their doses from government hospital was 87.5%. Percentage of fully immunized among children who received immunization from health centre was 76.2% and 68.4% for both outreach site as well as private establishments. No statistically significant relationship was seen between immunization status and source of immunization.

DISCUSSION

A cross-sectional survey was conducted from 1st of December, 2011 to 31st of November, 2012, using WHO's thirty cluster sampling technique in Bijapur district of Karnataka. A total of 210 children aged 12-23 months were included in the present study. A total of 1014 households were surveyed.

A. Socio-demographic profile:

1. Gender

   The proportion of males and females in the present study was observed to be almost equal (51% and 49%, respectively). This is similar to the findings in the studies done in Kancheepuram (51% males and 49% females) [52], Mumbai (55.4% males and 44.6% females) [48], Nellore (50.4% males and 49.6% females) [56], rural Pune (53.8% males and 46.2% females) [57] and Ahmedabad (52.8% males and 47.2% females) [41].

2. Religion

   In our study, majority of the children were Hindu (79%) and the remaining were Muslim (21%). Similar findings were observed in studies done in Delhi (70% Hindu and 30% Muslims) [45], Bareilly (76.2% Hindu and 23.8% Muslims) [53] and Ahmedabad (65% Hindu, 30% Muslims and 5% others) [67].

3. Socio-economic status

   Majority of the children in the present study belonged to middle class i.e. class II and class III (22.9% and 50.5%, respectively). This is in contrast to the studies donein Bareilly (59.05% in class IV) [53], Mumbai (50.5% in class IV) [48]

and Lucknow (more than half the households in class IV) [73] where most children belonged to lower class families.

4. Mother's Socio-demographic profile

   - Mother's Age:

   Almost two-thirds of the mothers were in the 21-25 years age group (64.8%). This is in contrast to CES report of 2005, where most of the mothers were in the age group of 25-35 years (50.6%) and 43.4% were below 25 years of age.[30]

   In our study 80.5% of the mothers were in the age group of 21- 30years which is similar to the study done in Ahmedabad where 73% of the mothers were in the age group of 21 -30 years.[67]

   - Mother's Education

   In the present study, 39.5% of the mothers were illiterate and 60.5% were literate. This is similar to the study done in Etawah district (46.2% illiterate and 53.8% literate) [59] but in contrast to the study done in Bareilly where majority of the mothers were illiterate (53.8%) [53].

   Most of the mothers had studied up to secondary school (41.9%). This is similar to the study done in Mumbai where majority of the mothers had studied up to secondary (33.5%) or higher secondary school (38.9%). [48] However, it is in contrast to the study done in Delhi where majority of the mothers (66%) had primary level education or were illiterate.[45]

   - Mother's Occupation

   Over two-thirds of the mothers in the present study were housewives (69.5%). This is less compared to the studies done in Ahmedabad (72% were

housewives) [67], North Kashmir (93% were housewives) [68], Bareilly (87.6% were housewives) [53] and Mumbai (97.1% were housewives)[48].

5. Father's socio-demographic profile

   - Father's education

   Majority of the fathers in the present study were literate (63.9%). This is similar to the study done in Bareilly (66.2% literate and 33.8% illiterate) [53].

   Most of the fathers in our study had education up to secondary school (34.6%). This is similar to the studies done in Etawah (30.5% had been up to high school) [59] and Mumbai (32.3% had been up to secondary school) [48].

   - Father's occupation

   In the present study most of the fathers were employed (98%). This is similar to the studies done in Bareilly (99.1% were employed) [53], Mumbai (96.6% were employed) [48] and Surat (98.9% were employed) [43].

   Most of the fathers in our study were involved in agricultural pursuits (33.7%). This is in contrast to the studies done in Surat where majority of the fathers were laborers (50%).[43]

B. Immunization details.

1. Immunization card

   Less than half (46.2%) of the children in our study possessed an immunization card. This is higher than the number according to the MICS 2002 report of Bijapur district where they saw immunization cards were available for only about one-tenth (14%) of the children aged 12-23 months.[70] It is also higher than the DLHS-3 reported figure for Bijapur district, which reported that 34.5% of the children aged 12-23 months had an immunization card.[13]

The percentage of children having an immunization card is higher than the national average given by NFHS-3(37.5%) and DLHS-3 (42.9%) while it is lower compared to the state figures given by the same reports (NFHS-3(52.8%) and DLHS-3 (53.7%)).[6, 11]

The findings in our study is higher compared to the findings of the studies done in Agra district (41.5%)[42] and Alwar district (27.8%)[37] but lower compared to the studies done in rural Pune (60.9%)[57], Jamnagar city (74.3%)[39] and Kota (67.6%) [44].

2. Immunization status

The percentage of children in our study that were fully vaccinated was 68.1%. 29% were partially immunized and the remaining 2.9% were unimmunized.

