

**PREVELANCE AND FACTORS ASSOCIATED WITH
MISSED OPPORTUNITY FOR IMMUNIZATION IN
CHILDREN ATTENDING PAEDIATRIC OUTPATIENT
CLINIC AT JUBA TEACHING HOSPITAL**

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DECLARATION

This dissertation is my original work and has not been submitted for a degree in any other university.

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DEDICATION

This study is dedicated to my beloved parents, Chan Malual Chan and Mary Mohamed Mingi for their prayers, encouragement and they were behind any success in my life, to my husband Capt Makur Maker Athorbei for his support and to the children of South Sudan generally and in particular children who participated in the success of this study.

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TABLE OF CONTENTS

DECLARATION	ii
DEDICATION	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
ABBREVIATIONS LIST	xi
DEFINITIONS.....	xii
ABSTRACT.....	xiii
1. INTRODUCTION AND LITERATURE REVIEW	1
1.2. Missed opportunity for immunization.....	5
1.3. Factors associated with missed opportunity for immunization.....	6
1.4. Problem statement	7
1.5. Study Justification	7
1.6. Study utility	8
2. STUDY QUESTIONS	9
3. OBJECTIVES.....	9
3.1. Primary Objective	9
3.2. Secondary objective	9
4. METHODOLOGY	10

4.1.	Study area description	10
4.2.	Study population	10
4.3.	Study design	10
4.4.	Study period	10
4.5.	Inclusion criteria.....	10
4.6.	Exclusion criteria.....	10
4.7.	Sample size determination formula for a Cross sectional studies.....	11
4.8.	Sampling procedure.....	11
4.9.	Data collection.....	12
4.10.	Study Variables.....	13
4.11.	Data management and analysis.....	13
5.	Study limitations	13
6.	ETHICALCONSIDERATION	14
7.	RESULTS	15
7.1.	Characteristics of study children	15
7.2.	Socio-demographic characteristics of the caretakers	16
7.3.	Prevalence of missed opportunity for immunization	16
7.4.	Conditions considered by caretakers as contra-indications for immunization.....	18
7.5.	Knowledge of caretakers on immunization.....	19
7.6.	Source of information on immunization	20
7.7.	Reasons for incomplete immunization.....	20
7.8.	Factors associated with missed opportunity for immunization at Juba Teaching Hospital	21
7.10.	Health workers interview.....	23

7.11.	Disease recognized to be preventable through immunization	23
7.12.	Immunization schedule	24
7.13.	Health worker knowledge on adverse events following immunization	24
7.14.	Contra-indication to immunization.....	25
7.15.	Health workers practice on how to identify children that have not missed immunization	26
7.16.	Immunization activity at Juba Teaching Hospital	26
8.	DISCUSSION	27
9.	CONCLUSIONS.....	30
10.	RECOMMENDATIONS.....	30
11.	REFERENCES	31
12.	APPENDICES	36
	Appendix I: Study eligibility checklist.....	36
	Appendix II: Consent form (Parents/Guardian)	37
	Appendix III: Data collection form.....	44
	Appendix IV part A: Questions for the hospital EPI manager.....	51
	Appendix IV part B: Questions for the health workers providing vaccination at Juba Teaching Hospital	53
	Appendix V: Immunization schedule for children in the Republic of South Sudan [31]	56
	Appendix VI: Interview guide for parental recall	57
	Appendix VII: Contraindication for immunization.....	58

LIST OF TABLES

Table 1	Children’s characteristics	15
Table 2	Socio-demographic characteristics of the caretakers.....	16
Table 3	Missed opportunity for immunization per vaccine.....	17
Table 4	Children who have been immunized and had immunization cards.....	18
Table 5	knowledge of caretakers on the benefit of immunization.....	19
Table 6	Factors associated with missed opportunity for immunization.....	22
Table 7	Multivariate logistic regression analysis.....	23
Table 8	Diseases recognized to be preventable through immunization.....	23
Table 9	Immunization schedule.....	24
Table 10	Health workers knowledge on adverse events following immunization...	25
Table 11	contra-indication to immunization.....	25

LIST OF FIGURES

Figure 1	South Sudan map shows number of children under five years.....	5
Figure 2	Prevalence of missed opportunity for immunization.....	17
Figure 3	Conditions considered by health workers and caretakers as contra-indications for immunization.....	19
Figure 4	Source of information on immunization.....	20
Figure 5	Reasons for missed opportunity for immunization.....	21

ABBREVIATIONS LIST

AIDS	Acquired Immune Deficiency Syndrome
BCG	Bacille Calmette Guerin
DTP	Diphtheria Tetanus and Pertussis
EPI	Expanded Programme on Immunization
TB	Tuberculosis
WHO	World Health Organization

DEFINITIONS

Missed immunization

Failure to vaccinate a child who attends immunization or curative clinics with vaccine (s), for which he/she is eligible in the absence of any known contra-indication.

Fully immunized

A child who had completed the recommended EPI immunization schedule of BCG, DTP and OPV (3doses) and measles before one year of age.

Adverse event following immunization

Any event or reaction that occurs after receiving a vaccine, it does not necessarily have a causal relationship with the administration of the vaccine.

ABSTRACT

Introduction: Immunization is one of the most effective public health interventions; it reduces morbidity and mortality from vaccines preventable diseases.

Objectives: To determine the prevalence and factors associated with missed opportunity for immunization in children aged 0-23 months attending paediatric outpatient clinic at Juba Teaching Hospital, South Sudan.

Methodology: The study was a hospital-based cross-sectional study conducted between May and June 2012 at Juba Teaching Hospital. The standard World Health Organization, Expanded Programme on Immunization (WHO EPI) protocol for assessing missed opportunity for immunization was used to conduct this study. It involved client exit interviews and reviews of immunization cards plus parental recall for those who met the inclusion criteria and those whose parents/guardian gave consent was sampled. Eighteen health workers from different paediatric wards and EPI department were interviewed.

Results: A total of 448 children were included in the study and 18 health workers were interviewed. Overall prevalence of missed opportunity for immunization in the study was (56.5%). Missed opportunity for immunization was more common for OPV 3 (24.4%), DPT 3 (22.1%) and measles (31.2%) compared to other vaccines. The reasons for this rate were failure to attend antenatal care and home delivery. Lack of information was cited as the reason for missing immunization by the parents/guardians.

Conclusion and recommendations: The high prevalence of missed opportunity for immunization at Juba Teaching Hospital can be reduced by strengthening of immunization services through caretaker's health awareness on the important of immunization and defaulter tracing.

1. INTRODUCTION AND LITERATURE REVIEW

The Expanded Programme on Immunization was established by the World Health Organization (WHO) in 1974 to ensure universal access to routinely recommended childhood vaccines. Six vaccine-preventable diseases initially were targeted at tuberculosis, poliomyelitis, diphtheria, tetanus, pertussis, and measles [1]. In 1974, fewer than 5% of the world's infants were fully immunized [1]; by 2005, global coverage with the third dose of diphtheria-tetanus-pertussis (DTP) vaccine (DTP3) was 79%, but many children, especially those living in poorer countries, still were not being reached. In 1974, WHO and the United Nations Children's Fund (UNICEF) developed the Global Immunization Vision and Strategy, with the aim of decreasing vaccine preventable disease related morbidity and mortality by improving national immunization programmes [2]. Global Immunization Vision and Strategy goals; goal1: were for all countries to achieve 90% national DTP3 coverage and at least 80% in every district or equal administrative unit, goal 2:Globally, mortality due to measles will have been reduced by 90% compared to the 2000 level, goal 3: sustain immunization coverage, reduce morbidity and mortality from vaccine preventable diseases, goal 4: ensure access to vaccine of assured quality for every person eligible for immunization, goal 5: introduce new vaccine for the entire eligible population within five years of the introduction of these new vaccine in the national programme, goal 6: Ensure capacity for surveillance and monitoring for **all** countries will have developed the capacity at all levels to conduct case-based surveillance of vaccine-preventable diseases, goal 7: Strengthen systems and Assure sustainability [2].

