A CASE CONTROL STUDY OF THE PROTECTIVE EFFECT
OF MEASLES VACCINE USED DURING 1994-1996
IN VIENTIANE MUNICIPALITY (LAO.P.D.R)

SAMPHANH KHAMSINGSAVATH

A THESIS SUBMITTED IN PARTIAL Fulfillment OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
(MEDICAL EPIDEMIOLOGY)

With compliments
of
Faculty of Graduate Studies, Mahidol Univ.

IN
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
1997
ISBN 974-589-192-4
COPYRIGHT OF MAHIDOL UNIVERSITY
Thesis
entitled

A CASE CONTROL STUDY OF THE PROTECTIVE EFFECT OF MEASLES VACCINE USED DURING 1994-1996 IN VIENTIANE MUNICIPALITY (LAO.P.D.R)

Samphanh Khamsingsavath
Candidate

Kulaya Narksawat
Major Advisor

Somchai Supanvanich
M.D., M.P.H.&T.M.
Co-advisor

Pipat Luksamjarulkul
B.Sc.(Med.Tech), M.Sc.(Public Health)
Co-advisor

Adulya Viriyavejakul
M.D., LL.B., F.R.C.P.
Dean
Faculty of Graduate Studies

Pratap Singhasivanon
M.B., B.S., D.T.M&H., Dr.P.H.
Chairman Master of Science Programme in Medical Epidemiology
Faculty of Tropical Medicine
Thesis

entitled

A CASE CONTROL STUDY OF THE PROTECTIVE EFFECT
OF MEASLES VACCINE USED DURING 1994-1996
IN VIENTIANE MUNICIPALITY (LAO.P.D.R)

Was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Science (Medical Epidemiology)

on

November 4, 1997

Samphanh Khamsingsavath
Candidate

Kulaya Narksawat
Chairman

Somchai Supanvanich
M.D., M.P.H.&T.M.
Member

Vason Silpasowan,
B.Sc.,M.Ed.,M.P.H.,Dr.P.H
(Health service development)
Member

Adulya Viriyavejakul
M.D.,LL.B.,F.R.C.P
Dean
Faculty of Graduate Studies

Pipat Luksamijarulkul
B.Sc.(Med.Tech), M.Sc.(Public Health)
Member

Porapan Punyaratabundhu,
M.D.,M.P.H.,M.H.S(Epid),Dip Board
Dean
Faculty of Public Health
ACKNOWLEDGEMENT

I would like to express my deepest gratitude to those who help me and contributed to the successful completion of this study.

From the bottom of my heart, I am very thankful to Assoc. Prof. Kulaya Narksawat, my major advisor, who gave me very helpful and valuable comments for the completion of my thesis. Without her help, I could not finish it.

My appreciation and profound gratitude are also given to my co-advisor, Prof. Dr. Somchai Supanvanich, for his valuable suggestion, time and patience during the proposal and analysis. The time and effort that he has put into helping me to complete this thesis could not be forgotten.

Special thanks is also extended to Assoc. Prof. Pipat Luksamijarulkul my co-advisor for his enormous guidance and support. It would have been impossible to complete my thesis without his guidance.

I would like to express my gratefulness to Asst. Prof. Dr. Pratap Singhavanon for his kind, suggestion and help throughout my study.

Gratefulness to all health personnel in Vientiane Municipality who helped me in the process of data collection.

My heartfelt thanks and appreciation to all staff of Department of Epidemiology, Faculty of Public Health and the Department of Tropical Hygiene, Faculty of tropical Medicine, Mahidol University for giving the knowledge and made this study possible.

I am also greatly indebted to my family for their love, understanding and encouragement during my study.

Many thanks to all my friends at National Institute of Hygiene and Epidemiology, who gave me support and provided me a lot of data for my study.

Finally, my very special thanks to SEAMEO TROPMED-D.A.A.D, who supported me with the funding for the program of Master of Science in Medical Epidemiology.

Samphanh KHAMSINGSAVATH.
A case-control study was conducted during 17 March to 7 June 1997 to assess the protective effect of measles vaccination, and factors affecting the protective effect, which was used during 1994-1996 in Vientiane Municipality. A total of 164 cases of children under five years old were taken from most recent hospital records of 5 main hospitals. All of the cases came to hospitals to receive treatment for measles during 1994-1996. The 171 controls were selected by choosing the closest neighbors to the cases who were closest in age and never had measles. The information on the past history of the measles vaccination, and other factors affecting the protective effect of the vaccine, were collected by using questionnaires.

The results of the study showed that the majority of measles cases occurred in children aged 13-24 months (39.63 %). The percentage of those who never received a measles vaccination (67.68 %) was higher than among controls (32.32 %). Among the cases who did not receive the vaccination 17.68 % were children aged less than 9 months. This age group had not yet received the scheduled measles vaccination which suggested the maternal antibody had diminished.

The overall protective effect of the measles vaccine used during 1994-1996 was 76 %. The adjusted significant factor affecting the protective effects of the measles vaccine was found to be only the place of vaccination. Children who received measles vaccination from a fixed center had protective effect of 91 % (OR = 0.09 and 95 % CI = 0.05-0.12) higher than those who received vaccination from a mobile team of 66 % (OR = 0.34 and 95 % CI = 0.18-0.69 ).

The results from this study suggest that the knowledge of mothers about their nutritional status to increase maternal antibody in their children, and the schedule of measles vaccination of their children should be improved. Cold-chain, especially for the mobile team, needs to be reviewed in order to improve the protective effect of the measles vaccine for preventing measles in children in Vientiane Municipality.
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>I</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>II</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>III</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>IV</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>I . Introduction</td>
<td>1-4</td>
</tr>
<tr>
<td></td>
<td>- General objectives</td>
</tr>
<tr>
<td></td>
<td>- Specific objectives</td>
</tr>
<tr>
<td></td>
<td>- Significance of research</td>
</tr>
<tr>
<td>II . Literature review</td>
<td>11-17</td>
</tr>
<tr>
<td>III. Materials and methods</td>
<td>18-25</td>
</tr>
<tr>
<td>IV. Results</td>
<td>26-50</td>
</tr>
<tr>
<td>V . Discussion</td>
<td>51-53</td>
</tr>
<tr>
<td>VI. Conclusion and Recommendation</td>
<td>54-56</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>57-60</td>
</tr>
<tr>
<td>APPENDIX</td>
<td></td>
</tr>
<tr>
<td>1. A. THE STUDY AREA</td>
<td>61</td>
</tr>
<tr>
<td>2. B. DATA COLLECTION FORM</td>
<td>62-66</td>
</tr>
<tr>
<td>3. C. OBSERVATION FORM</td>
<td>67</td>
</tr>
<tr>
<td>4. D. IMMUNIZATION SCHEDULE IN LAO.P.D.R</td>
<td>68</td>
</tr>
<tr>
<td>5. E. CALCULATION OF VACCINE EFFICACY</td>
<td>69</td>
</tr>
<tr>
<td>6. F. ABREVIATIONS</td>
<td>70</td>
</tr>
<tr>
<td>7. G. LIST OF VARIABLES AND CODES USED IN THE STUDY</td>
<td>71</td>
</tr>
<tr>
<td>BIOGRAPHY</td>
<td>72</td>
</tr>
</tbody>
</table>


LIST OF THE TABLES

<table>
<thead>
<tr>
<th>TABLES:</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Immunization coverage by age 12 months of age in LAO.P.D.R from 1991-1995</td>
<td>2</td>
</tr>
<tr>
<td>2. Reported cases of EPI diseases in LAO.P.D.R from 1991-1995</td>
<td>4</td>
</tr>
<tr>
<td>3. The EPI coverage among children under 1 year from 1991-1995 in Vientiane Municipality</td>
<td>19</td>
</tr>
<tr>
<td>4. Reported numbers cases of diseases from 1991-1996 in Vientiane Municipality</td>
<td>20</td>
</tr>
<tr>
<td>5. The distribution of measles cases by age group and residence in Vientiane Municipality from 1994-1996</td>
<td>27</td>
</tr>
<tr>
<td>6. A comparison of cases and controls with regard to infant factors</td>
<td>30</td>
</tr>
<tr>
<td>7. A comparison of cases and controls with regard to mother factors</td>
<td>33</td>
</tr>
<tr>
<td>8. A comparison of cases and controls with regard to place of receiving vaccination</td>
<td>35</td>
</tr>
<tr>
<td>9. Crude analysis of risk factors of measles occurrence among cases and controls</td>
<td>38</td>
</tr>
<tr>
<td>10. The results of multiple logistic regression for risk factors</td>
<td>40</td>
</tr>
<tr>
<td>affecting to the measles occurrence</td>
<td></td>
</tr>
<tr>
<td>12. The protective effect of measles vaccine in various variables</td>
<td>43</td>
</tr>
<tr>
<td>13. The knowledge, practice of mothers among vaccinated and non-vaccinate groups and E.P.I.</td>
<td>47-49</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

**FIGURES**


3. Distribution of cases by age group when measles occurred in Vientiane Municipality from 1994-1996 .................................................. 28

4. Distribution of cases by residence in Vientiane Municipality from 1994-1996 ................................................................. 28

5. Distribution of cases and controls according to measles vaccination ................................................................. 30

6. Distribution of cases and controls according to sex .................................. 31

7. Distribution of cases and controls according to history of measles occurrence in the family ...................................................... 31

8. Distribution of cases and controls according to occupation of mother ................................................................. 34

9. Distribution of cases and controls according to place of receiving vaccination .................................................................................. 35
CHAPTER I

INTRODUCTION

Measles was an ubiquitous, highly contagious, seasonal and common disease affecting nearly every person in a given population among adolescence with the absence of immunization.