The vaccination coverage of Bijapur district according to the present study is better than the previous surveys conducted in the district. The figures reported by the MICS 2002 report of Bijapur district showed that 25.8% of the children aged 12-23 months were fully immunized, 55.8% were partially immunized and 18.4% were unimmunized.[70] The DLHS-2 reported the percentage of fully immunized as 49.2%, partially immunized children as 46.3% and unimmunized children as 4.5% in Bijapur.[12] The DLHS-3 report stated that the coverage of Bijapur district was 50.5%, with the percentage of partially immunized and unimmunized being 45.4% and 4.1%, respectively.[13] However our findings are lower compared to the coverage for Karnataka given by both DLHS-3 (76.7%) [13] and CES 2009 (78%).[7] Hence, we see that though the coverage has improved in Bijapur over the years, the district is still lagging behind the state's average.

The percentage of fully immunized according to our study is higher compared to the national average reported by DLHS-3 (53.5%) [11] and CES 2009 (61%) [7].

The percentage of fully immunized in our study is lower compared to other studies done in South India, such as in Bangalore City (84.09%) [38], Kancheepuram district (71.9%) [52], and Kerala (>75%) [74] , as well as studies done in the neighbouring state of Maharashtra such as in rural Pune (86.67%) [57], Mumbai (88.07%) [48] and Miraj (87.5%) [35]. However, the coverage of the present study is better compared to the studies done in various places in Andhra Pradesh such as Guntur town (38.57%) [60] and Nellore city (60.6%) [56] , and also studies done North India such as in Surat (49.8%) [65] and Bareilly (50%) [51].

3. Coverage of individual vaccines

The coverage of BCG vaccine in our study was found to be 96.7%. The coverage of BCG in our study is higher than the previous statistics for Bijapur district given by MICS report of 2002 (72.8%) [70], DLHS-2 report of 2002-04 (88.6%) [12] as well as the DLHS-3 report of 2007-08 (91.3%) [13]. It is also higher compared to the national coverage of BCG given by both DLHS-3(86.7%) [11] as well as CES 2009 report (86.9%) [7]. It is however very similar to BCG coverage of Karnataka state given by DLHS-3 report (96.8%) [13].

In our study the coverage for DPT-1, DPT-2 and DPT-3 was 96.2%, 91.9% and 78.1%, respectively. The coverage of DPT-3 in our study is higher than what was reported for Bijapur district by MICS report of 2002 (40.8%) [70], DLHS-2 (64.2%) [12] and DLHS-3 (68.2%) [13]. DPT-3 coverage for India by DLHS-3 report (63.5%) [11] and CES 2009 report (71.5%) [7] was lower compared to the present study. However, the DPT-3 coverage for Karnataka

according to DLHS-3 (84.8%) [13] and CES 2009 (88.2%) [7] is higher compared to the present study.

The coverage for OPV-1, OPV-2 and OPV-3 was 96.2%, 93.8% and 81%, respectively. The coverage of OPV-3 in our study is higher than what was reported for Bijapur district by MICS report of 2002 (60.5%) [70], DLHS-2 (67.7%) [12] and DLHS-3 (73.7%) [13]. At the national level, OPV-3 coverage as per DLHS-3 report (66%) [11] and CES 2009 report (70.4%) [7] is lower compared to the coverage obtained from the present study. However, the OPV-3 coverage for Karnataka state according to DLHS-3 (90.3%) is higher compared to the present study. [13]

Measles coverage was found to be 78.6%. This is higher than reported for Bijapur district by MICS report of 2002 (46.9%) [70], DLHS-2 (64.1%) [12] as well as DLHS-3 (67.4%)[13], and the national average given by DLHS-3(69.1%) [11] and CES 2009 (74.1%) [7]. But it is lower than that for Karnataka given by DLHS-3 (85.1%) [13] and CES 2009 (89.9%) [7].

Our findings are similar to the findings of the studies done in Wardha district[62], Surendranagar city [61], Jamnagar city[39], Gandhinagar[49], Surat[43] and Ahmedabad city [41].

In the present study it was observed that the coverage for all vaccines except for measles vaccine was higher among male children than compared to female children. This is similar to the findings of the study done in Guntur town of Andhra Pradesh [60] and Surat[34]. The coverage of both BCG and DPT1 are WHO indicators for immunization system access. The coverage of BCG and DPT1 dose in our study was found to be 96.7% and 96.2%, respectively. This

indicates that almost 96% of the population has access to the immunization services being provided which is very encouraging.

4. Source of immunization

The main source of BCG vaccine was found to be the government hospital (44.8%) followed by health centre (21.7%) and private establishments (18.2%). Only15.3% took their BCG dose from an Outreach site. A possible explanation for this is that with an increase in institutional deliveries, majority of the children are receiving their BCG dose at birth in the hospital itself.

The main source for all remaining vaccines was mainly from outreach sites (72.3%) followed by health center (10.4%). Government hospitals were the least common source of immunization for the remaining doses of vaccine. The remaining doses are mostly being given at outreach sites such as the anganwadis as it is more easily accessible for people living in rural areas. This is similar to the study done in Kota where Anganwadi (66.6%) was found to be the major source for getting vaccinations among the children.[44]

In the present study the main source of immunization for BCG (81.8%) as well as the remaining doses of vaccine (90.6%), was from governmental health facilities. This is similar to the DLHS-2 as well as the DLHS-3 report for India in which they found that majority of the children (68.2% in DLHS-2 and 66.9% in DLHS-3) received their immunization from the government sector.[10,11] The CES 2002 also showed that the major source of immunization among children was “mostly government” (36.5%) and Outreach site (32%).[32] The CES 2005 report also showed similar findings where the main source of immunization was government hospital (21.9%) and Outreach site (29%).[30]

Similarly, the latest CES 2009 report also showed governmental outreach sites (54%) and fixed sites (24%) as the main source of immunization.[7]The same trend is observed in Karnataka state also as per DLHS-2 (74.3%) and DLHS-3(79.7%) where government sector was the main source.[12, 13]

In our study it was observed that there was no statistically significant relationship between source of immunization and immunization status of the child.