In 2010, one hundred and thirty (67%) countries had achieved 90% DTP3 coverage, and an estimated 85% of infants worldwide had received at least 3 doses of DTP vaccine. However, 19.3 million children were not fully vaccinated and remained at risk for diphtheria, tetanus, and per-

tussis and other vaccine-preventable causes of morbidity and mortality; approximately 50% of these children live in India, Nigeria, and the Democratic Republic of Congo [3]. In 2010, estimated global DTP3 coverage among children aged less than 12 months was 85%, representing 109.4 million immunized children, slightly higher than the estimated coverage in 2009 (82%) [3]. DTP3 coverage in 2010 ranged from 77% in the African and South-East Asian WHO regions to 96% in the Western Pacific and European regions. Fifty-nine (30%) member states reported achieving a second Global Immunization Vision and Strategy target of $\geq 80\%$ DTP3 coverage in every district [4]. Estimated DTP3 coverage ranged from 80% to 89% in 30 (16%) countries, 70% to 79% in 15 (8%) countries, and $<70\%$ in 18 (9%) countries [3]. Estimated global coverage was 90% for Bacille Calmette-Guérin vaccine, 86% for the third dose of polio vaccine, and 85% for measles-containing vaccine first dose [5].

By the end of 2010, a total of 179 countries (including parts of India and Sudan) had introduced hepatitis B (HepB) vaccine in routine vaccination programs; 93 (52%) of these countries had a recommendation to administer the first dose of vaccine within 24 hours of birth to prevent perinatal hepatitis B virus transmission. By 2010, coverage with 3 doses of HepB vaccine (HepB3) was 75% globally and ranged from 52% to 91% by region, being lowest in South East Asian (52%) and highest in Western Pacific (91%). Coverage with haemophilus influenzae type b (Hib) vaccine, which had been introduced in 169 countries (including parts of Sudan, Philippines, and Belarus) by 2010, was 42% globally and ranged from 9% to 92% by region, being lowest in South East Asian (9%) and highest in American (92%). The Millennium Development Goals (MDGs) are eight international development goals that were officially established following the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration, MDG4 is one of the eight goals which was to reduce under five mortal-

ity rates by two third between 1990 and 2015 [6] .To reduce unnecessary child death, Integrated Management of Childhood Illness Strategy was implemented, which includes immunization, one of the most effective interventions in reducing child mortality.

The Ministry of Health/Republic of South Sudan and partners prepared a Comprehensive Multi – Year Plan for the Expanded Programme on Immunization (2007-2011) to begin the effort to revitalize immunization services. The Primary Health Care Department of the Ministry of Health (MOH) has prepared immunization policy document to guide implementation of immunization services in South Sudan [7] Government of Southern Sudan/Ministry of Health Policy for Expanded Programme on Immunization 2009].

1.1. Expanded programme on immunization in South Sudan

Expanded programme on immunization (EPI) was launched in Sudan in 1976. However; immunization coverage in South Sudan remained very low due to the long civil war. According to Sudan Household Health Survey (Southern Sudan Report 2006), approximately 43% of children received BCG vaccination by the age of 12 months and coverage for DTP1 was 37%, DTP2 was 26% and DTP3 was 20%. Children who had received OPV1 and OPV 3 were 46%, 24% respectively by the age of 12 months. Children who had received measles vaccine by the age of 12 months were 28%. The percentage of children who had all the recommended vaccinations by their first birthday was 32% while 43% of children aged 12-23 months had not received any of the recommended vaccinations [8]

By the end of 2004, DTP3 coverage of children less than one year of age in South Sudan reported to be 10% [9]. After the comprehensive peace agreement in 2005, Ministry of Health-Republic of South Sudan (MOH/RSS) together with its partners has worked to re- establish the immunization programme in all parts of South Sudan. The Ministry of Health/ RSS launched the

routine immunization policy document in 2009. The aim was to improve the immunization coverage among children of South Sudan. After a lot of efforts immunization coverage for DTP3 has improved steadily up to 43% in 2009; the coverage still low as the expected target is not met [9].

In South Sudan, the vaccination calendar includes BCG, three doses of DTP, four doses of OPV, and a measles vaccine. According to Sudan Household Health Survey II, 2010, Southern Sector, only 4.3 percent aged 12-23 months had immunization cards and for those who did not have, mothers were asked to recall whether or not the child had received each of the of the immunization and, for DTP and polio how many times [10]. (According to Sudan Household Health Survey II, 2010, Southern Sector), 34.4 % of children aged 12-23 months had received BCG vaccine. The coverage for DTP3 was 15%, for OPV 3 was 14.8% and for measles was 26.3%. On average, immunization activities are very limited in South Sudan, with only 6.3% of all children between the ages 12 and 23 months found to be fully immunized against vaccine preventable diseases [10].

In 2009, the coverage for DTP3 was 43% and this shot up to 71% in 2010 [9]. In 2010 South Sudan saw a further improvement in routine immunization coverage. This achievement was the reaping effect of three rounds of routine vaccination acceleration campaign. As a measure to maintain immunity profile of children less than five years, four rounds of supplementary immunization activities were conducted in South Sudan [9].

Many countries have not achieved GIVS goals due to missed opportunity for immunization which is one of the most important factors that influence immunization coverage.



Figure 1: South Sudan map shows number of children under five years old in its ten states

1.2. Missed opportunity for immunization

World Health Organisation's Expanded Programme on Immunization (EPI) recommends that children be vaccinated at every contact with a health facility [11]. Failure to vaccinate a child who attends immunization or curative clinics with vaccine(s), for which he/she is eligible in the absence of any known contra-indication, constitutes a missed immunization opportunity [11].

When there is a true or absolute contraindication to immunization (Appendix VII), failure to immunize does not, by definition, constitute a missed immunization opportunity. True contrain-

dications of vaccination include complications arising from use of the vaccines such as DTP and measles.. Although the rate of occurrence of these complications is very rare, convulsions may, for example, follow DTP immunization [12]. DTP vaccination should not be given if a previous dose resulted in severe reactions such as shock, high fever, convulsions, neurological conditions or anaphylactic shock. It is recommended for sick children; whose conditions require hospital admission, that immunization is deferred so that the decision to immunize is made by the admitting hospital. This is to avoid difficulties in subsequent diagnosis should a child's condition worsen after immunization [13]. The EPI recommends that children who had not received relevant doses are eligible for immunization even if they present in health facilities with low-grade fever, mild respiratory illness, diarrhoea and other minor illnesses that are considered as false contraindications [appendix vii].

1.3. Factors associated with missed opportunity for immunization

Various reasons have been given for the occurrence of missed opportunity for immunization in low and middle income countries. These include; health systems factors, services provider factors, child factors, caretaker factors and cultural factors (such as low parental education, non availability of vaccines, failure by facilities to immunize on all days of the week, or negative parental beliefs, inappropriate health worker practices; including not opening a multi dose vaccine for a small number of persons to avoid vaccine wastages; and logistical problem) [14-21]

A hospital based study in the Kenyatta National Hospital in 1996, showed that, the prevalence of missed opportunity for immunization was 57.5% in inpatients and 100% in the outpatients. The reasons for this high rate was attributed to the hospital not having a policy for immunizing children who were attended at the paediatric outpatient or admitted in the hospital. The health staffs were also noted to have inadequate knowledge on the immunization schedule [22]

A community based study in Nairobi province (Kibera Division, Embakasi Division and Westlands Division), showed that, overall prevalence of missed opportunity for immunization in the study population was 23.8%. There was geographical variation with Kibera Division having a prevalence of 32%, while Embakasi and Westlands Divisions had prevalence of 11.6% and 14.2% respectively [23]. Socio-demographic factors that significantly affected vaccination rates were place of delivery, where children born at home had higher missed opportunity rates than those born in a health facility. Lack of information and antigen stock-outs were the commonest reasons for missing vaccine [23].

1.4. Problem statement

In 2010 South Sudan saw a dramatic improvement in routine immunization coverage. This achievement was the reaping effect of three rounds vaccination acceleration campaigns. Despite these achievements, bad road network, inadequate technical staffs, low accessibility to health facilities, frequent stock outs of vaccines and frequent breakdown of cold chain system continue to be major constraints to routine immunization service delivery in South Sudan [9].

1.5. Study Justification

Immunization is a key strategy in the promotion of child health, and it protects against childhood diseases. WHO recommends that each health facility should have a health information system for monitoring and evaluation of immunization programmes. Evaluation of immunization status of children exiting health facility is recommended to monitor and identify the gaps in the programmes and to identify factors associated with missed opportunity for immunization. Each child should have his/her immunization status updated at every contact with the health care system. Despite the fact that immunization services are offered free of charge in South Sudan, the

coverage is still low and the expected targets are not met. There is scarcity information on the prevalence of missed opportunity for immunization in health facilities in South Sudan.

1.6. Study utility

The results of prevalence and factors associated with occurrence of missed opportunity for immunization at Juba Teaching hospital will help policy makers on development of policies to improve immunization services in South Sudan for example reducing occurrence of missed opportunity for immunization by defaulter tracing and increase awareness on routine immunization.