It was one of the leading causes of childhood mortality throughout the world. In developing countries, case-fatality rate (CFR) were similar to those found in developed countries in the 1800s. The community studies showed CFR varying from 3% to 15%, CFR varied depending on the age at the time of infection, intensity of exposure, nutritional status, and availability of treatment. These conditions can be prevented by several approaches, one of this, was through immunization.[1] [2]

World Health Organization estimated that in 1994 more than a million children died from measles, and about 40 million cases of measles occurred each year but a small percentage of these (less than 5%) were ever reported, 98% occurred in developing countries. Globally the disease accounts for over 10% of deaths among the under-five, and half of them in children under a year old.[3]

Before a vaccine was licensed, proof of efficacy was observed ideally in a prospective, randomized double-blind placebo controlled trial. After license, effectiveness of the vaccine and vaccination program have been monitored, usually by assessing coverage and monitoring disease incidence. There were two options to determine vaccine efficacy in the field (field evaluation of vaccine post license) namely the serologic study and epidemiologic study.[4]

All the countries in South-East Asia region, now participating in the global Expanded Program on Immunization (EPI), and have given high priority to the program.[5]

The commitment of WHO to this program will have to be supported by National and Personal commitment services a permanent component of primary health care system, to develop National self reliance, and to ensure the presence of basic material and management resources.[6]

The EPI of WHO recommends immunization with a single dose of Schwarz attenuated live measles vaccine at the age 9 months in developing countries. Due to maternal antibodies, not more than 80-90% may have seroconverting at this age. In the industrialized countries, measles vaccination was delayed to the age of 15 months or later in order to prevent interference from maternal antibodies. However, if immunization was delayed that along in developing countries, an unacceptably large proportion of the children would already have contacted measles before the age of
vaccination. The 9 months of limit was a compromise between need to protect children early and the lower seroconversion rate at lower ages.[7]

Lao P.D.R is a tropical country in the Western pacific region, landlocked country with an area of 236,800 Km² stretching 1,700 Km from north to south and between 100 and 400 Km from east to west. Lao P.D.R shares borders with Vietnam, Thailand, Cambodia, China and Burma. Rivers, mountains and forests are the striking physical features of the country. Whilst lacking direct access to the sea, about two-thirds of the country is mountainous. A total population of 4.58 million as of March 1, 1995.[8]

In Lao P.D.R, with the assistance of the United Nations Children’s Fund (UNICEF) and the World Health Organization (WHO), under of Ministry of Public Health, the EPI was started in 1982 including Measles vaccine. One of the EPI objectives is to reduce morbidity and mortality from measles, pertussis, tetanus, diphtheria and tuberculosis by achieving immunization coverage for children and female [9]. Usually the EPI policy conducts services into two kind: (1) Routine: Fixed center (open every day) and Mobile team (Four time per year), (2) National Immunization Days (Conduct two times per year during January and February). Since 1991 the EPI has undergone rapid expansion. A prime Minister’s decree was issued in April 1993 to support of EPI activities. In 1994, the Immunization coverage in Lao P.D.R. continued improving [10] [11] (see in table 1)

Table 1: Percentage of immunization coverage by 12 months of age in Lao P.D.R from 1991 - 1995.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td></td>
<td>34</td>
<td>34</td>
<td>42</td>
<td>69</td>
<td>59</td>
</tr>
<tr>
<td>DPT 3</td>
<td></td>
<td>22</td>
<td>23</td>
<td>25</td>
<td>48</td>
<td>54</td>
</tr>
<tr>
<td>OPV 3</td>
<td></td>
<td>22</td>
<td>27</td>
<td>26</td>
<td>57</td>
<td>64</td>
</tr>
<tr>
<td>MEASLES</td>
<td></td>
<td>48</td>
<td>46</td>
<td>39</td>
<td>73</td>
<td>68</td>
</tr>
<tr>
<td>TT 2 +</td>
<td>PREGN</td>
<td>13</td>
<td>17</td>
<td>23</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td>C.B.A</td>
<td></td>
<td>12</td>
<td>18</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
</tbody>
</table>

Source: National Institute of Hygiene and Epidemiology

PREGN: Pregnancy.
C.B.A: Child Bearing of Age.
Figure 1: Percentage of immunization coverage from 1991-1995 in Lao P.D.R.

The infant morbidity and mortality were still high. The infant mortality rate was reported decreasing from 160/1000 in 1960 to 118/1000 in March 1985, and more recently to 117/1000 live birth. The under-five mortality rate was reported decreasing from 240/1000 in 1960 to 193/1000 in March 1985. A fertility-mortality survey carried out in 1986-87 found that infant deaths represented 61 percent of under-five deaths. Most deaths of children were due to communicable diseases. The main causes of children deaths were Malaria, Acute respiratory infection (ARI), Meningitis, Diarrhea, Dengue hemorrhagic fever, and Measles.[12].

Measles has been included as one of five diseases in National Surveillance System. One of the National surveillance objectives is to eliminate Measles by the year 2000. Occurrence of measles cases were reported in each month to National Institute of Hygiene and Epidemiology (see in table 2) [13].
Table 2: Reported cases of EPI diseases in Lao PDR from 1991 - 1995.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DISEASES</th>
<th>POLIO CASES</th>
<th>MEASLES</th>
<th>PERTUSSIS</th>
<th>TETANUS ALL</th>
<th>TETANUS NNT</th>
<th>DIPHTHERIA</th>
<th>TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>No. cases</td>
<td>2</td>
<td>1400</td>
<td>2227</td>
<td>37</td>
<td>20</td>
<td>2</td>
<td>1602</td>
</tr>
<tr>
<td></td>
<td>Rate per 100.000</td>
<td>0.04</td>
<td>35</td>
<td>55.5</td>
<td>1</td>
<td>0.5</td>
<td>0.04</td>
<td>40</td>
</tr>
<tr>
<td>1992</td>
<td>No. cases</td>
<td>5</td>
<td>520</td>
<td>233</td>
<td>16</td>
<td>12</td>
<td>5</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Rate per 100.000</td>
<td>0.1</td>
<td>12.5</td>
<td>5.6</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td>13.5</td>
</tr>
<tr>
<td>1993</td>
<td>No. cases</td>
<td>7</td>
<td>1083</td>
<td>104</td>
<td>15</td>
<td>5</td>
<td>4</td>
<td>632</td>
</tr>
<tr>
<td></td>
<td>Rate per 100.000</td>
<td>0.17</td>
<td>26.41</td>
<td>2.54</td>
<td>0.37</td>
<td>0.03</td>
<td>0.10</td>
<td>15.41</td>
</tr>
<tr>
<td>1994</td>
<td>No. cases</td>
<td>6</td>
<td>984</td>
<td>900</td>
<td>39</td>
<td>10</td>
<td>8</td>
<td>1841</td>
</tr>
<tr>
<td></td>
<td>Rate per 100.000</td>
<td>0.14</td>
<td>22.88</td>
<td>20.93</td>
<td>0.91</td>
<td>0.06</td>
<td>0.19</td>
<td>42.81</td>
</tr>
<tr>
<td>1995</td>
<td>No. cases</td>
<td>11</td>
<td>3174</td>
<td>106</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>Rate per 100.000</td>
<td>0.24</td>
<td>70.53</td>
<td>2.36</td>
<td>0.16</td>
<td>0.03</td>
<td>0</td>
<td>...</td>
</tr>
</tbody>
</table>

Source: National Institute of Hygiene and Epidemiology.

.... Data not available.

Immunization has been used as a tool to control the communicable diseases and eliminate its causative agent. There are three factors that come into play: vaccine efficacy, Vaccine coverage and Herd effect.[14]

The purpose of this study, the case-control study was to assess the measles effectiveness measles vaccine operated in Vientiane Municipality during 1994 - 1996.
OBJECTIVES

General Objective:

- To determine the protective effect of measles vaccine used during 1994-1996 of children in preventing the measles.

Specific Objectives:

1. To identify some risk factors influencing occurrence of measles included demographic characteristics such as: sex of children, age at time of measles occurred, history of measles occurrence in the family, residence, and history of receiving measles vaccine, age, occupation, education of mothers, number of siblings in the family, and place of receiving measles vaccination.

2. To determine protective effect of measles vaccine in Vientiane Municipality.

3. To identify the factors that influence the protective effect of measles vaccine.

4. To describe the knowledge and practices of mothers of children between vaccinated and non-vaccinated group.
HYPOTHESES

1. Measles vaccine had a protective effect on the occurrence of measles.

2. The following factors influencing the protective effect of measles vaccine:
   - Sex of children.
   - Age of mothers.
   - Occupation of mothers.
   - Education of mothers.
   - Number of siblings in the family.
   - Place of receiving vaccination.
DEFINITION TERM

Measles:

The WHO definition for clinical measles cases is:
(1) Generalized rash of 3 days or more.
(2) Fever ( > 101.5°F or 38°C if measured).
(3) Any one of the following:
   a. cough.
   b. coryza.
   c. conjunctivitis.

Or Koplik spots 2 to 3 days before rash (if observed).