5. Reasons for immunization failure

   The most common reason for immunization failure was lack of information as cited by 41.8% of the mothers. 35.8% cited lack of motivation as the reason for failure. The remaining 22.4% mothers cited obstacles as the main reason for immunization failure.

   Similar findings i.e. lack of information as the main cause for immunization failure, has been reported in DLHS-3, CES 2002, CES 2005 and CES 2009.[11,32,30,7] Similar results were seen in the studies done in Bareilly[51], Alwar district[37] as well as in rural Rajasthan[36].

6. Presence of BCG scar among children reporting BCG with card evidence.

   The absence of BCG scar in children reporting BCG immunization with card evidence is usually taken as an indicator of faulty injection technique. In our study we found that a total of 94 out of the 96 children (97.9%) that reported BCG immunization with card evidence had a BCG scar.

   This is, however, an improvement from what was previously reported in the MICS report for Bijapur district where only 79.8% of those that reported of having taken the BCG vaccine had a BCG scar.[70] The CES 2002 reports that of the 74% who received BCG, only 75.3% had a scar.[32]

Our findings are better compared to the findings of the studies done by Govani *et al* in rural Ahmedabad (91.2%) [58] and Govindrajan PK *et al* in Tamil Nadu (88.8%).[50]

7. Dropout rates

Dropout rates are one of the WHO indicators for immunization system utilization.

In our study the highest dropout rate was for DPT1 to DPT3 (18.8%).This is, however, lesser compared to the DPT dropout rate of 36.8% reported by the MICS 2002 report of Bijapur district[70], but higher than national average for the same year given by CES 2002 (9.5%) [32].The CES report of 2009 shows a lower dropout rate of 13% for DPT1 to DPT3.[7] The DPT1to DPT3 dropout rate in our study is lower compared to the studies done in Alwar district (25.3%) [37], Bareilly (19.7%) [51] and Surat (31.9%) [34] . It is, however, higher compared to the studies done in east Delhi (13.8%) [63], Surendranagar city (10.21%) [61], Jamnagar city (10.4%) [39] and rural Gandhinagar (7.53%) [49].

The next highest dropout rate in the present study was for BCG to measles (18.7%). This is lower than the dropout rate of 39.2% for BCG to Measles given by the MICS report for Bijapur district.[70] However, it is higher compared to the national average of 15% given by CES 2009 report.[7] The BCG to measles dropout rate in the present study is lower compared to the studies done in Bareilly (37.3%) [51], Surat (60.2%) [34] and Surendranagar city (21.4%) [61] but higher compared to the study done in rural Gandhinagar (10.69%) [49].

The dropout rate from DPT1 to Measles in our study was 18.3% which is lower than that reported by the MICS report of Bijapur (34.7%).[70]It is also lower compared to the study done in East Delhi (28.7%).[63]

The lowest dropout rate was for OPV vaccine (15.8%). The same was also observed in the MICS report of Bijapur, where the dropout rate for OPV was found to be the lowest (17.6%).[70] The OPV dropout rate in our study is lower compared to that reported by NFHS-1 (20%)[4] and MICS 2000 (16.7%)[31] but higher compared to that reported by CES 2002 (9.1%)[32]. The OPV1 to OPV3 dropout rate in the present study is lower compared to the studies done in Alwar district (23.2%) [37], Bareilly (18.2%) [51] and Surat (31.5%) [34]. However, it is higher compared to the studies done in Surendranagar city (9.4%) [61], Jamnagar city (10.1%) [39] and rural Gandhinagar (7.5%) [49].

It was observed that though the coverage for all individual vaccines was above 78%, the proportion of fully immunized children was only 68%. This can be explained by the high dropout rates observed. This is in concurrence with the MICS 2002 report which stated that the reason for the low percentage of fully immunized children in spite of having achieved a higher coverage for individual vaccinations was mainly because children who had received a particular vaccine did not continue to complete the full doses for that vaccine, or they did not complete all the different vaccinations.[70]

It was also observed that the dropout rate was higher among the males than compared to females for BCG to measles, DPT1 to DPT3, OPV1 to OPV3 as well as DPT1 to Measles. This is similar to what was seen in the MICS report of Bijapur district.[70] Similar findings were also observed in the study done in the slums of Surat, where though the dropout rates were similar for males and

females with respect to DPT and OPV, the dropout rates were higher for males compared to females for BCG to Measles and DPT1 to Measles.[34]

8. Source of information regarding immunization

   The main source of information regarding immunization among the mothers was the health worker (ANM/AWW) (75.5%) followed by doctors (23%).It is disheartening to see that media played a very minor role as a source of information. Only 3 out of the 210 mothers said that their main source of information regarding immunization was the media.