2. STUDY QUESTIONS

What is the prevalence of missed opportunity for immunization at Juba Teaching Hospital?

What are the factors associated with missed opportunity for immunization at Juba Teaching Hospital?

3. OBJECTIVES

3.1. Primary Objective

To determine the prevalence of missed opportunity for immunization in children attending paediatric outpatient clinic at Juba Teaching Hospital.

3.2. Secondary objective

To determine factors associated with missed opportunity for immunization in children attending paediatric outpatient clinic at Juba Teaching Hospital.

4. METHODOLOGY

4.1. Study area description

The study was carried out in the paediatric outpatient clinic at Juba Teaching Hospital (JTH). JTH is the largest public teaching and referral hospital in South Sudan. Currently JTH has 22 wards and 524 beds. Paediatrics department wards are four with beds capacity of 108. The total numbers of children aged less than five year seen at Juba Teaching Hospital outpatient clinic are approximately eighty and half of this eighty are 0-23 months. The vaccines are administered in the mother and child health office (MCH) to all children less than one year by the nurses and it is free of charge. The MCH office is next to paediatric outpatient clinic.

4.2. Study population

Children aged 0-23 months attending paediatric outpatient clinic at JTH during the study period.

4.3. Study design

The study was a hospital-based cross-sectional study.

4.4. Study period

The study was conducted in May and June 2012.

4.5. Inclusion criteria

- All children aged 0-23 months in paediatric outpatient clinic at JTH.
- Children whose parents/guardians gave consent.

4.6. Exclusion criteria

- Children whose parents/guardian could not remember the number or type of vaccine they had received (Appendix VI).
- Children with true or absolute contra-indication for immunization (appendix VII).

- Children/patients admitted on the wards.

4.7. Sample size determination formula for a Cross sectional studies

The sample size estimation was determined using Fisher formula for cross-sectional designs [24]

$$n = \frac{Z^2_{1-\alpha/2} P(1-P)}{d^2}$$

Where;

n= Minimum required sample size

α = Level of significance (0.05)

$Z_{1-\alpha/2}$ = Standard normal deviate at 95% CI (1.96)

P= Assumed prevalence of missed opportunity for immunization (50%)

d=Absolute precision (Margin of error), (0.05)

Minimum required sample size was 385. Allowing for 10% non-response, the sample size was adjusted upwards to 424.

4.8. Sampling procedure

An estimate of daily turnover of patients aged 0-23 months in the outpatient paediatric clinic was obtained from the hospital management in order to calculate the expected total number of patients within the study duration and develop a sampling frame. Juba Teaching Hospital runs for 7 working days (Monday to Sunday). On average the hospital serves 80 patients (under five years) in a day (from 8am to 8pm) from Monday to Sunday (7 days). Working out with these statistics we expect to access 560 patients in one week. The intended study duration was one month (4 weeks), therefore the estimated total number of clients accessed (sampling frame) was 2,240 (560x4). On each day of the interview, the first client was selected based on first come first cho-

sen for the interview. This was done everyday of the study period until the required sample size was attained. All nurses working in paediatric wards, EPI department (total of 18 health workers) were interviewed using a questionnaire administered by the principle investigator. A consecutive sampling technique was employed for collecting data ensuring that all the nurses who reported to duty during the study period were interviewed. The focus was on nurses because they are the ones who provide immunization services.

4.9. Data collection

The standard WHO EPI protocol for assessing missed opportunity for immunization was adapted and used to conduct this study [25]. It involved client exit interviews and reviews of immunization cards plus parental recall for those who met the inclusion criteria and those whose parents/guardians gave consent were sampled using consecutive sampling. The interview was conducted with the parents/guardian of these children everyday (including weekends) of the week from 8:00am-8:00pm. The nurses in paediatric wards and EPI department were questioned by using the health workers questionnaire (Appendix IV). Data was collected by the principal investigator. The caretakers (or parents/guardian) exit interviews and health workers interviews were conducted using a pre-designed questionnaire consisting at both closed and open question. (Appendix III, IV part B).The immunization manager of JTH was interviewed using a pre-designed questionnaire. (Appendix IV part A). The health workers were interviewed after collection of data on exit interview was completed. Preliminary analysis of the caretakers' exit interview was used to make health workers questionnaire more sensitive to the context. EPI hospital manager was asked on specific questions that related to the overall immunization programme in JTH using a structured questionnaire (Appendix IV part A)

4.10. Study Variables

The main study variables were the prevalence of missed opportunity for immunization and the factors associated with MOI. The socio-demographic data of the caretakers, children and clinical characteristic of the children were also variables. Most of the parents/guardians had appropriate knowledge on the importance of polio vaccine and measles vaccine. Knowledge on others immunizable diseases (DTP and BCG) were inappropriate as shown in table 5.

4.11. Data management and analysis

Data collected were transferred into Microsoft Access data base and then analyzed using IBM-SPSS soft ware version. These data were checked for accuracy and completeness. Errors and omissions identified were rectified. On completion of data entry, data cleaning was carried out to identify any mistakes that might have occurred during data entry. Prevalence of missed opportunity for immunization was computed from the proportion of studied children who had missed a vaccine. The chi-square test and Mann Whitney U test were applied to determine factors that related to children and parents /guardians and descriptive analysis was applied to assess health workers knowledge, attitude and practices on EPI. Odd's ratio and test of significance were used to determine factors associated with MOI. Logistic regression analysis was done to determine factors associated with missed opportunity.

The information obtained from the open ended questions was summarized into emerging themes and frequency of the responses tabulated.

5. Study limitations

Some mothers may not have had a child immunization card during the study. In this circumstance, information on vaccination status was provided via recall therefore posing a possibility of introducing recall bias.

6. ETHICAL CONSIDERATION

Approval was sought from the Kenyatta National Hospital/ University of Nairobi/ Ethics and Research committee and from the Ministry of Health Ethical committee / Republic of South Sudan. Informed verbal and written consent to participate in the study was obtained from the parents or guardian accompanying the child to the clinic after explanation of the study and voluntary nature of participation. The consent form was obtained and interpreted into the Arabic language in case the parents/guardians did not speak English. The names were not included in the data form; participants were identified by a study number.

7. RESULTS

7.1. Characteristics of study children

A total of 448 children aged 0-23 months were included in the study. The median age (IQR) was 8 months (5.0-13). Majority of children 328 (73.3%) were less than 12 months and (120) 26.7% were more than One year. More than half of children 259 (57.8%) were males and 189 (42.2%) were females. Most of these children's mothers 427 (95.3%) attended antenatal care clinic and 294 (65.7%) delivered in a health facility.

Table 1: Children's characteristics

Variable	Number (%)
Age (months)	
Median (IQR)	8.0 (5.0-13)
Age group	
<=12months	328(73.3)
>12months	120(26.7)
Sex	
Male	259 (57.8)
Female	189 (42.2)
Antenatal care	
Yes	427 (95.3)
No	21 (4.7)
Place of birth	
Health facility	294 (65.7)
Home	154 (34.3)

7.2. Socio-demographic characteristics of the caretakers

Of the 448 caretakers 435 (97.1%) were mothers out of whom 431 (99%) were married. Majority 374 (83.5%) of these caretakers were unemployed, 134 (29.9%) had no formal education and 435 (97.1%) were of the Christian faith as shown in table 2.

Table 2: Socio- demographic characteristic of the parents/guardians

Variable	Number %
Sex of the guardian	
Male	9 (2.0)
Female	439 (98.0)
Relationship with child	
Mother	435 (97.1)
Other relative	13 (2.9)
Marital status	
Married	431 (96.2)
Single/Widowed/Separated/divorced	17 (3.8)
Occupation	
Employed	74 (16.5)
Unemployed	374 (83.5)
Education	
No education	134 (29.9)
Primary education	190 (42.4)
Secondary	92 (20.5)
College / University	32 (7.1)
Religion	
Christianity	435 (97.1)
Muslim	13 (2.9)

7.3. Prevalence of missed opportunity for immunization

Missed opportunity for immunization was assessed as a proportion of age eligible children (for each of the EPI vaccine) who were attended to Juba Teaching Hospital for various reasons. The overall prevalence of missed opportunity for immunization in children attending paediatric out-

patient clinic at Juba Hospital was 253 (56.5 %) children out of 448 as depicted in figure 2.