Measles Vaccine:

It is immunobiological substance used for active immunization by introducing into the body, a live modified, attenuated measles infectious organism. The vaccine is capable of stimulating immune response by the host, who is thus rendered resistance to infection.[15]

Protective effect:

It is the effect of measles vaccine to protect the children from measles which can be calculated in term of effectiveness. (By this case-control study, OR was used to calculated )

Effectiveness:

It is the extent to which a specific intervention, procedure, regimen, or services, when deployed in the field, does what is intended to do for a defined population.[15]

Efficacy:

It is the extent to which a specific intervention, procedure, regimen, or service produces a beneficial result under ideal conditions. Ideally, the determination of efficacy is based on the results of a randomized controlled trial.[15]

Demographic characteristics of cases and controls:

Is the characteristics of cases and controls when interviewed and when they was sick from measles such as: measles vaccination status, age at time when measles occurred, sex of children, history of measles occurrence in the family, age of mother, occupation of mother, education of mother, number of siblings in the family, place of receiving vaccination.
Receiving vaccine:

To certified the attendance measles vaccination, among case and control mothers of children must holding vaccination card or included in a list of family book for EPI.

Cold-chain:

Is a system for ensuring the potency of a vaccine since the time of manufacture to the time, it is given to a children or pregnant woman.
CONCEPTUAL FRAME WORK

**Independent Variable**

- Infant factors
  - Age
  - Sex
  - History of measles occurrence in the family

- Measles vaccination attendance

- Mother factors
  - Age
  - Occupation
  - Education
  - No. siblings
  - Knowledge
  - Practice

- Other factors
  - Place of receiving vaccination

**Dependent Variable**

- Measles occurrence

- Protective effect of measles vaccine
SIGNIFICANCE OF THE RESEARCH

Deaths among children in Lao.P.D.R. usually reported due to complications, particularly pneumonia and encephalitis, and mortality rates always under reported. If vaccine efficacy was 90-95% or greater (this was consistent with seroconversion data) then its effectiveness could be achieved between 80-90% when appropriately administered, measles vaccine was among them, the protective effect of measles vaccine was evidently high and the morbidity and mortality of measles should decreased.[16]

Eventhough The EPI in Lao.P.D.R was started in 1982, the disease incidence has not much decreased, including measles, inspire of increased vaccination coverage and still stand high rank among leading causes of morbidity and mortality in many parts of the country.

Considering the above facts, the effectiveness of measles vaccine can explain the existing discrepancies between the expected and actual health situation.
CHAPTER II

LITERATURE REVIEWS

Measles was an acute highly communicable disease with 80% attack rate among susceptible household contacts. The infectious agent was the measles virus and man was the host. Approximately 10 days after exposure, the prodromal phase ensures, which usually lasts for 3rd - 5th days, characterized by low grade to moderate fever, cough, coryza and conjunctivitis. These almost always precede koplak spots, the pathognomonic sign of measles by 2nd or 3rd days. Koplik spots were grayish white dots, usually as small as grains of sand, with a slight, reddish areola found opposite the lower molars but may spread irregularly over the rest of the buccal mucosa. A characteristic dusky-red, blotchy rash appears on the 3rd to the 7th days beginning on the face then becoming generalized lating from 4th to 6th days and sometimes ending as branlike desquamation.[16] [17] [18]

The period of communicability was 2nd - 4th days before rash and decrease rapidly after the onset of rash. Coincident with the appearance of the exanthem was the detection in serum of circulating measles antibody in nearly 100% of patients by the second days of rash. Striking clinical improvement begins at this time, interrupted a few days later in a varying number of patients by secondary illness caused by bacteria that have migrated across the damaged respiratory tract lining.[18]

Mode of transmission was by droplet spread or direct contact with nasal, throat or urinary secretions of infected patients. At the portal of entry a short period of local virus multiplication and limited spread ensures, followed by a brief, low liter, primary viremia that distributes the agent to different sites, where the virus replicates actively in lymphoid tissues. A prolonged secondary viremia of higher titer occurs, associated with the onset of clinical prodromata and the widespread dissemination of virus. From the time of exposure until the beginning of rash, the virus can be detected throughout the body, especially in respiratory tract and lymphoid tissues, it can also be recovered from nasopharyngeal secretion, urine and blood.[18]

Pathogenesis of measles infection indicates that prevention through immunization could be accomplished: (1) by inhibiting replication at the dissemination from the nasopharynx and (2) by inhibiting viremia during the incubation period. The first approach would require the presence of local secretory IgA antibody[19], the second would require circulating antibody, either actively or passively acquired, to neutralize the virus.

Recovery from infection was associated with the production of interferon [20] [21] [22] [23] and serum and secretory antibodies [24] [25] [26] as well as the establishment of cellular immunity [27]. Based on observations, after natural and vaccine induced infections, the actual level of antibody was not a critical factor for
protection [28]. What was important was for the immune system to be appropriately primed so that the host will almost always retain enduring immunity.

In developing countries, the average of measles infection much lower than observed in developed countries. In some area of Africa, more than 50% of 2 years old and 100% of 4 years old children may be expected to have had measles. Poor nutrition and rapid loss of maternal antibody may explain why a greater proportion of these infants were susceptible at an earlier age than those in developed areas.[16]

The WHO reported that, in developing countries usually measles occurred in group of children under 2 years of age. [ 7 ]

In Lao.P.D.R. Measles vaccine was administered at 9 months of age (see in Appendix D: Lao EPI schedule) by WHO recommendation.

It was believed that maternally derived transplacental antibody persisted rarely beyond 7 months of age and that an adequate immune response could be achieved if vaccination was limited to infants 9 months of age and older [28] [29]. It was hoped that achieving very high measles vaccination coverage at this age will not only protect vaccine recipients but also provide sufficient herd effect to prevent exposure of infants younger than the recommended age for vaccination [30]. Though vaccine induced immunity was quantitatively different from that achieved after natural infection, it does not differ qualitatively [16]. After seroconversion, a single dose of live vaccine that was properly administered could confer life long protection.

Proof of efficacy was obtained ideally in a prospective, randomized double-blind placebo-controlled trial [35]. This type of study was generally not possible after a vaccine has been licensed because, when the vaccine was proven benefit, the use of a placebo was unethical [35]. Another disadvantage of randomized controlled trial to assess vaccine efficacy were expensive to conduct and beyond resources of most developing countries.

Previous studies conducted claimed that measles vaccine if appropriately administered yields 80-95% effectiveness [31] [32] [33] [34] To determine whether a given proportion of cases with a vaccination history was still compatible with a good efficacy [35].

The quality and durability of measles vaccine induced immunity was highly dependent on a number of factors that relate both to the vaccine and to the host [28]. There were 2 kind of vaccine failure, namely primary vaccine failure, wherein there was failure of seroconversion after vaccination, and secondary vaccine failure which was loss of protection after demonstrated seroconversion.

The most important vaccine related factors were the type of antigen and the potency of vaccine [16]. There were different causes of primary vaccine failure with
live vaccine. Loss of potency of live vaccine can result from improper shipping, storage and handling [28].

There were host factors which could contribute to the primary vaccine failure. First, even after receipt of potent vaccine, approximately 2 to 5% of vaccines will fail to respond, owing to unknown reasons [28]. Second interferon produced by an inter current infection may interfere with successful vaccination. Lastly, passively derived measles antibodies may neutralize vaccine virus before a complete immune response develops [36].

Vaccine effectiveness can be measured epidemiological by comparing the risk of disease in vaccine and non vaccine. The main advantage of an epidemiological study was that, actual efficacy rather than some surrogate can be measured and with regards to laboratory confirmation of cases, it was useful, but not required if case definition was specific. Since our concern was clinical protection, there was no need of determining the presence or absence of serum antibody. Many epidemiological studies can be performed as part of disease control efforts [35].

In the field of infectious disease, case-control study of the “Cumulative incidence” type can be used as an estimate of the relative risk of a disease attributable to exposure to an agent only when the incidence of the disease was low [45]. Case-control study can be used to estimate vaccine efficacy. On the assumption that vaccine offers at least some protection, the odds ratio should be less than 1. Thus, a greater proportion of cases was unvaccinated, compared with controls [35].

There were 4 major factors which could affect most epidemiological studies of vaccine effectiveness, namely: (1) case definition, (2) case ascertainment (case detection), (3) vaccine status determination and (4) comparability of exposure. It was critical to have a uniform definition of cases and it should be applied to all study subjects. Such definition should be sensitive and specific. Generally, sensitivity was important for gaining the most precise estimate, however, specificity was more critical than sensitivity for accurately determining vaccine efficacy [35].

In a retrospective study done in Mozambique, used the WHO criteria for measles case determination. Results showed that the sensitivity of mother’s diagnosis of measles (as confirmed by serological findings) was estimated to be 52.6% and the specificity was 82.8%. The positive and negative predictive values of measles history in the unvaccinated group were 62% and 79%, respectively. Several other epidemiological studies used these criteria such as in a large outbreak in Pointe-Noire, Congo, in Ebeye used the same criteria in the studies [35] [37] [38].

In case finding, it was important to assure that there was equal detection of cases among vaccinated and unvaccinated populations. Its design depends on factors such as nature of disease, study designs, degree to which study subject will seek and have access to medical care, quality of records, validity of parental history of disease and resources. Another important factor was vaccination status determination. Its
accuracy was a must; thus, vaccine history should be based on a record indicating the data of vaccination. Lastly, was the comparability of exposure. The vaccines and non-vaccines should have equal likelihood of exposure to measles disease but which was less assured since it depends on several variables.

Vaccine status should be confirmed by persons unaware of the clinical histories of the population under study. Different rates of record loss between case and well persons could influence the vaccine efficacy estimate. It was best to exclude unknowns rather than to classify them as unvaccinated or vaccinated [35].

In observational study, if any variable was related to the outcome of interest, be it disease or vaccination status, the estimate of vaccine efficacy will be biased by the confounding effect of the extraneous factors and lead to underestimate or overestimate vaccine efficacy. Potentially confounding variables include but were not limited to age, sex, race, socio-economic status, attendance at institution where risk of exposure was greater than in the general, and place of residence [35].