   The findings in the present study are similar to the findings in the CES 2005 report, where they observed that the main source of information regarding immunization among the mothers was the anganwadi worker/ ANM/ lady health visitor (53%) followed by the government doctor (30.5%).[30]

   Our findings are similar to the studies done by Rachna Kapoor *et al*[67], MC Singh *et al*[11], Bhola Nath *et al*[73], N Gulati *et al*[75] and R S Gupta *et al*[37], all of whom found that the main source of information among mothers was the health worker.

9. Mother's knowledge and perception regarding immunization

   It was promising to see that, in general, mothers had a positive perception regarding immunization in Bijapur district. It was encouraging to see that almost all (96.7%) of the mothers believed that immunization could prevent diseases in their children. Almost two thirds of the mothers (61.4%) believed that it was important to give all doses of vaccine in the immunization schedule. But this positive perception was marred by the lack of knowledge regarding immunization and the immunization schedule. A majority of the mothers (83.8%) could not even name one disease which could be prevented

by immunization. Only 5 out of the 210 mothers knew when they had to take their child for immunization. This observation is supported by the finding that the main reason for immunization failure was a lack of information regarding the immunization schedule.

Similar findings were seen in the study conducted by Manjunath *et al*, who concluded that though many were aware of the importance of vaccination in general, specific information about importance of completing the schedule and knowledge about vaccine preventable diseases other than poliomyelitis was very limited.[76]

Our findings are also similar to a study done by Shamila Hamid *et al* in a rural area of North Kashmir, where theyfound all 300 mothers that were studied knew that vaccination was beneficial and protects their children from diseases.[68] Similar findings were also observed in the study done by MC Singh *et al*, where they found that mothers had a fair knowledge regarding the need for immunization but a poor knowledge regarding the diseases prevented and the doses of the vaccines.[62]

In our study, it was observed that among the mothers that could name one or more vaccine preventable diseases, polio and measles were the most commonly named. This is similar to the findings of the study done in a rural community of West Bengal where they found that polio and measles were the most heard diseases among the parents interviewed.[69] Similar findings were seen in the study done by Shamila Hamid *et al*, where they found that polio was the most commonly named disease.[68]

C. Factors influencing immunization status.

1. Relationship between gender and immunization status

   Though the proportion of full immunization status was higher among female children (71.8%) than compared to male children (64.5%), the difference was found to be statistically insignificant. Similar results are also seen in the studies done in Alwar district (52.3% for females and 48.4% for males) [37] and in the slums of Surat (27.3% for females and 23.4% for males) [34].

   Studies done in Surendranagar (65% for females and 76% for males) [61], rural Pune (85.6% for females and 87.6% for males) [57], Bareilly (55.9% for females and 68.7% for males) [53], Kota (77.9% for females and 81.2% for males) [44], Mumbai (73.9% for females and 79.5% for males) [48] and Ahmedabad (63.5% for females and 76% for males) [41] all show that fully immunized status, though observed to be higher among male children than female children, had no significant association with gender of the child.

   Hence, we see that gender bias with regards to immunization is very minimal in the present day. This can be credited to the improved mobilization activities of the grass-root level health workers that have succeeded in mobilizing the parents to immunize their child.

2. Relationship between religion and immunization status

   In our study we observed that the proportion of fully immunized children was higher among Hindu children as compared to Muslim children. However no significant association was seen between immunization status and religion. Similar findings were observed in a study done in the urban slums of Delhi.[45]

However, studies done in Lucknow[40], Bareilly [53] and Mumbai [48] show that fully immunized status is significantly higher in Hindu children than compared to Muslim children.

A study done in Kota revealed that the immunization coverage was similar in Hindu (84.84%) and Muslim children (83.3%).[44]

3. Relationship between mother's socio-demographic profile and immunization status

   - Mother's age and immunization status

   In the present the study, we observed there was a statistically significant improvement in the immunization status with increase in the mother's age. However, in the CES 2005 report we see that the coverage decreases with increase in mother's age. According to CES 2005, the percentage of fully immunized children was 56.9% in below 25 year age group, 54.5% in 25 – 34 years age group and 37.8% in above 35 years age group.[30]

   - Mother's education and immunization status

   In our study it was observed that there was no significant relationship between mother's educational status and immunization status of the child. This is similar to the findings of the study done in Lucknow where they found that literacy status of the mother had no significant independent bearing on the immunization status of the child.[40]

   Our findings are in contrast to the studies done in Etawah[59], Bareilly [53], Kota [44], Lucknow[46] and Surat[43] where they found that the mother's literacy played a significant role in the immunization status of the child.

- Mother's occupation and immunization status

No significant relationship was seen between mother's occupation and immunization status of the child. This is in contrast to the findings of the study done in Surat where they found that immunization coverage was significantly higher among the children whose mothers were housewives compared to the children whose parents were employed.[43]

4. Relationship between father's socio-demographic profile and immunization status

- Father's education and immunization status

In the present study, no significant relationship was seen between father's education and immunization status of the child. This is similar to the findings of the study done in Kota, Rajasthan.[44]Our findings are in contrast to the findings of the studies done in Etawah [59], Bareilly [53], Surat[43]and Lucknow[46], where they found that the father's literacy status had a significant relationship with immunization status of the child.