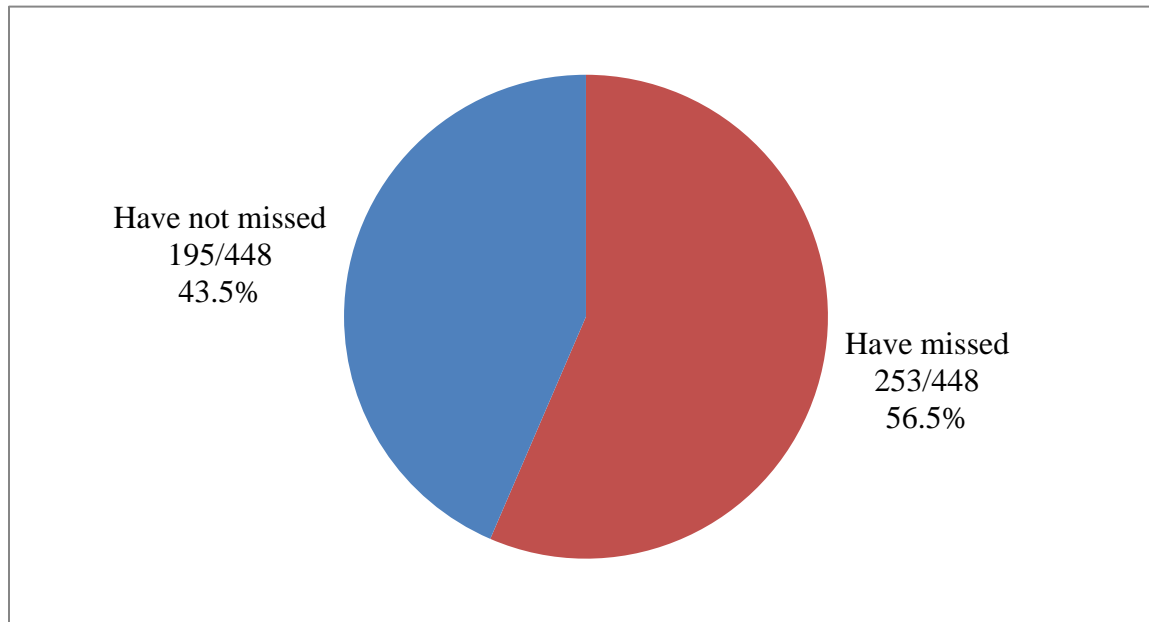


Figure 2: Prevalence of missed opportunity for immunization

There was increased prevalence of missed opportunity for immunization as the age for administration of the vaccine increased. As shown in table 3 below, missed opportunity for immunization was higher for third doses of OPV (24.4%), DTP (22.1%) and measles vaccine (31.2%)

Table 3: Missed opportunity for immunization per vaccine

Vaccine	Missed opportunity N (%)	95% CI of %
BCG (n=448)	34 (7.6)	5.4 - 10.0
OPV1(n=399)	20 (5.0)	3.0-7.1
OPV2 (n=375)	39(10.4)	7.2-13.5
OPV3 (n=357)	87(24.4)	20.0-29.0
DTP1 (n=399)	14 (4.5)	1.8 -5.4
DTP2 (n=375)	38 (10.1)	7.0 -13.3
DTP3 (n=357)	79 (22.1)	17.5 - 26.4
Measles (n=218)	68 (31.2)	25.2 - 37.6

Overall, 423 (94.4%) children had received one or more vaccine while 25/448 (5.6%) children had never been immunized. Only 96/448 (22.7%) of children had immunization cards during the period of data collection.

Table 4: Children who have been immunized and had immunization cards.

Variable	Number (%)	95% CI
Immunization status		
Yes	423 (94.4)	92.2-96.4%
No	25 (5.6)	
Immunization card		
Yes	96 (22.7)	18.7-27%
No	327 (77.3)	

7.4. Conditions considered by caretakers as contra-indications for immunization

Many children missed immunization because of misconceptions about contra-indications by the caretakers. Disease that were perceived as contraindicated for immunization were gastroenteritis 127/448 (28.3 %), malaria 119/488 (26.6 %), pneumonia 99/448 (22.1 %), upper respiratory tract infection 94/448 (21 %) and other diseases (skin infection, urinary tract infection, otitis media, conjunctivitis and oral thrush) as shown in figure 3.

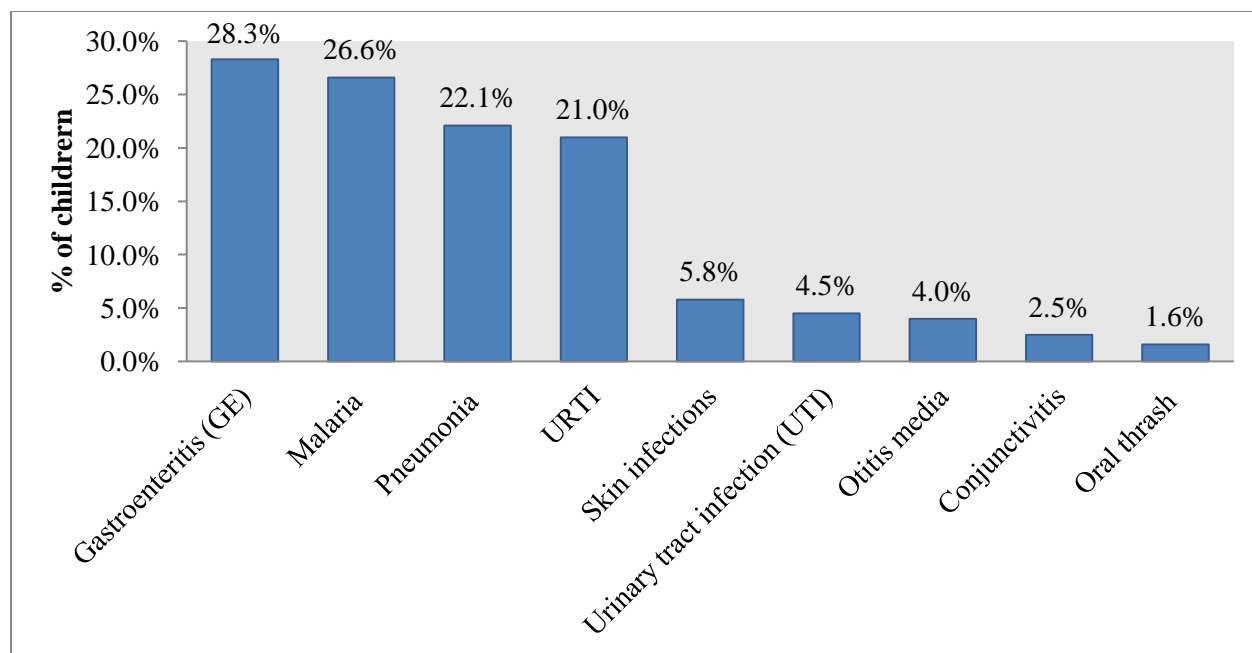


Figure 3: Conditions considered by caretakers as contra-indication for immunization.

7.5. Knowledge of caretakers on immunization

Parents/guardians were asked about the benefits of immunization by the principle investigator. Most of the parents/guardians 275/488 (61.4 %) had appropriate knowledge on the importance of polio vaccine and 235/488 (52.5 %) for measles vaccine. Knowledge on others immunizable diseases are summarised in table 5.

Table 5: Knowledge of caretakers on the benefits of immunization

Vaccine	Benefits of immunization	Number (%)
OPV	Prevents polio	275 (61.4)
measles	Prevents measles	235(52.5)
BCG	Prevents TB	93 (20.8)
DTP	Prevents tetanus	44(9.8)
DTP	Prevents whooping cough	36(8.0)
Others	(diarrhoea, malaria, HIV/AIDS , Cholera, Typhoid and Syphilis)	16 (3.6)

7.6. Source of information on immunization

Most of caretakers, 301 (67.2%) out of 448, had obtained information about immunization from a health worker (health workers, community health workers) while 136/448 (30.4%) got information from non health worker (media, friends and relatives). Few, 11/448 (2.5 %) of caretakers had never heard about immunization in their life.