In an adtorial written by George Comstock (1990), he claimed that interpretation of observational evaluation of vaccination almost universally share a serious problem. He mentioned that Houston (1990) noted that in most observational studies, effectiveness was being assessed rather than efficacy.

The study was conduct during the months of August to September, 1991 an outbreak of measles occurred in northeastern Quebec, Canada. During and outbreak of measles, monovalent measles vaccine was administered as part of outbreak control to children age 6 to 11 months. Active surveillance was used to detect cases of measles occurring during the following month. Children who did not develop measles were tested for measles antibody before their revaccination at 15 months of age. The result of 81 children 6 to 11 months of age, 56 were vaccinated and two received immunoglobulins. Measles occurred in 15 of 79 children during and after vaccination campaign, for and overall attack rate of 19%. The attack rate among unvaccinated children was 39% compared with 11% among those vaccinated. The overall vaccine effectiveness was 73%. This study confirm that measles vaccination of infants age 6 to 11 months was an effective intervention measure during measles outbreaks.[39] [40]

In September to October 1985, a measles outbreak occurred among elementary school students on a small Offshore island near Taiwan. It has 22 cases occurred, most of whom were born before measles vaccine was locally available. To determine the efficacy of measles vaccine, the measles immunization status was determined for all cases by reviewing immunization card, 8 (42%) of 19 vaccinated compared to 14 (70%) of 20 unvaccinated developed measles. The efficacy of measles vaccine was 39.8%. This study were currently underway to determine the magnitude of cold-chain problem throughout the Taiwan area and identify specific training need for health station staff.[41]
Case-fatality rate (CFR) for measles cases have previously been reported to higher in hospital than in community studies. Data on measles morbidity and mortality abstained in community investigations of measles outbreaks in two rural districts in Kenya were compared to data from the same time period on measles morbidity and mortality in children hospitalized with measles in the respective district hospitals. The CFR were found to be considerably lower in the respective district hospitals, 1.7 and 2.1%, than in the community surveys, 8.0% and 9.4%, respectively (relative risk [RR] 0.17, 95% confidence interval [CI] 0.10 - 0.30, and RR = 0.20, 95% CI: 0.05-0.81). Hospital-based studies of CFR in measles infection were not representative of measles morbidity in community, it may be misleading to use hospital data in control surveillance systems. Further studies were needed of the mortality after discharge of hospitalized measles cases. [42] [43]

In general females have a lower mortality than males at all ages. Excess female mortality has been documented in certain high mortality situations, in particular in South Asia. However, females may have a higher mortality for certain causes of death, one of the causes of death for which excess female mortality was suspected was measles. Sex differences in measles were investigated using all national data on causes of death published by WHO since 1950. An index of excess mortality was used: the geometric mean of the female sex ratios of age-specific deaths rates from measles, from age 0 to 44 years. When pooled together, the results show an access of female mortality from birth until age 50 years. The excess female mortality appears small at age 0-4 large at age 5-14 and peaks during the female reproductive period, at age 15-44. This pattern of excess female mortality occurs in all the major regions of the world: Europe, North and South America, Far-East Asia, the Middle East and South Asia. The only noticeable exceptions were Philippine and Thailand. The validity of the finding was extensively reviewed. Emphasis lies on the statistical power to prove that sex differences in measles mortality do exist, on the critical analysis of a cases study in England and Wales, on the comparison with the overall pattern of sex differences and on available data on sex differences in incidence. Possible explanations were reviewed.[44]

To improve measles control in Kinshasa, Zaire a project to increase vaccine coverage was begun in 1988, and in 1989, the city vaccination program changed measles vaccination policy from Schwartz vaccine at age 9 months to medium titter Edmonston Zagreb (EZ) vaccine at age 6 months. We report the impact of the program on measles incidence and mortality. Data on vaccine coverage were obtained from cluster sample surveys conducted every 1-2 years and from routine reports of vaccine dosed administered. Data on measles incidence and mortality were obtained from sentinel surveillance sites. The serological response to EZ measles vaccine was evaluated at health center in 1989 and in a community survey in 1990. Measles vaccine coverage estimated in cluster surveys increased from 50% of the 1984 birth cohort to 89% of the 1989 birth cohort, accepting either a home based record or verbal history of vaccination. Reported measles incidence per 100,000 population decreased by over 90%, from 37.5 in 1980 (early vaccination years) to 1.6 in 1991. There was a relative decrease in the proportion of cases aged < 9 months
(32% of cases in 1986-1987 and 23% of cases in 1990-1991) and an increase in proportion aged > 23 months (29% of cases in 1986-1987 and 43% in 1990-1991). According to Elisa, 74-76% of children seroresponded to EZ vaccine administered at age 6-7 months under routine program conditions. Measles can be controlled in urban areas, although it was difficult to determine how great a contribution vaccination at age 6 months makes over and above the achievement of high coverage.[45] [46]

A study was carried out in three selected administrative regions of Ethiopia to identify factors responsible for non-attendance in immunization coverage. Sixty clusters were selected from EPI operational localities. A house to house survey was done and ten children between the ages of 12-23 months from each cluster were included in the study. Factors such as sex and age of children, marital status, age, occupation, education, knowledge, attitude and practice of mothers were looked into find out their influence on non-attendance of immunization program. (Alemu et al in 1988) Consequently, education of mothers and sending back of mothers without their children being immunized we found to be significant factor in influencing attendance for immunization (P-Value less than 0.05) [47].

To assess the effectiveness of measles vaccine in Philippine a retrospective cohort study was undertaken from the civil registry. The 1985 birth cohorts were identified and followed up. Out of 635 birth cohorts, 484 (76.22%) children were included in this study while 151 (23.78%) were dropped. The cohorts were found to be homogeneous with respect to sex, number of siblings in the family, mother's occupation and education. Cumulative incidence of measles among the vaccinated (0.31) was significantly lower than among the unvaccinated (0.42) (P-value = 0.046). Crude analysis showed that those vaccinated were 0.74 time protective of having measles compare to unvaccinated. Place of receiving vaccination was found to be statistically associated (P-value = 0.001) with occurrence of measles. Those vaccinated in outreach clinics had higher incidence of measles compared to those vaccinated in the static clinics. (RR = 2.00; 95% CI = 1.44, 2.77). Obtained vaccine effectiveness was 35% (95% CI = 21%, 46%) which was low compared to the expected (80-95%) [48].

A case-control study was done in Thailand to find the factors influencing immunization coverage, 184 parents whose children were 1-4 years of age and had health record was conducted in the Din-Daeng community, Bangkok (Luksamjarulkul P et all). The 88 parents whose children had incomplete the basic immunization(1 BCG, 3 DPT, 3 OPV and 1 Measles) and the 96 parents whose children had incomplete immunization were interviewed about factors associated with basic immunization coverage. The comparison of studied variables between the 2 groups used odd ratio (OR) and X2 - test. The results showed that factors influencing the incomplete of immunization were (a) socio-economic factors: low income OR = 6.5 (P < 0.001), low education OR = 5.26 (P < 0.001), (b) socio-psychological factors: lack of knowledge about vaccines OR = 1.77 to 8.14, uncertainty of vaccine efficacy OR = 2.40 to 8.90, (c) health service factors: parent's dissatisfaction with service OR = 8.79 (P < 0.001). Furthermore, the efficacy of the vaccine were reviewed, and
the estimated vaccine coverage for herd immunity against tuberculosis, diphtheria, tetanus, poliomyelitis and measles was also calculated.[49]

The study was done in Ramathibodi Hospital, Bangkok, Thailand during February to September 1992. Seventy-eight sample were obtained, 45 were boys and 33 were girls. There were 41 with single vaccination and protective immunity were found in 36 accounting for 87%. There were 12 cases with MMR vaccine, all showed protective immunity while 25 cases received both vaccine with 22 of them demonstrating protective antibody levels. [50]

A study of measles and cost estimate of treatment was done at Children Hospital, Bangkok, Thailand. The most frequently affects in children under 3 years of age.[51]

Past experience about immunization programs calls for continuous monitoring of a healthy attitude among users towards vaccination. The aim of this study was to assess the effect of health education messages (mass media) on knowledge and practice of mothers as regards compulsory vaccination schedule. (Shazly-MK et al 1991). Data were collected from 250 females attending MCH centers during the first half of 1991 for either vaccinating their children or receiving ante natal care (exposed group). These data were compare to the data collected from a group of mothers before implementation of the intense mass media campaign on immunization (1983) (non-exposed group). There was a significant increase in the mean score of knowledge among the exposed mother. The mass media message became the main source of information among the majority of exposed group. Females utilizing mass media as their main source of information were largely having a satisfactory level of knowledge. This study recommended enforcement of mass media educational campaign on childhood immunization as well as reconsideration paid to the nature and content of messages. [52]

In order to gather information on the factors affecting the spread of measles vaccine in Pakistan, 287 mothers living in Karachi were interviewed concerning their knowledge, attitude and beliefs about measles and measles vaccine (Isomura-S et al 1992). Measles had been highly prevalent, mainly among infants between 9 and 18 months of age. The severity of the illnes and the frequency of complications were well known and the importance of immunization was well recognized. In traditional combined families grand parents had the decision to take children for immunization, but many mothers had begun to feel that they were responsible for participation in the program. The vaccine acceptance rate had increased sharply educator's activities and mass media such as Television, radio program. The present findings confirm the importance to continuous effort toward promotion of primary health care by collaboration of motivated mothers and community health workers. [53]
CHAPTER III

MATERIALS AND METHODS

1. General background of the study area:

The Vientiane Municipality (V.M) (sometimes referred to as the Vientiane Prefecture) has splitted from Vientiane Province in 1982. The total population was 528,109 persons with 261,981 females and 266,128 males and 10,179 households and estimated children under one of age was 21,124. It occupies a land area was about 3,920 square kilometer, divided into 9 districts, out of them were 4 urban and 5 rural districts. Approximately 50% of population were living in urban area. V.M shares border with Thailand, Vientiane Province, Borikhamxay province, Xiengkhouang province. The average temperatures range from 16°C in January to 31°C in April.[14] [54]

The health system of Vientiane Municipality was divided into 3 levels: Provincial, District and Commune levels. Centers for hygiene and epidemiology at provincial level and district level were responsible for the epidemiological activities under preventive cares. Curative services including emergency care were provided at three levels: first in commune level, second in district hospitals, and third in provincial hospital.