- Father's occupation and immunization status

In our study it was observed that there was no significant relationship between father's occupation and immunization status of the child. This is in contrast to the findings of the study done in Surat, where they found that father's occupation had a significant relationship with immunization status of the child. They found that the percentage of fully immunized children was significantly higher among the children whose fathers were laborers by profession.[43]

5. Relationship between immunization card and immunization status

   Though the percentage of fully immunized children was more among those who possessed an immunization card, the difference was found to be statistically insignificant.

   All the National Family Health Surveys, NFHS-1, NFHS-2 and NFHS-3, report that the percentage of fully immunized children is higher among the children who possess an immunization card than those without one.[4, 5, 6]

   Several studies have reported a better coverage among children who own an immunization card. In a study done in the urban slums of Mumbai, they found that the percentage of fully immunized children among those had an immunization card was 79% compared to 62.8% among those who did not have one.[48] This relationship was found to be statistically significant, which is in contrast to the findings of our study where no statistical association was found. Similarly, a study conducted in Kota revealed that the coverage among children who had an immunization card was 91.5% compared to 83.5% coverage among children without immunization cards.[44] Similar findings were also observed in a study done in Lucknow where the coverage among card-holders was 50.98% compared to a mere 3.6% among the children who did not have an immunization card.[46]

6. Relationship between socio-economic status and immunization status

   It was observed that immunization status of the child was not significantly related to socio-economic status. This is similar to the findings of the studies done at Bareilly [53] and Mumbai [48] where they found that the relationship between socio-economic status and immunization status was statistically not significant. A study done in Lucknow found that though low socio-economic

status was significantly associated with unimmunized status, it had no significant bearing upon partial immunization status.[40]

However our findings are in contrast to the findings of the studies done in Kota [44] and Delhi [45], where they found that there was a significant improvement in immunization status with increase in socio-economic status.

CONCLUSION

Though the vaccination coverage of Bijapur district has improved over the years, the coverage is still lagging behind the state's average as well as the UIP target of 85% coverage. Observations from our study shows that we are faced with a pressing need to accelerate coverage and reduce dropout rate.

It is evident from the BCG and DPT-1 coverage in our study that immunization system access is no longer the reason for the slow progress made in terms of immunization coverage. This is also evident from the fact that factors that hitherto influenced immunization coverage, such as religion, socio-economic status and parent's socio-demographic profile,has not shown to have any significant bearing on the immunization status of the child.

What appears to be causing the current scenario is a lack of information and motivation that has consequently led to a large number of children dropping out of the immunization schedule. This is evident from the low immunization system utilization indicated by the high dropout rate. Though we have succeeded in changing the perception of mothers regarding immunization, we have failed to provide sufficient information regarding the schedule and its benefits. Thus we have been able to improve access without a corresponding improvement in demand.

To make amends to this situation, we should make it our primary goal to get people to better understand what vaccination is about and what is at stake. Emphasis should be given to strengthening of IEC (information, education and communication) activities at the primary level. Health personnel and policy makers must make it their priority to plan and execute IEC activities in a more focused and sustained manner

because comprehensive information and communication on immunization will help us tackle the barrier of ignorance. Intensive and extensive health education with community participation can help in keeping the parents sufficiently motivated to completely immunize their children. In addition to this, an enhanced involvement of mass media can prove to be critical in improving awareness and generating demand for this safe and cost-effective life-saving intervention.

SUMMARY

A cross-sectional survey was conducted using WHO's thirty cluster sampling technique in Bijapur district of Karnataka. A total of 210 children aged 12-23 months were included in the present study. A total of 1014 households were surveyed. The proportion of male and female children was almost the same. Majority of the children were Hindu by religion (79%) and belonged to middle class families (73.4%). While studying the socio-demographic profile of the mothers, it was seen that most of them were in the age group of 21 – 25 years (64.8%), most had studied up to secondary school (41.9%) and majority of the mothers were housewives (69.5%). Most of the fathers were illiterate (36.1%) and majority was involved in agricultural pursuits (33.7%).

Less than half (46.2%) the children included in our study had an Immunization Card. 143 (68.1%) of the children were fully immunized, 61 (29%) were partially immunized and 6 (2.9%) were unimmunized. The highest coverage for any individual vaccine was for BCG (96.7%) and the lowest coverage was for DPT-3 (78.1%). Most of the children had received their immunization from governmental health facilities. The dropout rate was 18.8% for DPT-1 to DPT-3, 18.7% for BCG to Measles and 15.8% for OPV-1 to OPV-3. The most common reason for immunization failure was lack of information.

The main source of information regarding immunization was health workers (ANM/AWW). Though the mothers had a positive perception regarding immunization their knowledge regarding immunization was dismal.

Immunization status was seen to have a statistically significant improvement with increase in maternal age. However, immunization status was not found to have significant association with gender, religion, socio-economic status, presence of immunization card, source of immunization, parent's education and parent's occupation.