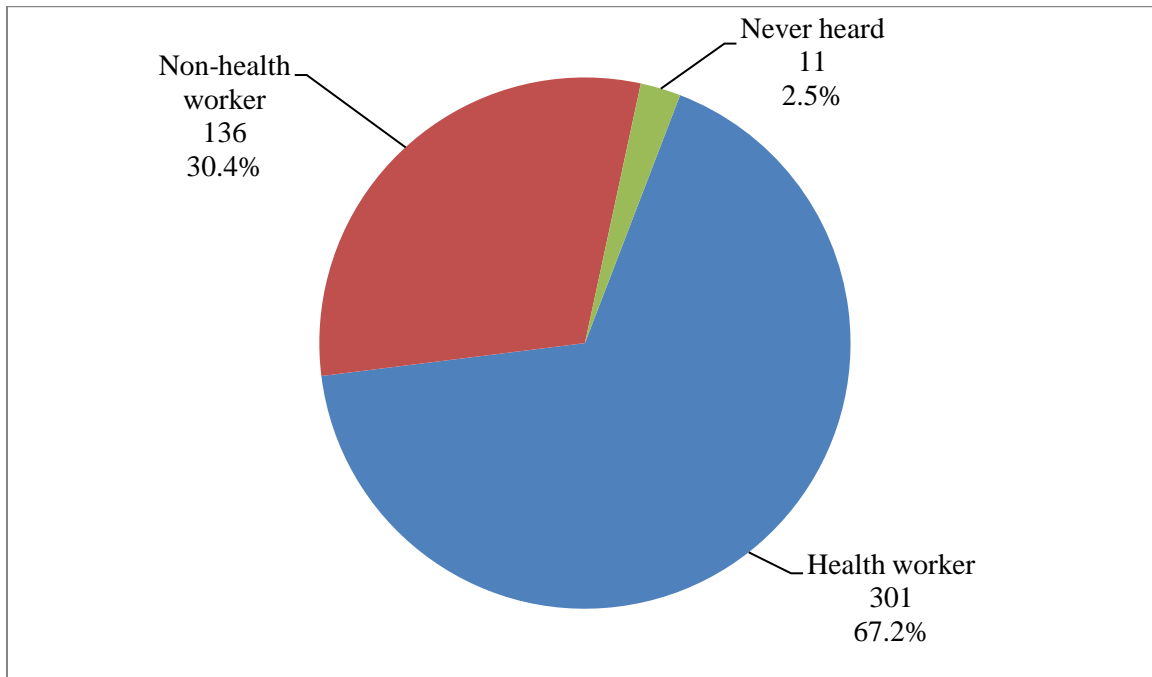


Figure 4: Source of information on immunization

7.7. Reasons for incomplete immunization

Various reasons were given by the caretakers for incomplete immunization for their children. These included; lack of information 266/448 (59.4 %). They were either unaware of need for immunization or unaware that needed to return for 2nd and 3rd dose, vaccinator absent 78/448 (17.4 %), negligence from mothers (mothers forgot, busy with social activities) (11.2 %) 50/448 and others are summarized below (Figure 4). The total respondents in the figure 5 below are more than 100% because a respondent could give more than one reason.

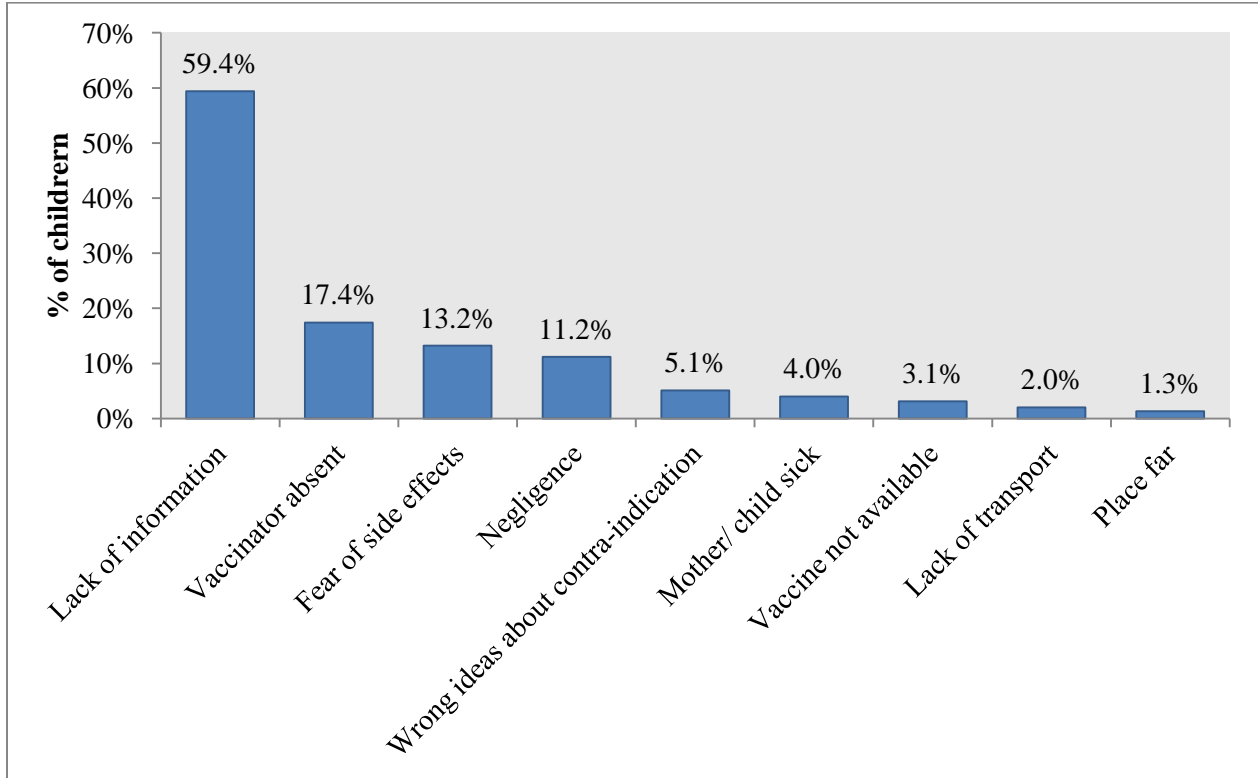


Figure 5: Reasons for missed opportunity for immunization

7.8. Factors associated with missed opportunity for immunization at Juba Teaching Hospital

Missed opportunity for immunization in children attending paediatric outpatient clinic at Juba Teaching hospital was associated with child's and caretaker's socio-demographic characteristic. Children who had missed immunization were older than 12 months (OR 1.5, 95% CI 1.0-2.4, $p=0.047$). Children whose mothers attended antenatal care were less likely to have missed immunization compared to those whose mothers did not attend antenatal care; this difference is statistically significant (OR 0.1; 95% CI 0.0-0.5, $p= 0.001$) Children born at home were more likely to have missed immunization (OR 2.2, 95% CI 1.4-3.3, $p=0.001$) compared to those who were born in hospital. Lack of formal education was associated with an increased missed opportunity

for immunization (OR 1.8, 95% CI 1.4-3.3, p= 0.006) which is statistically significant as shown in table 6. Median age (IQR) for children who have missed immunization was 9.0 (6.0-14.0). This median age was calculated by using Mann Whitney U test.

Table 6: Factors associated with missed opportunity for immunization

Variable	Missed opportunity		OR (95 % CI)	P value
	Yes	No		
Patients' age group				
<=12 months	176(69.6)	152(77.9)	1.0	
>12 months	77(30.4)	43(22.1)	1.5(1.0-2.4)	0.047
Antenatal care				
Yes	233 (92.1)	194 (99.5)	0.1 (0.0-0.5)	<0.001
No	20 (7.9)	1 (0.5)	1.0	
Place of birth				
Health facility	147 (58.1)	147 (75.4)	1.0	
Home	108 (41.9)	48 (24.6)	2.2 (1.4-3.3)	<0.001
Caretakers education				
No formal education	89 (35.2)	45 (23.1)	1.8 (1.2-2.8)	0.006
Formal education	164 (64.8)	150 (76.9)	1.0	

7.9. Factors associated with MOI by Logistic Regression Analysis

To adjust for confounding the data were analysed using logistic-regression modelling. The following were independently associated with missed opportunity for immunization; antenatal care (p=0.018) and place of birth (p=0.007). However the caretakers education (p=0.115) and patient's age (p=0.074) were not associated with missed opportunity for immunization as shown in table 7.

Table 7: Multivariate Logistic regression analysis

Variable	OR (95% CI)	P value
Patients' age group		
<=12 months	1.0	
>12 months	1.5(1.0-2.3)	0.074
Antenatal care		
Yes	0.1 (0.0-0.8)	0.018
No	1.0	
Place of birth		
Health facility	0.6 (0.4-0.9)	0.007
Home	1.0	
Caretakers education		
No formal education	1.4 (0.9-2.2)	0.115
Formal education	1.0	

7.10. Health workers interview

Eighteen health workers out of 30 (EPI unit, paediatric wards) were interviewed, because the rest were not ready to participate in the study.