From 1991, the EPI in V.M has undergone rapid expansion. The EPI coverage was continued improving (see in table 3), but the diseases still have reported.
Table 3: The percentage of EPI coverage among children under 1 year in V.M. From 1991-1995.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>53</td>
<td>50</td>
<td>71</td>
<td>85</td>
<td>96</td>
</tr>
<tr>
<td>OPV3</td>
<td>39</td>
<td>63.5</td>
<td>80</td>
<td>82</td>
<td>81</td>
</tr>
<tr>
<td>DPT3</td>
<td>39</td>
<td>51.7</td>
<td>78.5</td>
<td>80</td>
<td>78</td>
</tr>
<tr>
<td>MEASLES</td>
<td>38</td>
<td>70</td>
<td>75</td>
<td>80</td>
<td>86</td>
</tr>
</tbody>
</table>

Source: National Institute of Hygiene and Epidemiology.

Figure 2: Percentage of immunization coverage from 1991-1995 in Vientiane Municipality.
In surveillance system, to control the disease and eliminate its causative agent measles was one among five diseases. The number of cases was reported every month (see in table 4).

Table 4: Reported numbers cases of diseases, From 1991-1996 In Vientiane Municipality.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td>46</td>
<td>18</td>
<td>80</td>
<td>130</td>
<td>49</td>
<td>46</td>
</tr>
<tr>
<td>NNT</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Cholera</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AFP</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>18</td>
</tr>
</tbody>
</table>

Source: Vientiane Municipality Hygiene Station.

There were four main hospital centers, one provincial hospital and nine district hospitals in Vientiane Municipality. Usually measles vaccination was handled in each hospital. For the activity of outreach and mobile team, they were conducted 4 times per year. The policy of EPI, measles vaccination was given at 9-23 months of age. From 1991, National Immunization Days was conducted two times a year during January to February.

In children, those who were immunized were reported in children card (Yellow card) that’s mothers keep it, and family book for EPI (EPI 9) that’s health center or villages head men keep it.

2. Study design:

A case-control study was used.
3. **Study Population:**

The children who were born during 1991 to 1995 and included in cases and controls criteria were a target population of this study. Because they were old enough to have life through a sufficient period of risk of disease, and young enough for their parents to recall occurrence of measles reliably.

4. **Method of cases and controls selection:**

4.1. **Selection of cases:**

The children with recent record of received treatment from hospitals, during 1994-1996 from 5 main hospitals, namely: Mahosoth hospital, Setthathilat hospital, 109 hospital, 103 hospital, 150 beds were selected at the sample of the case study. And find the address of the cases where they were from.

4.1.1. **Criteria for the diagnosis of Measles:**

The WHO definition for clinical measles cases was used in this study[35]. The criteria included:

1. Generalized rash of 3 days or more.
2. Fever (> 101°F or 38°C if measured).
3. Any one of the following:
   a. cough.
   b. coryza.
   c. conjunctivitis.

Cases must meet all 3 criteria to be classified as measles.
Or have koplik’s spots 2 to 3 days before rash (if observed).

4.1.2. **Inclusion criteria of cases:**

- The children < 5 years of age during the time of data collection.
- Occurred measles based on WHO clinical criteria case definition.
- To certified in cases of measles who were vaccinated, must have children card or should included in a list of family book for EPI.
- In case of receiving measles vaccine, must be received at least 1 month before interview, with certificate of receiving vaccine.

4.1.3. **Exclusion criteria of cases:**

- Children > 5 years of age during the time of data collection.
- Not meet all 3 criteria of WHO clinical case definition or koplik’s spots.
- In case of receiving measles vaccine, if less than 1 month before interview.
- Children who have anti HIV positive.

4.2. Selection of controls:

Controls were selected from closest neighborhood of cases by health staffs. The team investigators visited villages where cases came from, to select controls and to interview cases and controls to complete information including measles vaccination, socio-demographic characteristics and others factors which affected the effectiveness of measles vaccine.

4.2.1. Inclusion criteria of controls:

- The children < 5 years of age during the time of data collection.
- Not development measles during follow up period one month after interview.
- To certify in control who received measles vaccination, must have children card or should included in a list of family book for EPI.

4.2.2. Exclusion criteria of controls:

- Children > 5 years of age during time of data collection.
- After one month follow up, if children developed measles were excluded.
- In case of receiving measles vaccine, if less than 1 month before interview.
- Children who have anti HIV positive.

In both cases and controls who received measles vaccine must have certified document or including in a list of vaccination book, and received vaccine at least 1 month before interview. If they both (cases and controls) do not have certified in receiving vaccine (just only telling), they were excluded from this study.

5. Data collection:

5.1. To find the cases by exploring the most recent hospital records for:

- Address of cases.
- Some information available.

5.2. Data collection forms were prepared by staffs of National Institute of Hygiene and Epidemiology.

5.3. The questionnaire was pre-tested in some villages before use and was improved for more understanding.
5.4. Arranged the meeting and training among health staffs for understanding of method of data collection and selection of controls.

5.5. Health staffs went to villages where cases lived, to:
- find controls.
- train local interviewers.

5.6. Household interviews were conducted by local interviewers to interview both cases and controls, and completed information need. During interviewing, interviewers asked mothers first to describe the sign and symptom of measles, if mothers have no knowledge about disease, picture of children with measles were showed.

Questionnaire form was included:

Infant factors: - Sex.
- Measles vaccination status.
- Age at time of Measles occurrence.
- History of measles occurrence in the family.

Mother factors: - Age.
- Number of siblings in the family.
- Occupation.
- Education.
- Knowledge.
- Practices.

Other factors: - Residence.
- Place of receiving vaccination.

And the other ones were observed:
- Transportation of vaccine from refrigerator to immunization site.
- Method of administration of measles vaccine.

6. Sample size estimation:

The estimation of sample size was take \( n \) by using unmatched case-control study. The formula was used: [55] [56] [57]

\[
n = \left[ Z_{a/2} \sqrt{2pq} + Z\beta \sqrt{pq1+ p0q0} \right]^2 \left( p1 - p0 \right)^2
\]
Where:

\( p_0 \) : Estimated vaccination rate among controls.
\( q_0 \) : \( 1 - p_0 \).
\( p_1 \) : Estimate vaccination rate among cases.

\[
p_1 = \frac{p_0 \cdot R}{1 + p_0(R - 1)}
\]

\( q_1 = 1 - p_1 \)

Since there was no available data regarding incidence of measles among the vaccinated and unvaccinated children in Lao.P.D.R. A survey in Abidjan, Ivory Coast [4] will take into consideration.

Relative Risk of the protective effect of measles vaccine in vaccinated group compared to the unvaccinated group was 0.5.

\[
p = \frac{1}{2}(p_1 + p_0)
\]

\( q = 1 - p \)

\( Z_{\alpha} = 1.96 (= 0.05, \text{two - tailed}) \)

\( Z_{\beta} = 0.842 (= 0.20) \)

\( n \) : Number of cases.
\( p_0 \) : Based on the estimated average of coverage of measles vaccine period 1994 - 1996 was 80% [11].

By using above equation the calculated number of:

Cases \( (n) = 76. \)
Controls \( = 76. \)

During data collection was collected 100 cases and 100 controls or more.

Total sample size at least = 200.
7. **Data of analysis:**

Data were edited, coded, and entered in the computer by using the **dBASE IV** program. Stata program was used for analysis the data.

The results of the study were presented in the following:

7.1. **Descriptive statistics:**

Variables were described by measles and non-measles cases. Infant factors (sex, age at time of measles occurrence, measles vaccination status, history of measles occurrence in the family), Mother factors (age, number of sibling, occupation, education, knowledge, practices), other factors (place of receiving vaccination, residence) were consider as independent variables. The percentage, mean with standard deviation, median value for continuous variable and proportion for nominal and categorize variables were obtained.

7.2. **Analytic statistics:**

Bivariate analysis was used to calculate crude odds ratio. The crude odds ratio (OR) with 95% CI and P-value = 0.05 significant level was used to determine strength of association between factors affecting measles occurrence in cases group by sex of children, history of measles occurrence in the family, age of mother, occupation of mother, education of mothers, number of siblings in the family, place of receiving measles vaccination. Crude odds ratio with 95% CI was examined by using 2 x 2 table and chi-square and fisher's exact test were used to evaluated the significant difference.

The overall effectiveness (VE) of measles vaccination was calculated from WHO formula for vaccine efficacy with 95% confidence interval. [2] [35]

\[
VE(\%) = (1 - OR) \times 100\%
\]
CHAPTER IV

RESULTS

From 1996 down to 1994, there were 225 cases of measles registered in the report of Vientiane Municipality Hygiene station. From most recent record 164 cases of measles were interviewed. 171 controls were selected from neighbor's houses of the same village with similar age group, and residence as the cases. Two of controls were excluded from this study after time of following up. The characteristics of infants factors such as: sex of children, age of children when measles occurred, measles vaccination status of children, history of measles occurrence in the family, mothers factors such as: age, occupation and education, number of siblings in the family, knowledge and practice of mother; and others factors such as: residence place of receiving vaccination were included.