RECOMMENDATIONS

- The immunization card is a valuable source of information and a reliable method to monitor the immunization status of each child. Health personnel should ensure that every child is issued an immunization card and the mothers must be advised regarding the importance of keeping it safe and bringing it for subsequent immunizations.
- As lack of information was the major reason for immunization failure, there is an urgent need to strengthen the IEC strategies. It requires a strong commitment of the government at political, legislative and administrative levels for planning and executing the policies.
- Lack of motivation is another reason for immunization failure. The use of influential individuals in spreading awareness like sportspersons, celebrities and religious leaders has proven to work wonders in the pulse polio programme. The same can be implemented to achieve the targets set for the routine immunization programme.
- One week of every year can be celebrated as “Immunization awareness week” to improve the awareness regarding immunization.
- Efforts like intensified social mobilization by health workers can help to resolve the problem of dropout. Specific strategies including provision of health care packages under the Reproductive and Child Health (RCH) programme to mothers, such as iron and vitamin A supplementation or the provision of iodized salt, can be given to attract parents especially to sustain contact for the time between DPT-3 and measles vaccinations.

- In view of the Janani Suraksha Yojana and the increased the number of institutional deliveries, the role of medical birth attendant (doctor or nurse) becomes important to encourage the mother to accept immunization. Hence, health personnel should be strictly advised to impart health education regarding immunization to mothers and other family members when they come in contact with them at the time of delivery.
- Auxiliary nurse midwife and the anganwadi worker are the major source of information for immunization and their participation is required for improving the immunization of the children. Therefore, they should be given refresher training at regular intervals so that their knowledge regarding immunization is kept fresh and updated.
- Coverage can be improved by increasing the accountability of the health personnel with regards to providing immunization and increasing immunization coverage within a fixed time period.
- Pediatricians are in regular contact with mothers of children in the target age group of routine immunization. Pediatricians should be encouraged to impart information regarding immunization to mothers/ caregivers, as and when they come in contact with them.
- It was observed in our study that private establishments played a negligible role as a source of immunization. Emphasis should be given to improve public private partnership so as to increase the utilization of private establishments for immunization activities.
- One of the most powerful tools to reach out to the public is mass media (Television, radio, internet, newspapers, etc.). Unfortunately it is currently under-utilized as a medium to spread awareness among the people. We should

realize the true potential of this mode of communication and harness it to benefit the routine immunization programme.

- National immunization days can be taken as an opportunity to educate parents about routine immunization programme while going door to door for the administration of polio vaccine.
- Intervention based on health metrics strategy in which every child is tracked with computerized database for timely immunization has proven effective. This strategy has been employed in the intensification of routine immunization initiatives for over 10 million children. Efforts should be made to bring the remaining children under this initiative.
- Coverage surveys should be done on a periodic basis to check progress of immunization coverage, find the changes in the reasons for immunization failure and monitor the effectiveness of measures undertaken.

LIMITATIONS OF THE STUDY

- The study done calculates the crude coverage using "card plus history" as majority of the children did not have an immunization card. Though this is the recommended method in areas where majority of the children do not have an immunization card, this introduces the possibility of recall bias. Efforts have been made to avoid recall bias by taking extensive history regarding the doses. In spite of this, chance of recall bias still exists.
- WHO recommends coverage surveys to be conducted within a span of one month to give the best picture regarding immunization activities in a given area. However, these surveys require extensive manpower support. The present study was conducted over a period of one year due to constraints in manpower support.
- Information from the health worker, regarding the reasons for dropout and problems faced by them, would have thrown more light on the current scenario.

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ANNEXURE - I

PROFORMA

A STUDY TO ASSESS IMMUNIZATION COVERAGE IN BIJAPUR DISTRICT.

Cluster No.		**Name of the child**						
Child No. in cluster								
Mothers Information	**Age**							
	Education							
	Occupation							
Fathers Information	**Education**							
	Occupation							
Religion								
S.E.S.	Annual income							
	Per capita income							
	S.E. Class							
Perception and Knowledge	Can diseases be prevented by immunization?							
	What are the diseases that can be prevented by immunization?							
	Do you know when to take your child for immunization?							
	Is it important to give all doses of the vaccine?							
	Who is the main source of information regarding immunization?							

INFANT IMMUNIZATION PROFORMA

(1) Cluster Number:			(5) Name of the child								Total	
(2) Date:											Card	Card plus history
(3) Area:												
(4) Range of Birth Dates From …… Until ……												
Child number in the cluster												
(6) Birth date												
(7) Sex (M/F)												
(8) Immunization card		Yes/ No										
(9) BCG		Date/+/0										
		Scar Yes/No										
		Source										
(10)	DPT1	Date/+/0										
		Source										
	DPT2	Date/+/0										
		Source										
	DPT3	Date/+/0										
		Source										
(11)	OPV1	Date/+/0										
		Source										
	OPV2	Date/+/0										
		Source										
	OPV3	Date/+/0										
		Source										
(12) Measles		Date/+/0										
		Source										
(13) Immunization Status		Not imm.										
		Partially										
		Fully										
(14) Fully immunized before 1 yr of age		Yes/No										
(15) Tally of households visited - _____												

Key:

- ✓ **/+/0**
- ✓ **: Date verified to be within first birthday using Immunization card.**

+ : Mother reports immunization was given.