7.11. Disease recognized to be preventable through immunization

Out of 18 health workers interviewed 17 of them recognized tuberculosis (TB) and poliomyelitis, 16/18 measles, 15/18 diphtheria, tetanus and pertussis (DTP) as diseases that are preventable through immunization. One, 3/18 and 2/18 of the health workers did not recognize tuberculosis and polio, measles and DTP respectively as vaccine preventable diseases.

Table 8: Diseases recognized to be preventable through immunization

Health workers n=18	Diseases preventable through immunization
17	Tuberculosis and poliomyelitis
16	Measles
15	Diphtheria, pertussis and tetanus

7.12. Immunization schedule

OPV0 is given at birth or within 14 days after birth while BCG is given at birth or on first contact. The 3 doses of OPV and DTP are given at 6, 10 and 14 weeks with a minimum 4 weeks interval between doses. Measles vaccine is given at 9 months as per EPI guidelines (Appendix V) Among the 18 health workers interviewed, six of them knew the appropriate time to give all doses of polio vaccine, while 8 and 15 knew the appropriate time to give DTP (3 doses) and measles respectively. None of the health workers knew the appropriate time to give BCG.

Table 9: Immunization schedule

Health workers n=18	Immunization schedule
6	Poliomyelitis
8	DTP
15	Measles
none	BCG

7.13. Health worker knowledge on adverse events following immunization

An adverse event following immunization (AEFI) is any event or reaction that occurs after receiving a vaccine. Among 18 health worker interviewed, 12, 4, and 1 mentioned wound at the side of injection, swelling and abscess respectively as an AEFI following BCG vaccine. Regarding DPT, 13 health workers mentioned fever and 3 mentioned swelling as AEFI. Twelve health workers mentioned fever as an AEFI following measles while all did not have an idea on any AEFI following polio.

Table 10: H/W knowledge on AEFI

Health workers n=18	AEFI
12,4,1	Wound, swelling and abscess respectively as an AEFI following BCG
13,3	Fever and swelling respectively as an AEFI following DTP
12	Fever as an AEFI following measles

7.14. Contra-indication to immunization

Eighteen health workers were interviewed on contra-indication for immunization. Sixteen and fifteen health workers did not have an idea on contra-indication for BCG and polio respectively. None of them was aware of any contra-indication of immunization for DTP and measles vaccines.

Table 11: Contra-indication to immunization

Health workers n=18	Contra-indication to immunization
16	No idea on contra-indication for BCG
15	No idea on contra-indication for polio
none	Aware on contra-indication for DTP

7.15. Health workers practice on how to identify children that have not missed immunization

All the 18 health workers were asked how they would identify a child who had missed immunization. Half of them said they compared the age and date of vaccination, 4/18 said they asked for the child immunization card to get information on immunization status and 5/18 did not know. Health workers were asked how they would handle a child due for immunization brought in without a card; 13/18 respondents said they would give the vaccine the child is due for and issue new card while 5/18 said they would neither immunize nor give new card. .

7.16. Immunization activity at Juba Teaching Hospital

The EPI hospital manager was interviewed on the immunization practice at JTH and said that, there was outreach in addition to routine (static) immunization services .The manager explained that they forecast for the vaccine and other supplies need by calculating the largest population, they never got any vaccine stock out at any time of the year.

8. DISCUSSION

Immunization is an effective preventive medicine and is one of the pillars of the child survival. The overall prevalence of missed opportunity for immunization among children aged 0-23 months attending paediatric outpatient clinic at Juba Teaching Hospital was 56.5% (95% CI 51.8-60.9) as shown in figure 1. The high prevalence of missed opportunity for immunization in this study is similar to a study which had been done in Kenya 57.5% inpatient and 100% outpatient [22]. In the Kenyan study high prevalence of missed opportunity for immunization was attributed to inadequate knowledge of health workers on immunization practices [22]. A study in Sudan among children who had attended a health centre for various reasons other than immunization, the prevalence of children missing at least one antigen was 58% and 29% missing all antigens [26]. In Uganda Tugumisirize found in 1998 the overall missed opportunity for immunization was 59.6% with 24.4% missed opportunity for immunization prevalence among children attending routine immunization sessions [27].

Our study shows a higher prevalence of missed opportunity for immunization for OPV 3, DPT3 and measles vaccine [table 3]; results suggest that the missed opportunity for immunization among the three vaccines was not statistically different as shown in table 3. A higher prevalence of missed opportunity for immunization for measles compared to DPT3 have attributed to the long interval between DPT3 and measles vaccine, and similar findings have been found in Nigeria (inpatient) in 2004 which measles was the commonest missed vaccine 38.7%, this was attributed to those children had measles, chronic ill health [28]. For example study in health facilities that serve slum areas of Nairobi missed opportunity for immunization for DTP1, DTP2 and DTP3 was 0.6%, 0.7% and 0.4% respectively while for OPV1, OPV2 and OPV3 was 4.4%, 5.5% and 5.7% respectively. In Kenyan study missed opportunity for immunization for BCG was 4.8% and for Measles was 3.7%,

this was attributed to the vaccines were out of stock for OPV and BCG, child was ill or under weight and child had a rash [29]. The statistical significant discrepancy between missed opportunity for immunization for DTP2 and DTP3 in this study was attributed to the side effects of this vaccine which was mostly fever.

High prevalence of missed opportunity for OPV3, DTP3 and measles as shown in table 3 shows that children of South Sudan are still at high risk of vaccine preventable disease especially poliomyelitis, diphtheria, tetanus, pertussis and from the complications of measles particularly malnutrition and pneumonia. So South Sudan policy makers need to address the issues of missed opportunity for immunization very serious in order to reduce its occurrence and to improve the immunity profile of children of South Sudan.

This high prevalence of missed opportunity for immunization per vaccine as shown in table 3 was attributed to the long civil war in South Sudan, bad road network, inadequate technical staffs, low accessibility to health facilities, frequent stock outs of vaccines and frequent breakdown of cold chain system continue to be major constraints to routine immunization service delivery in South Sudan.

In this study 5.6% children had never been immunized in their life, this was attributed to the lack of information which means that out-reach programme is not effective enough to cover the remote area where those caretakers have not had an access to the health services especially EPI.

Over half of the caretakers knew the value of immunization. Polio and measles were the most frequently identified vaccine preventable illnesses. This can be attributed because of the frequent campaign against these two diseases. Children of mothers who did not use ANC and delivered at home associated independently with increase chance of not being immunized. This finding is similar to a

study which had been done in Nigeria in 2008 [30] and Nairobi Province [23]. This may be attributed to the fact that majority of the caretakers in this study learned about immunization through health workers; thus it is plausible that ANC and hospital delivery facilitated the learning process. Lack of information was sited as the commonest cause of incomplete immunization; either caretakers did not know child needed to be immunized or were unaware of return visits. This finding is similar to a study which had been done in Nairobi Province [23]. Inadequate knowledge of health workers on dosing, schedule and contra-indication on immunization is a similar finding in a study which had been done in Kenyatta National Hospital in 1996 [22].

Missed opportunity for immunization is the most important factor that influencing immunization coverage in South Sudan. Many children miss immunization in South Sudan because of the wrong believed in immunization (immunization affects cognitive development) and poor health system information.

9. CONCLUSIONS

1. The prevalence of missed opportunity for immunization at JTH paediatric outpatient clinic was 56.5% (95% CI 51.8-60.9).
2. Home delivery and failure to attend antenatal clinic were independently associated with missed opportunity for immunization.
3. Lack of information, vaccinator absent, fear of side effect, negligence and wrong ideas about contra-indication were the most common reasons given by the caretakers for incomplete immunization.

10.RECOMMENDATIONS

1. The South Sudan EPI should come out with a clear policy that every child comes in contact with a health facility should have her/his immunization status updated.
2. Health awareness of caretakers on the importance of immunization.

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12. APPENDICES

Appendix I: Study eligibility checklist

Date: DD.MM [] [] 2012

Data collector's initial:.....

Patient Code No:.....

Inclusion criteria (if any criteria is marked "No", the patients is not eligible for enrolment

1. Child whose parents consented to this study. Y [] N []

Exclusion criteria (if any of exclusion criteria is marked "YES", the patient is not eligible for enrolment)

1. Child aged more than 23 months. Y [] N []

- Is the child eligible for the study? Y [] N []

Appendix II: Consent form (Parents/Guardian)

Patient study serial number.....

Date...../...../.....

Study title

PREVALENCE AND FACTORS ASSOCIATED WITH MISSED OPPORTUNITY FOR
IMMUNIZATION IN CHILDREN ATTENDING PAEDIATRIC OUTPATIENT CLINIC AT
JUBA TEACHING HOSPITAL.