The results of the comparison of the characteristics between cases and controls for each variable mentioned above were as following:

1. **Characteristic of cases group**

This part was described in total 164 cases by the distribution of age when measles occurred, and distribution of measles cases by residence:

1.1. **The distribution of measles cases by age when measles occurred**:

The results from table 5 showed that, the majority of cases in age group 0 - 12 months were 52 (31.70%), 13 - 24 months 65 (39.63%), followed by age group 25 - 36 months 27 (16.47%), 49 - 60 months 12 (7.32%) and the smallest were age group 37 - 48 months, 8 (4.88%) with mean age 23.22 months and standard deviation of 19.34 months. (Table 5, Figure 3)

1.2. **The distribution of measles cases by residence**:

The most common measles cases was in residence zone 0 71.95 %, followed by zone 1 17.07 % and zone 2 10.98 % (Table 5, figure 4).
Table 5: The distribution of Measles cases by age group and residence in Vientiane Municipality from 1994-1996.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number (n = 164)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group when measles occurred:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Months)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 0 - 9</td>
<td>29</td>
<td>17.68</td>
</tr>
<tr>
<td>- 10 - 12</td>
<td>23</td>
<td>14.02</td>
</tr>
<tr>
<td>- 13 - 24</td>
<td>65</td>
<td>39.63</td>
</tr>
<tr>
<td>- 25 - 36</td>
<td>27</td>
<td>16.47</td>
</tr>
<tr>
<td>- 37 - 48</td>
<td>8</td>
<td>4.88</td>
</tr>
<tr>
<td>- 49 - 60</td>
<td>12</td>
<td>7.32</td>
</tr>
<tr>
<td>Residence of children:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Zone 0</td>
<td>118</td>
<td>71.95</td>
</tr>
<tr>
<td>- Zone 1</td>
<td>28</td>
<td>17.07</td>
</tr>
<tr>
<td>- Zone 2</td>
<td>18</td>
<td>10.98</td>
</tr>
<tr>
<td>- Zone 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 0 - 9 months = 17.68 %; 4 months: 0.61 %
5 months: 0.61 %
6 months: 1.22 %
7 months: 7.32 %
8 months: 4.88 %
9 months: 3.04 %

10 - 12 months = 14.02 %; 10 months: 3.66 %
11 months: 5.48 %
12 months: 4.88 %
Figure 3: The distribution of measles cases by age group (in month) from 1994-1996 in Vientiane Municipality.

Figure 4: The distribution of measles cases by residence from 1994-1996 in Vientiane Municipality.
2. Analytic study of factors related to measles occurrence in study group (cases and controls):

2.1. Description of characteristic of infant factors:

2.1.1. Sex of children:

The results showed that, the sex distribution among cases and controls was not equal. In cases group 71 (43.29%) were girls and 93 (56.71%) were boys. In controls group 96 (56.80%) were girls and 73 (43.20%) were boys.

The difference between sex distribution of cases and controls was statistically significant, P-value = 0.014. (Table 6, Figure 6).

2.1.2. Measles vaccination status:

The distribution of measles vaccination status of children among cases and controls was not equal. The majority of cases who received measles vaccine were 53 (32.32%) and did not received measles vaccine were 111 (67.68%). Among controls, 116 (68.64%) received measles vaccine and 53 (31.36%) were not received measles vaccine.

The difference between measles vaccination status of cases and controls were statistically significant, P-value 0.001. (Table 6, Figure 5).

2.1.3. History of measles occurrence in the family:

The distribution of the history of measles occurrence in the family among cases and controls was not equal. The majority of cases in history of measles occurrence in the family were 92 (56.10%) and had not history of measles occurrence in the family were 72 (43.90%). In controls group, the history of measles occurrence in the family were 137 (81.55%) and had not history of measles occurrence in the family were 31 (18.45%).

The difference between history of measles occurrence in family of cases and controls was statistically significant, P-value less than 0.001. (Tables 6, figure 7).
Table 6: Comparison of cases and controls with regard to infant factors.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cases</th>
<th>Controls</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (164)</td>
<td>%</td>
<td>No (169)</td>
</tr>
<tr>
<td>Sex:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Girls</td>
<td>71</td>
<td>43.29</td>
<td>96</td>
</tr>
<tr>
<td>- Boys</td>
<td>93</td>
<td>56.71</td>
<td>73</td>
</tr>
<tr>
<td>Measles Vaccination:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>53</td>
<td>32.32</td>
<td>116</td>
</tr>
<tr>
<td>- No</td>
<td>111</td>
<td>67.68</td>
<td>53</td>
</tr>
<tr>
<td>History of measles occurrence in the family:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>92</td>
<td>56.10</td>
<td>137</td>
</tr>
<tr>
<td>- No</td>
<td>72</td>
<td>43.90</td>
<td>31</td>
</tr>
</tbody>
</table>

* From chi-square test.

Figure 5: Percentage of cases and controls according to measles vaccination from 1994-1996 in Vientiane Municipality
Figure 6: The distribution of measles cases according to sex from 1994-1996 in Vientiane Municipality.

Figure 7: The distribution of measles cases according to history of measles occurrence in the family from 1994-1996 in Vientiane Municipality.
2.2. Description of characteristic of mother factors:

2.2.1. Age group of mother:

The distribution of age group of mother among cases and controls was almost equal. The majority of cases was in the age group of mother less than 35 years old 120 (73.17%) and 44 (26.83%) in the age group of mother equal and more than 35 years old. Among controls, the age group of mother less than 35 years old were 129 (76.33%) and 40 (23.67%) were age group of mother equal and more than 35 years old.

The difference between age group of mother among cases and controls was not statistically significant, P-value = 0.507. (Table 7).

2.2.2. Occupation of mother:

The distribution of mothers' occupation among cases and controls was not equal. The majority of cases in house wife were 110 (67.07%) and 54 (32.93%) were working. Among controls 134 (79.29%) were house wife and 35 (20.71%) were working.

The difference between occupation distribution of cases and controls was statistically significant, P-value = 0.012. (Table 7, Figure 8).

2.2.3. Education of mother:

The distribution of education of mother among cases and controls was almost equal. In cases of measles, education of mothers 15 (9.15%) were none, 140 (85.37%) were primary-secondary and 9 (5.49%) were university higher than university. In controls group 21 (12.43%) were none, 139 (82.25%) were primary-secondary and 9 (5.33%) were university higher than university.

The difference between education of mother distribution of cases and controls was not statistically significant, P-value = 0.629. (Table 7).

2.2.4. Number of siblings in the family:

The distribution of number of siblings in the family among cases and controls almost equal. The majority of cases were number of siblings 2-3 68 (41.46%), followed by number of siblings >3 55 (33.54%) and number of siblings 1 were 41 (25.00%). Among controls, number of siblings 2-3 were 69 (40.83%), followed by number of siblings >3 59 (34.91%) and number of siblings 1 were 41 (24.26%).

The difference between number of siblings in the family among cases and controls was not statistically significant, P-value = 0.946. (Table 7)
Table 7: Comparison of cases and controls with regard to mother factors.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cases</th>
<th>Controls</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (164)</td>
<td>%</td>
<td>No (169)</td>
</tr>
<tr>
<td>Age of mother:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- &lt;35</td>
<td>120</td>
<td>73.17</td>
<td>129</td>
</tr>
<tr>
<td>- &gt;=35</td>
<td>44</td>
<td>26.83</td>
<td>40</td>
</tr>
<tr>
<td>Education of mother:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- None</td>
<td>15</td>
<td>9.15</td>
<td>21</td>
</tr>
<tr>
<td>- Primary-Secondary</td>
<td>140</td>
<td>85.37</td>
<td>139</td>
</tr>
<tr>
<td>- High-University-Higher</td>
<td>9</td>
<td>5.48</td>
<td>9</td>
</tr>
<tr>
<td>Occupation of mother:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- House-wife</td>
<td>110</td>
<td>67.07</td>
<td>134</td>
</tr>
<tr>
<td>- Working</td>
<td>54</td>
<td>32.93</td>
<td>35</td>
</tr>
<tr>
<td>Number of siblings in the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>family:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 1</td>
<td>41</td>
<td>25.00</td>
<td>41</td>
</tr>
<tr>
<td>- 2-3</td>
<td>68</td>
<td>41.46</td>
<td>69</td>
</tr>
<tr>
<td>- &gt;3</td>
<td>55</td>
<td>33.54</td>
<td>59</td>
</tr>
</tbody>
</table>

* From chi-square test.
2.3. **Description characteristic of other factor:**

2.3.1. **Place of receiving vaccination:**

The distribution of place of receiving vaccination among cases and controls was not equal. The majority of cases were received vaccine from outreach team 34 (64.16 %), 19 (35.84 %) received vaccine from fixed center. Among controls 77 (66.38 %) received from fixed center and 37 (31.90 %) received from outreach team.

The difference between place of receiving vaccination among cases and controls was highly statistical significant, P-value less than 0.001. (Table 8, Figure 9).
Table 8: Comparison of cases and controls with regard to place of receiving vaccination.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases</th>
<th></th>
<th>Controls</th>
<th></th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Place of receiving vaccination:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fixed center</td>
<td>19</td>
<td>35.84</td>
<td>77</td>
<td>66.38</td>
<td></td>
</tr>
<tr>
<td>- Outreach team</td>
<td>34</td>
<td>64.16</td>
<td>37</td>
<td>31.90</td>
<td></td>
</tr>
<tr>
<td>- Mobile team</td>
<td>0</td>
<td>0.00</td>
<td>2</td>
<td>1.72</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>100.00</td>
<td>116</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

* From chi-square test.