0 : Immunization not given

Source

OUT: Outreach HC: Health Centre

HOS: Hospital PRIV: Private

NGO: Non-governmental organization

SIA: Supplementary immunization activity

REASONS FOR IMMUNIZATION FAILURE PROFORMA

(1)	**Cluster number:**			**(4) Birth dates**			**From: …….**						
(2)	**Date:**						**Until: …….**						
(3)	**Area:**												
	Child/ woman number in cluster												**Total**
(5)	**Sex (M/F)**												
(6)	**Immunization status**	**Not immunized**											
		Partially immunized											
		Fully immunized											
(7)	**Lack of information**	**Unaware of need for immunization**											
		Unaware of need to return for 2nd or 3rd dose											
		Place and/or time of immunization unknown											
		Fear of side reactions											
		Wrong ideas about contraindications											
		Other											
	Lack of motivation	**Postponed until another time**											
		No faith in immunization											
		Rumours											
		Other											
	Obstacles	**Place of immunization too far**											
		Time of immunization inconvenient											
		Vaccinator absent											
		Vaccine not available											
		Mother too busy											
		Family problem, including illness of mother											
		Child ill- not brought											
		Child ill- brought but not given immunization											
		Long waiting time											
		Other											
(8)	**Tally of households visited: ……..**												

ANNEXURE - II

ETHICAL COMMITTEE CLEARANCE LETTER

Ethical Committee BIJAPUR-586103 OUT WARD 27/2011 Date 21-10-2011 Shri B. M. PATIL Medical College

B.L.D.E.UNIVERSITY'S
SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR-586 103
INSTITUTIONAL ETHICAL COMMITTEE IEC/27/11

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 20-10-2011 *at* 10-30am *to scrutinize the Synopsis/Research projects of postgraduate/undergraduate student/Faculty members of this college from Ethical Clearance point of view. After scrutiny the following original/corrected & revised version synopsis of the Thesis/Research project has been accorded Ethical Clearance.*

Title "A Study to assess immunization coverage in Bijapur district"

—x—x—x—

Name of P.G./U.G. student/Faculty member Dr Arun Pulikkottil Jose
Dept of Community Medicine

Name of Guide/Co-investigator Dr. K.A. Masali, Prof Com-Medicine.

DR.M.S.BIRADAR,
CHAIRMAN
INSTITUTIONAL ETHICAL COMMITTEE
BLDEU'S, SHRI.B.M.PATIL
MEDICAL COLLEGE, BIJAPUR.

Chairman
Ethical Committee
BLDEA'S Shri. B.M. Patil
Medical College
Bijapur-586103

Following documents were placed before E.C. for Scrutinization
1) Copy of Synopsis/Research project.
2) Copy of informed consent form
3) Any other relevant documents.

ANNEXURE - III

SOCIO-ECONOMIC CLASSIFICATION

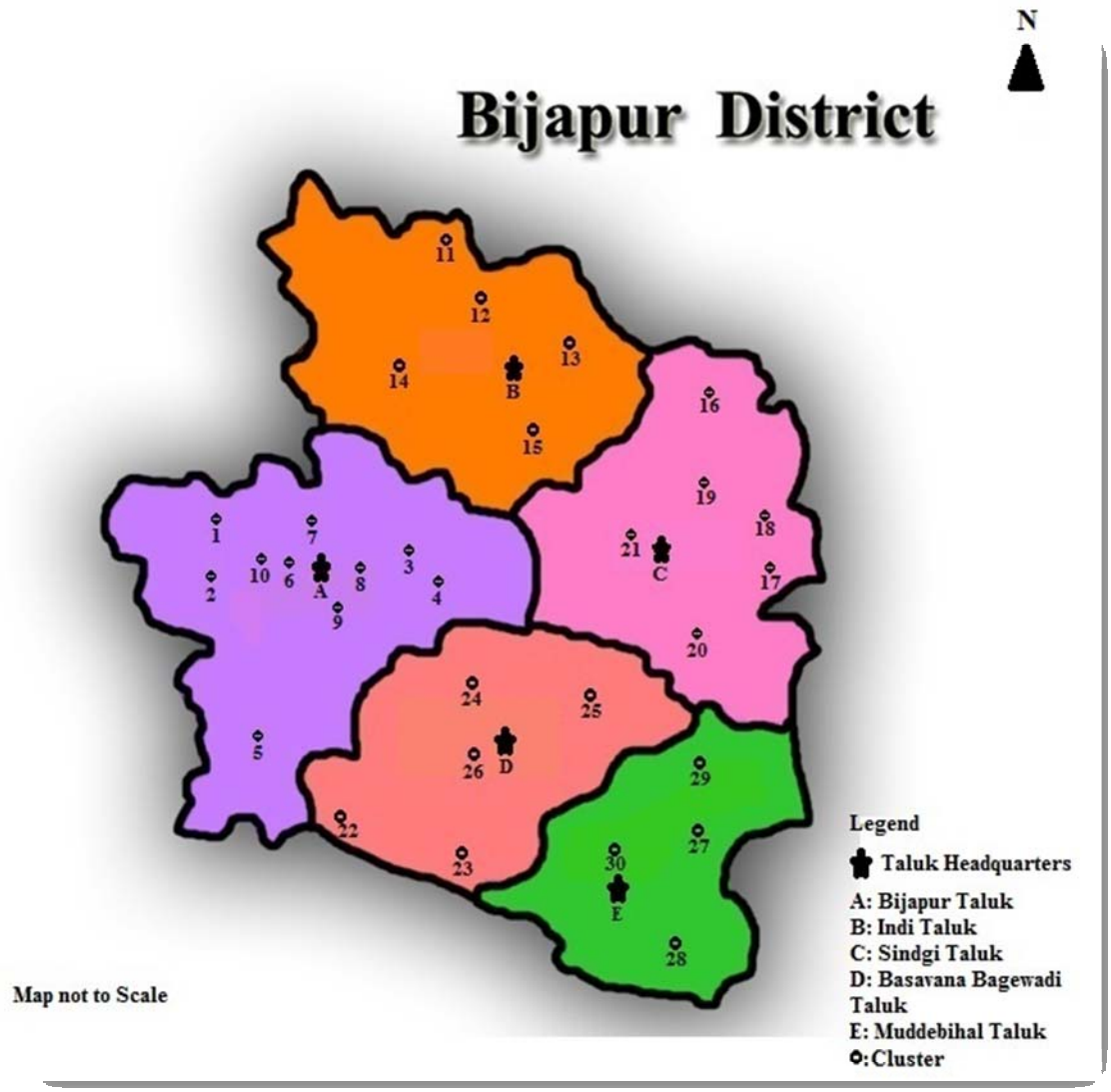
Prasad's updated criteria for year 2012.