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Paediatric Nephrologist

Lecturer, Department of Paediatrics and Child Health

University of Nairobi

Investigator statement

I am a postgraduate student at the University of Nairobi – Department of Paediatrics. I am asking you and your child to participate in a research study. The purpose of this consent form is to give you information you will need to help you decide whether to participate in the study. Please read this form carefully. You are free to ask any questions about the study. The investigator will be available to answer any questions that arise during the study.

Introduction

The widespread use of vaccines has greatly improved global public health, preventing million of childhood hospitalizations and deaths each year. Six vaccine-preventable diseases initially were targeted: tuberculosis, poliomyelitis, diphtheria, tetanus, pertussis, and measles.

World Health Organisation's Expanded Programme on Immunization (EPI) recommends that children be vaccinated at every contact with a health facility. Failure to vaccinate a child who attends immunisation or curative clinics with vaccine(s), for which he/she is eligible in the absence of any known contra-indication, constitutes a missed immunisation opportunity.

Benefit

The finding of this study will be communicated to the primary care givers which may help in reducing the occurrence of missed opportunity for immunization and thus improving immunization coverage of children in South Sudan.

Risk

There will be no risk to the patients (no invasive procedure) but there is a direct involvement of the patients in the study by interviewing the parents/guardian.

Voluntariness

The study will be fully voluntary. There will be no financial rewards to you for participating in the study. One is free to participate or withdraw from the study at any point.

Confidentiality

All data obtained will be kept in pass worded computer files to restrict access.

Data form will not bear patients names, patients will only be identified by study numbers. A separate code list containing the study numbers.

Problems /questions

If you have any questions about the study or your participation in the study you can contact the principal investigator, Dr.Adut Chan Malual, 0701838155.If you have any questions on your rights as a research participant you can contact the Kenyatta National Hospital Ethics and Research Committee (KNH- ESRC) by calling 2726300 Ext. 44355.

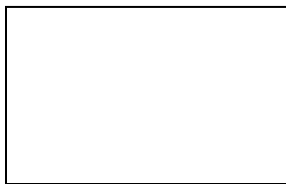
Consent form and participant’s statement

I.....parent/guardian of a child.....
.....confirm I have received adequate information regarding the study research, risks, benefits hereby agree to participate in the study with my child. I understand that our participation is fully voluntary and that I am free to withdraw at any time. I have been given adequate opportunity to ask questions and seek clarification on the study and these have been addressed satisfactorily.

Parents/Guardian’s Signature.....

Date...../...../.....

Parents/Guardian’s finger prints



Date...../...../.....

I..... Declare that I have adequately explained to the above participant, the study procedure, risks, and benefits and given him /her time to ask questions and seek clarification regarding the study.

Interviewer’s Signature.....

Date...../...../.....

الملحق الثاني: نموذج موافقة (الآباء / ولي الأمر)

الرقم التسلسلي لمريض الدراسة التاريخ / /

عنوان الدراسة :

فرصة ضائعة للتمنيع الأطفال الذين يترددون على العيادات الخارجية للأطفال في مستشفى جوبا التعليمي .

الباحث

شان ملوال الدكتورة ادوت

(MB.B.S)

للأطفال المقيمين في جامعة نيروبي

هاتف رقم 0701838155

بيان المحقق :

أنا طالب في الدراسات العليا في جامعة نيروبي - قسم طب الأطفال. أنا أسألك أنت وطفلك على المشاركة في دراسة بحثية. الغرض من هذا النموذج هو موافقة لتعطيك المعلومات التي سوف تحتاج لمساعدتك في تحديد ما اذا كانت ستشارك في هذه الدراسة. يرجى قراءة هذا النموذج بعناية. أنت حر في طرح أي سؤال عن الدراسة. وسوف المحقق تكون متاحة للرد على أية أسئلة التي تنشأ خلال فترة الدراسة.

مقدمة

الاستخدام الواسع النطاق للقاحات قد تحسنت إلى حد كبير في الصحة العامة العالمي، ومنع مليون من الاطفال من دخول المستشفيات وحالة وفاة سنويا. ستة أمراض يمكن الوقاية منها باللقاحات في البداية تم استهداف: السل، وشلل الأطفال والدفتيريا والكزاز والسعال الديكي والحصبة.

برنامج منظمة الصحة العالمية. الموسع للتمنيع (EPI) توصي بأن يتم تطعيم الأطفال في كل اتصال مع أحد المرافق الصحية. فشل لتطعيم الطفل الذي يحضر تحصين أو العيادات العلاجية مع لقاح (ق)، والذي هو / هي مؤهلة في غياب أي مؤشر كونترا معروف، يشكل فرصة التحصين الضائعة.

الاستفادة :

سيتم إبلاغ النتائج من هذه الدراسة إلى مقدمي الرعاية الصحية الأولية والتي قد تساعد في الحد من وقوع فرصة ضائعة للتمنيع، وبالتالي تحسين التغطية بالتحصين للأطفال في جنوب السودان.

المخاطر

لن يكون هناك أي خطر على المرضى (أي إجراء الغازية) ولكن هناك تدخل مباشر من المرضى في هذه الدراسة من خلال مقابلة الوالدين / الوصي.

الطوعية

وستكون هذه الدراسة طوعي تماما. لن تكون هناك مكافآت مالية لك على المشاركة في الدراسة. واحد حر في المشاركة أو الانسحاب من الدراسة في أي لحظة.

السرية

ستبقى كل البيانات التي تم الحصول عليها في تمرير ملفات الكمبيوتر تقييد في الوصول. بيانات النموذج لن توتي أسماء المرضى، وسوف يتم تحديد المرضى الذين يعانون فقط من أرقام الدراسة. قائمة رمز منفصل يحتوي على أرقام الدراسة.

المشاكل / أسئلة

إذا كان لديك أي أسئلة عن الدراسة أو مشاركتكم في هذه الدراسة يمكنك الاتصال الباحث الرئيسي، دكتور ظ ادوت شان ملوال، 0701838155.

إذا كان لديك أي أسئلة عن حقوقك كمشارك بحث يمكنك الاتصال مستشفى كينياتا الوطنية الأخلاق وجنة البحوث (KNH-ESRC) عن طريق الاتصال 2726300 تحويلة. 44355.

نموذج موافقة وبيان المشارك

أنا الوالد / الوصي للطفل
.....أؤكد لقد تلقيت معلومات وافية حول دراسة بحثية، المخاطر
والمنافع ووافق للمشاركة في هذه الدراسة مع طفلي. وأنا أفهم أن مشاركتنا هو طوعي تماما، وأنه أنا حر في الانسحاب في
أي وقت. لقد أعطيت الفرصة الكافية لطرح الأسئلة وطلب إيضاحات بشأن هذه الدراسة وعولجت هذه على نحو مرض.

توقيع الوالدين / الوصي..... تاريخ / /

بصمة الوالدين / الوصي..... تاريخ / /



أنا أعلن اني قد التي شرحتها على نحو ملائم للمشارك أعلاه،
فإن إجراء دراسة والمخاطر والمنافع ومنحته / منحتها ، وقته لطرح الأسئلة والحصول على توضيحات بشأن هذه الدراسة.
التوقيع المقابل تاريخ / /

Appendix III: Data collection form

EXIT INTERVIEW OF PREVALENCE AND FACTORS ASSOCIATED WITH MISSED
OPPORTUNITY FOR IMMUNIZATION

AGED GROUP 0-23 MONTHS

Identification

Serial number.....

Date of interview.....

1-age.....month(s)

2- Date of birth...../...../.....

3-Sex

- a. Male
- b. Female

4-Antenatal care

- a. Yes, where.....
- b. No
- c. Other specify.....

5-Place of birth

- a. Hospital
- b. Home
- c. Primary health care center
- c. Primary health care unit
- e. Others (specify).....

Personal characteristics of the guardian/parents

6-Sex

- a. Male
- b. Female

7-Relationship with child.

- a. Father
- b. Mother
- c. Aunt
- d. Uncle
- e. .Others specify.....

8-Marital status

- a. Single
- b. Married
- c. Widow
- d. Widower
- e. Divorced
- f. Separated

9-Occupation

- a. Government employee b. Private sector employee c. Self employee
- d. Unemployed e. Others/specify.....

10-Education

- a. No education b. Lower primary school education 1-4
- c. Upper primary school education 5-8 d. Secondary e. College/university
- e. Other (specify)

11-Religion

- a. Christianity b. Muslim c. None d. Others (specify).....

12-Has the child ever been immunized before? (Appendix VI) Injection on thigh or arm, oral drops.