**Figure 9**: The distribution of measles cases according to place of receiving measles vaccination from 1994-1996 in Vientiane Municipality.
3. **Crude analysis of factors related to measles occurrence:**

3.1. **Sex of children:**

From table 9, the results showed that, there was association between girls in comparison with boys and measles. The odds ratio was 1.72 with 95% CI was 1.12 - 2.66 and P-value 0.013. Crude odds ratio of 1.72 here means that, children in boys group have approximate to get diseases 1.72 times as compare to girl without any consideration of other factors. It can be concluded that sex of children was statistically significant associated with occurrence of measles because this characteristic was not similar between cases and controls, sex of children may be a risk factor of measles.

3.2. **Measles vaccination status:**

The results from table 9 showed that, The Odds ratio was 4.58 with 95% CI 2.89 - 7.26 and P-value less than 0.001. Crude odds ratio 4.58 means that, children who had not received measles vaccine would have approximate 4.58 times to suffer from measles as compared to one who had received measles vaccine without any consideration of other factors.

The association between measles vaccination status and measles was statistically significant at alpha level of 0.05 without any consideration on confounding bias and effect modification. Measles vaccination status may be a risk factor of measles.

3.3. **History of measles occurrence in the family:**

The results in table 9 showed that, history of measles occurrence in the family in the controls group was more likely to have had measles occurrence in the family as compared to cases group. The Odds ratio was 3.46 with 95% CI 2.11 - 5.67 and P-value less than 0.001. Crude Odds ratio 3.46 here, it means that a child who had not history of measles occurrence in the family would have approximate 3.46 times to suffer from measles as compared to one who had history of measles occurrence in the family without any consideration of other factors.

The association between measles and history of measles occurrence in the family was significant at alpha level of 0.05 without any consideration on confounding bias and effect modification. which suggested that history of measles occurrence in the family may be a risk factor of measles.

3.4. **Occupation of mothers:**

The results in table 9 showed that, mothers in controls group were more likely to have house-wife than mothers in cases group. The Odds ratio was 1.88 with 95% CI 1.15 - 3.07 and P-value = 0.012 which suggested that
occupation of mother may be a risk factor of measles. Crude odds ratio 1.88 here, it means that mothers of children in the working group would have approximated 1.88 times to suffer from measles as compared to the one in the house-wife group without any consideration of other factors.

The association between occupation of mother and measles was significant at alpha level of 0.05 without any consideration on confounding bias and effect modification.

3.5. **Place of receiving vaccination:**

The results from table 9 showed that, The Odds ratio was 2.35 with 95% CI 1.47 - 3.77 and P-value less than 0.001. Crude odds ratio here means that children who received vaccine from outreach team have approximate to get diseases 2.35 times as compared to those children who received vaccine from fixed center. We can concluded that place of receiving vaccination may be a risk factor of measles without any consideration on confounding bias and effect modification.

The association between place of receiving vaccination and measles was significant at alpha level of 0.05 without any consideration on confounding bias and effect modification.
Table 9: Crude analysis of risk factors of measles occurrence.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cases</th>
<th>Controls</th>
<th>OR(95%CI)</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No %</td>
<td>No %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Girls</td>
<td>71 43.29</td>
<td>96 56.80</td>
<td>reference</td>
<td></td>
</tr>
<tr>
<td>- Boys</td>
<td>93 56.71</td>
<td>73 43.20</td>
<td>1.72(1.12-2.65)</td>
<td>0.014</td>
</tr>
<tr>
<td>Total</td>
<td>164 100.00</td>
<td>169 100.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles vaccination status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>53 32.32</td>
<td>116 68.64</td>
<td>reference</td>
<td></td>
</tr>
<tr>
<td>- No</td>
<td>111 67.68</td>
<td>53 31.36</td>
<td>4.58(2.89-7.26)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Total</td>
<td>164 100.00</td>
<td>169 100.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>History of measles in the family:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>92 56.10</td>
<td>137 81.55</td>
<td>3.46(2.11-5.67)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>- No</td>
<td>72 43.90</td>
<td>31 18.45</td>
<td>reference</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>164 100.00</td>
<td>169 100.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupation of mother:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- House-wife</td>
<td>110 67.07</td>
<td>134 79.29</td>
<td>1.88(1.15-3.07)</td>
<td>0.012</td>
</tr>
<tr>
<td>- Working</td>
<td>54 32.93</td>
<td>35 20.71</td>
<td>reference</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>164 100.00</td>
<td>169 100.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place of receiving vaccination:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fixed center</td>
<td>19 35.84</td>
<td>77 66.38</td>
<td>reference</td>
<td></td>
</tr>
<tr>
<td>- Outreach +Mobile</td>
<td>34 64.16</td>
<td>39 33.62</td>
<td>2.35(1.47-3.77)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Total</td>
<td>53 100.00</td>
<td>116 100.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* From chi-square test
4. **Multivariate analysis factors related to measles occurrence:**

To assess the potential of each risk factor by taking others factors into account, all significant risk factors were added at a time to the models and the crude and adjusted OR were compared. *(Table 10)*

By multiple logistic regression, measles vaccination status was highly significant after control of sex, history of measles occurrence in the family, occupation of mother and place of receiving vaccination. The odds ratio was 3.72 with 95% CI 2.22 - 6.22 and P-value less than 0.001.

Sex of children was significant, after using multiple logistic regression to control immunization status measles vaccination status, history of measles occurrence in the family, occupation of mother and place of receiving vaccination. The odds ratio was 1.77 with 95% CI 1.07 - 2.93 and P-value = 0.025.

History of measles occurrence in the family was significant, after using multiple logistic regression to control sex, measles vaccination status, occupation of mother and place of receiving vaccination. The odds ratio equals 3.43 with 95% CI 1.95 - 6.01 and P-value less than 0.001.

Occupation of mother was significant, after using multiple logistic regression to control sex, measles vaccination status, history of measles occurrence in the family and place of receiving vaccination. The odds ratio equals 2.60 with 95% CI 1.45 - 4.70 and P-value = 0.001.

Place of receiving vaccination was significant, after using multiple logistic regression to control sex, measles vaccination status, history of measles occurrence in the family and occupation of mother. The odds ratio equals 1.93 with 95% CI 1.34 - 3.75 and P-value less than 0.001.
Table 10: The result of multiple logistic regression of risk factor affecting to the measles occurrence.

<table>
<thead>
<tr>
<th>Variables:</th>
<th>Cases</th>
<th>Controls</th>
<th>OR</th>
<th>95% CI</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Measles vaccination status:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>53</td>
<td>32.32</td>
<td>116</td>
<td>68.64</td>
<td>3.72</td>
</tr>
<tr>
<td>- No</td>
<td>111</td>
<td>67.68</td>
<td>53</td>
<td>31.36</td>
<td>1</td>
</tr>
<tr>
<td>Sex of children:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Girls</td>
<td>71</td>
<td>43.29</td>
<td>96</td>
<td>56.80</td>
<td>1.77</td>
</tr>
<tr>
<td>- Boys</td>
<td>93</td>
<td>56.71</td>
<td>73</td>
<td>43.20</td>
<td>1</td>
</tr>
<tr>
<td>History of measles occurrence in the family:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>92</td>
<td>56.10</td>
<td>137</td>
<td>81.55</td>
<td>3.43</td>
</tr>
<tr>
<td>No</td>
<td>72</td>
<td>43.90</td>
<td>31</td>
<td>18.45</td>
<td>1</td>
</tr>
<tr>
<td>Occupation of mothers:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House-wife</td>
<td>110</td>
<td>67.07</td>
<td>134</td>
<td>79.29</td>
<td>2.60</td>
</tr>
<tr>
<td>Working</td>
<td>54</td>
<td>32.93</td>
<td>35</td>
<td>20.71</td>
<td>1</td>
</tr>
<tr>
<td>Place of receiving measles vaccine:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed</td>
<td>19</td>
<td>35.84</td>
<td>77</td>
<td>66.38</td>
<td>1.93</td>
</tr>
<tr>
<td>Mobile</td>
<td>34</td>
<td>64.16</td>
<td>39</td>
<td>33.62</td>
<td>1</td>
</tr>
</tbody>
</table>

* From chi-square test.
5. **Estimation of the protective effect of measles vaccine:**

5.1. **Overall protective effect:**

Among 164 children in cases group, 53 (32.32%) were received measles vaccine, 111 (67.68%) were not received measles vaccine. The percentage distribution of measles vaccination status among controls 116 (68.64%) were received measles vaccine and 53 (31.36%) were not received measles vaccine.

The crude odds ratio was 0.21 with 95% CI was 0.13-0.34 and P-value less than 0.001. This finding indicates that there was an association between measles vaccination status and measles (Table 6, figure 6). After controlling for sex, history of measles occurrence in the family, occupation of mother and place of receiving vaccination. The odds ratio was changed to 0.24 with 95% CI was 0.16-0.44 and P-value less than 0.001. The children those who received measles vaccine have 0.24 times to suffer from measles as compared to one who did not received measles vaccination. Or it means that, children who were vaccinated would have protective effect against measles.

The overall effectiveness of the vaccination was:

\[(1 - \text{Odds Ratio}) \times 100 = (1 - 0.24) \times 100 \]
\[= 76 \%.
\]

The estimation of vaccine efficacy were shown in Table 11. Those who received measles vaccine reduced the risk of measles 76%.