Consumer Price Index (CPI) for year 2012 = 969

SOCIO-ECONOMIC CLASS		**PER CAPITA MONTHLY INCOME (Rs)**
CLASS **I**	**UPPER** CLASS	>4800
CLASS **II**	**MIDDLE** CLASS	4799 – 2400
CLASS **III**		2399 – 1440
CLASS **IV**	**LOWER** CLASS	1439 – 720
CLASS **V**		<720

ANNEXURE – IV

MAP SHOWING SELECTED CLUSTERS



LIST OF CLUSTERS

Cluster No.	Area	Taluk
1.	Takkalaki	Bijapur
2.	Tikota	Bijapur
3.	Aheri (Bheri)	Bijapur
4.	Kumatagi	Bijapur
5.	Shegunashi	Bijapur
6.	Ward No 1	Bijapur
7.	Ward No 10	Bijapur
8.	Ward No 18	Bijapur
9.	Ward No 27	Bijapur
10.	Toravi (OG) Part- Ward No 37	Bijapur
11.	Dhulikhed (old)	Indi
12.	Bhatagunaki	Indi
13.	Hanjagi	Indi
14.	Mavinalli	Indi
15.	Teggihalli	Indi
16.	Tarapur (old)	Sindgi
17.	Kakkalameli	Sindgi
18.	Muradi	Sindgi
19.	Karavinal	Sindgi
20.	Korwar	Sindgi
21.	Ward No 5	Sindgi
22.	Kolhar (old)	Bagewadi
23.	Araladinni	Bagewadi
24.	Masabinal	Bagewadi
25.	Sindgeri (old)	Bagewadi
26.	Ward No 3	Bagewadi
27.	Madikeshirur	Muddebihal
28.	Bailkur	Muddebihal
29.	Tumbagi	Muddebihal
30.	Ward No 12	Muddebihal

ANNEXURE - V

GANTT CHART - TIMELINE OF ACTIVITIES

ACTIVITY	2011							2012												2013								
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
TOPIC SELECTION																												
SYNOPSIS PREPARATION & SUBMISSION																												
REVIEW OF LITERATURE																												
PREPARATION OF PROFORMA																												
PILOT STUDY																												
ANALYSIS & INSTRUMENT MODIFICATION																												
DATA COLLECTION																												
DATA ANALYSIS																												
DISSERTATION WRITING																												
DISSERTATION SUBMISSION																												

ANNEXURE - VI

Photo graph showing interview of mother and checking for BCG scar

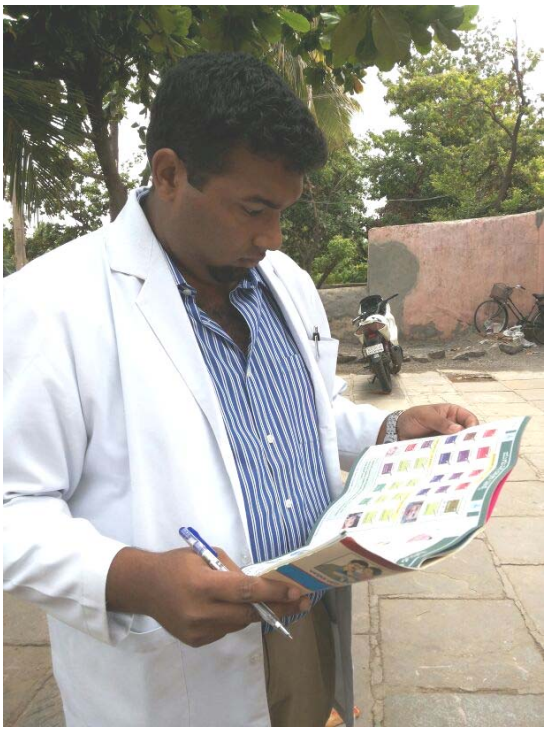


Photo graph showing checking of immunization card