- a. Yes b. No c. I don't know

13-if yes, do you have the immunization card?

- a. Yes b. No

If response to Q12 and 12 yes, indicate the specific vaccine based on the table below

Vaccine	Received/not received	re- ceived	Indicate date if given by card	Indicate if was given by recall only if no card(Appendix VI)
BCG				
OPV0				

DTP1			
OPV1			
DTP2			
OPV2			
DTP3			
OPV3			
Measles			

14-Review from the table above and determine if the child has missed any vaccine.

- a. Has missed (immunized for age) b. Has not missed (immunized for age)

If missed indicate the specific vaccine missed from the table below.

Vaccine	Tick if missed from card	Tick if missed by recall
BCG		
OPV0		
DTP1		
OPV1		
DTP2		
OPV2		
DTP3		
OPV3		
Measles		

19-What was the nutritional status as documented by the attending health worker?

- a. Good nutritional status b. Mild malnourished c. Moderately malnourished
- d. Severely malnourished e. Not documented

20- Where did you hear about immunization? (Allow multiple answers)

- a. Health worker. b. Community health worker. c. Media (TV, Radio).
- d. Friends/relatives. e. Campaign /outreach.
- f. Not applicable.(Respondent has not heard about immunization)

21-What services brought you to the facility?

- a. My child is unwell. b. Weighing. c. My decision to get immunization.
- d. Other (specify).....

22-What services did you get?

- a. Weighing.(if yes move to Q27)
- b. Treatment of illness.(if yes move to Q27)
- c. Advice only.(if yes move to Q27)
- d. Immunization.(if yes move to Q23)
- e. Other (specify).

23-Did you get the desired vaccine?(if response to Q22 is immunization)

- a. Yes (move to Q24) b. No (move to Q25) c. Not applicable

24-Were you advised on the side effects of the vaccine received?

- a. Yes b. No c. Not applicable

25-Why didn't your child get immunization?

- a. Don't know.(if yes move to Q27)
- b. Advised to come another day.(if yes move to Q26)

- c. Told to take treatment.
- d. Not due for immunization.
- e. Other (specify).....

26-Were you informed of your return to this facility?

- a. Yes
- b. No

27-By what transport means did you get to this facility?

- a. On foot.
- b. Taxi.
- c. Bicycle.
- d. Bus.
- e. Other means.....

28-How much did it cost you to come to this facility?

- a. 1-5SSP.
- b. 5-10SSP
- c. 10-15SSP.
- d. >15SSP.
- e. Not applicable.

29- What are some of the benefits of immunization?

- a. Prevent polio
- b. Prevent TB
- b. Prevent measles
- d. Prevent whooping cough
- e. prevent tetanus
- f. Others (specify).....

30-What other challenges or problems would make you not come for immunization services?

- a. Place of immunization too far
- b. Vaccine not available
- c. Vaccinator absent
- d. Long vaccine time
- e. Mother too busy
- f. Fear of side effect
- g. Others (specify).....

31- Had you ever received Tetanus toxoid injection before your last pregnancy?

- a. Yes
- b. No

32- How many times did you receive Tetanus toxoid injection previously during pregnancy?

(Corroborate from card if available)

- a. Not received any.
- b. Once.
- c. Twice.
- d. Three times
- e. Four times or more

33-State the tetanus immunization status of child at birth.(Four or more TT, child protected)

- a. Protected.
- b. Not protected.

34-Reasons for missed opportunity/ immunization failure in general. (Probe) match response with corresponding options. (Allow multiple answers)

- a. Unaware of need for immunization.
- b. Unaware of need to return for 2nd and 3rd dose.
- c. Place and/or time of immunization unknown.
- d. Wrong ideas about contra-indication.
- e. Other, specify.....

Appendix IV part A: Questions for the hospital EPI manager

Date of interview...../...../.....

Interview

1. Do you give outreach/mobile services in addition to routine immunization schedule?

- a. Yes b. No

2. Do you have guideline on immunization?

- a. Yes (check for evidence (book)) b. No

3. What are the practices in Juba Teaching Hospital? (Do you advocate for daily vaccinations for all antigens?)

- a. Weekday's b. Weekdays and weekends
c. Don't advocate d. Others (specify).....

4. Do you have all the vaccines? (OPV, BCG, DTP, and measles)

- a. Yes b. No c. If No, specify.....

5. Do you have a plan for immunization services?

- a. Yes (look for evidence if yes (book)) b. No

6. How do you forecast your vaccine and other supplies needs?

- a. Calculated using largest population b. Request when there is short of any
c. Other specify.....

7. Are there other areas in the hospital other than MCH that identify children that are due for immunization?

- a. Yes b. No c. Not Sure

8. How often do you get vaccine (any vaccine) stock out in a year?

- a. Never b. Often (more than one episode in a year) c. Rarely

9. Reasons for stock out.

a.

b.....

10. Any vaccine in particular.

a. BCG

b. DTP

c. OPV

d. Measles

11. How reliable is the electricity and what type of fridge is used?

a.....

Appendix IV part B: Questions for the health workers providing vaccination at Juba Teaching Hospital

Date of interview...../...../.....

Knowledge, attitudes and practices

1. Are there any limitations that would prevent you from vaccinating your target?

- a. Yes
 - b. No
- if yes move to Q10

2. How would you identify a child who has not missed to be immunized?

- a. Compare the age and date of vaccination
- b. Don't know

b. Other specify.....

3. If a one year child who has not received any vaccines, which vaccine would you give on that visit?

a.

b.

c.

4. Describe the national immunization schedule, vaccines and diseases that they prevent from

Vaccine	Number of doses	Age	Diseases that they prevent
BCG			
OPV			
DTP			
Measles			

5. What is adverse effect following immunization and what do you do in event you get an adverse effect?

Vaccine	Adverse effect	What do you do in event
BCG		
DTP		
Measles		
Polio		

6. What do you tell the Mother about the vaccine given?

- a. BCG.....
- b. .DPT.....
- c. Measles.....

7. What are the contra-indications that you will not give vaccine to child?

- a. BCG.....
- b. Polio.....
- c. DTP.....
- d. Measles.....

8. Are they any illnesses that would prevent you from immunizing a child who is due for immunization?

- a. Yes
- b. No
- if yes move to Q10

9. Which illnesses that would prevent you from immunizing your target?

- b. High fever
- b .Immune compromised

Appendix V: Immunization schedule for children in the Republic of South Sudan [31]

Minimum Age	Vaccine	Maximum age
At birth	OPV 0	2 weeks(4 weeks in SS)
At birth	BCG	11 months
6 weeks	DTP 1 and OPV 1	5 years
10 weeks	DTP 2 and OPV 2	5 years
14 weeks	DTP 3 and OPV 3	5 Years
9 months	Measles	15 years

OPV= Oral Polio Vaccine

DTP= Diphtheria Pertussis Tetanus

SS=South Sudan

Appendix VI: Interview guide for parental recall

1. BCG vaccination against TB that is an injection on the left forearm that is usually causes a scar
2. OPV, that is, immunization drops applied in the mouth to prevent polio.
3. How many times polio vaccine given?
4. Triple vaccine, that is, an injection usually given in the thigh often at the same time as polio.
5. How many times was triple vaccine given?
6. Measles vaccination that is an injection on the deltoid muscle that is usually given at 9 months.

Appendix VII: Contraindication for immunization

There are 2 absolute contraindications to DTP

- Immediate anaphylactic reaction[32,33]
- Encephalopathy within 7 days (includes severe, acute central nervous system disorder unexplained by another cause, which may be manifested by major alterations of consciousness or by generalized or focal seizures that persist for more than a few hours without recovery within 24 hours)[34].

Precautions for immunization against DTP

- Seizure with or without fever, occurring within 3 days of immunization with DTP [32, 35].
- Persistent crying within 3 days for 3 or more hours within 48 hours [36, 37].
- Collapse or shock-like state (hypotonic-hypo responsive episode) within 48 hours [38, 39].
- Temperature $\geq 40.5^{\circ}\text{C}$ (104°F), unexplained by another cause, within 48 hours.

True contraindication to BCG

- Patient with impaired immunity symptomatic HIV infection, known or suspected congenital immunodeficiency[40,41,42,33]
- Patients under immunosuppressive treatment(corticosteroid, radiation alkylating agent) [40,41,42,43]

Contraindication specific to OPV

- Individuals with impaired immune response.

Contraindication to measles vaccine

- Epileptic Seizure (uncontrolled), Brain Injury and Dysgammaglobulinemia [44].
- Primary Immune Deficiency Disorder and Hypo gammaglobulinemia [45,46,47,48]