**Table 11 : Efficacy of measles vaccine in preventing measles in Vientiane Municipality from 1994-1996.**

<table>
<thead>
<tr>
<th>MeaslesV</th>
<th>Statistical model</th>
<th>No.cases</th>
<th>No.controls</th>
<th>Efficacy(%)</th>
<th>95%CI(OR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
<td>111</td>
<td>53</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Unadjusted</td>
<td>53</td>
<td>116</td>
<td>79 %</td>
<td>65% - 87%</td>
</tr>
<tr>
<td></td>
<td>Adjusted</td>
<td>53</td>
<td>116</td>
<td>76 %</td>
<td>56% - 84%</td>
</tr>
</tbody>
</table>

5.2. **The protective effect of measles vaccine in each variables:**

From table 12 the results showed that, the protective effect of measles vaccination in various variable of total of 164 cases and 169 controls:
5.2.1. Sex of children:

After controlling by age, occupation of mothers, history of measles occurrence in the family, and place of receiving vaccination; the adjusted OR was 0.22, the protective effect of measles vaccine was 78% in girls group and the adjusted OR was 0.23, the protective effect of measles vaccine was 77% in boys group. Is no difference among sex of children by 95% CI. (Table 12)

5.2.2. Occupation of mothers:

After controlling by sex of children, history of measles occurrence in the family, and place of receiving vaccination; the adjusted OR was 0.10, the protective effect of measles vaccine was 90% in occupation of mothers house-wive group and the adjusted OR was 0.25, the protective effect of measles vaccine was 75% in working group. the protective effect in occupation of mother house-wive group was higher than working group was 15%. Is no difference among occupation of mothers 95% CI. (Table 12)

5.2.3. History of measles occurrence in the family:

After controlling by sex of children, occupation of mothers, and place of receiving vaccination; the adjusted OR was 0.20 with 95% CI was 0.09-0.33 and the protective effect of measles vaccine was 80% in group of had history of measles occurrence in the family, the adjusted OR was 0.50 with 95% CI was 0.25-1.20 the odds ratio was 0.47 with 95% CI was 0.18-1.20 but P-value 0.12 was not significant, the protective effect of measles vaccine was 53%. We can concluded that history of measles occurrence in the family was not factors affecting to the protective effect of measles vaccine, is no difference among history of measles occurrence in the family 95% CI. (Table 12)

5.2.4. Place of receiving vaccination:

After controlling by sex of children, occupation, education, age of mothers, number of sibling in the family; the adjusted OR was 0.09 with 95% CI was 0.05-0.12, the protective effect of measles vaccine was 91% in group of children who received vaccine from fixed center and the adjusted OR was 0.34 with 95% CI was 0.18-0.89, the protective effect of measles vaccine was 66% in group of children those who received from mobile team. The protective effect of measles vaccine was higher in group receiving from fixed center if we compared to group received from mobile team. We can concluded that place of receiving measles vaccination was factors affecting to protective effect of measles vaccine, there was the significant different in protecting effect of measles vaccine between the two places by 95% CI. (Table 12)
Tables 12: The protective effect of measles vaccine in various variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>M.V</th>
<th>Cases</th>
<th>Controls</th>
<th>Adjusted OR</th>
<th>95 % CI</th>
<th>Protective effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Yes</td>
<td>31</td>
<td>52</td>
<td>0.22</td>
<td>0.10-0.48</td>
<td>78 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>62</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>Yes</td>
<td>22</td>
<td>64</td>
<td>0.23</td>
<td>0.11-0.50</td>
<td>77 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>49</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Occupation of mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House-wife</td>
<td>Yes</td>
<td>47</td>
<td>87</td>
<td>0.10</td>
<td>0.03-0.33</td>
<td>90 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>78</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working</td>
<td>Yes</td>
<td>6</td>
<td>29</td>
<td>0.25</td>
<td>0.13-0.46</td>
<td>75 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>21</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>History of measles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>29</td>
<td>99</td>
<td>0.20</td>
<td>0.09-0.33</td>
<td>80 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>63</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>24</td>
<td>16</td>
<td>0.50</td>
<td>0.09-1.20</td>
<td>50 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>48</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place of receiving V</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed</td>
<td>Yes</td>
<td>40</td>
<td>84</td>
<td>0.09</td>
<td>0.05-0.19*</td>
<td>97 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>35</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile</td>
<td>Yes</td>
<td>13</td>
<td>31</td>
<td>0.34</td>
<td>0.18-0.69*</td>
<td>66 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>76</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>Yes</td>
<td>53</td>
<td>116</td>
<td>0.24</td>
<td>0.16-0.44</td>
<td>76 %</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>111</td>
<td>53</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M.V: Measles Vaccination.

* There was the significant different by 95% CI.
6. **Description about knowledge and practice of mothers of children in vaccinated and non-vaccinate groups about E.P.I:**

To improve the E.P.I program in Lao P.D.R, we would like to know that, what people or mother of children think about E.P.I.

According to the interview with questionnaire, this part will be described about knowledge and practice of mother in vaccinated group and non-vaccinated group.

6.1. **Knowing about EPI program in Lao P.D.R:**

The results showed that, the majority of mothers in vaccinated and non-vaccinate groups answered “Yes” were 148 (87.57 %) and 124 (75.61 %), answered “No” were 21 (12.43 %) and 40 (24.39 %). (Table 13)

6.2. **How many diseases are preventable from EPI in Lao P.D.R?**

The results showed that, the majority of the mothers in vaccinated and non-vaccinate group answered “6 diseases preventable” were 143 (84.62 %) and 104 (63.41 %), answered “< 6 or > 6 diseases preventable” were 26 (15.38 %) and 60 (36.59 %) (Table 13)

6.3. **What are they?**

The results showed that, the majority of mothers in vaccinated group and non-vaccinate group described right were 131 (77.51 %) and 96 (58.54 %), described wrong were 38 (22.49 %) and 68 (41.46 %). (Table 13)

6.4. **Why should receive vaccine?**

The results showed that, the majority of mothers in vaccinated and non-vaccinate groups answered “to prevent” were 132 (78.10 %) and 144 (87.80 %), answered “to treat” were 37 (21.90 %) and 20 (12.20 %). (Table 13)

6.5. **In children, measles could be cause of death?**

The results showed that, the majority mothers in vaccinated group answered “Yes” were 105 (62.13 %) and answered “No” were 64 (37.87 %). In mothers non-vaccinate group answered “Yes” were 73 (44.62 %) and answered “No” were 91 (55.38 %). (Table 13)
6.6. **For measles vaccination, how many dose children should receive?**

The results showed that, the majority of mothers in vaccinated group and non-vaccinate group answered "1 dose" were 161 (95.27 %) and 145 (88.41 %), answered "> 1 dose" were 8 (4.73 %) and 19 (11.59). (Table 13)

6.7. **Age of child should receive measles vaccine?**

The results showed that, the majority in vaccinated group and non-vaccinate group answered should receive at age "9-24 months" were 142 (84.02 %) and 98 (59.75 %), answered should receive at age "< 9 or > 9 months" were 27 (15.98 %) and 66 (40.25 %). (Table 13)

6.8. **Immunization card?**

The results showed that, the majority of mothers in vaccinated group and non-vaccinate group answered "Yes" were 164 (97.04 %) and 126 (76.83 %), answered "No" were 5 (2.96 %) and 38 (23.17 %). (Table 13)

6.9. **The reason of why vaccination not received measles vaccine?**

In total of cases and controls were 164 persons non-vaccinated measles vaccine. (Table 6).

The results showed the reason of why of unvaccinated measles vaccine, the majority of mothers firstly answered were 65 (39.63 %) mothers' busy, secondly were 44 (26.83 %) not reach age of nine months and followed by 30 (18.30 %) were afraid side effect, 13 (7.93 %) were children sick, 10 (6.10 %) were living far from immunization site and the smaller 2 (1.21 %) were doctor does not give.

6.10. **Have vaccination in each villages?**

The results showed that, the majority of mothers in vaccinated group and non-vaccinate group answered "Yes" were 159 (94.08 %) and 135 (82.32 %), answered "No" were 10 (5.92 %) and 29 (17.68 %). (Table 13)

6.11. **Before or after vaccination session, did the health worker give health education?**

The results showed that, the majority of mothers in vaccinated group and non-vaccinate group answered "Yes" were 142 (84.02 %) and 106 (64.63 %), answered "No" were 27 (15.98 %) and 58 (35.37 %). (Table 13)
6.12. Do you know how to do when your child got fever after vaccination?

The results showed that, the majority of mothers in vaccinated groups and non-vaccinate group answered “Yes” were 151 (89.35 %) and 111 (67.68 %), answered “No” were 18 (10.65 %) and 53 (32.32 %). (Table 13)

6.13. Get information about EPI from where?

Information about EPI, they could get from many ways. The results showed that, the majority of mothers in vaccinated group answered 108 (63.91 %) were from village head men, followed by 34 (20.12 %) were from health workers, 11 (6.51 %) were from others, 6 (3.55 %) were from radio, 5 (2.96 %) were from lao-women union, 3 (1.78 %) were from newspaper and lastly 2 (1.88 %) were from television. The majority in group of mothers non-vaccinate answered 126 (76.83 %) were from village head men, followed by 18 (10.98 %) were from health worker, 6 (3.66 %) were from lao-women union, 5 (3.05 %) were from radio, 4 (2.44 %) were from television, 3 (1.83 %) were from newspaper and 2 (1.22 %) were from others. (Table 13)
Table 13: The knowledge and practice of mothers and immunization among vaccinated and non-vaccinate groups.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Vaccinated (n = 169)</th>
<th>Non-vaccinate (n = 164)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No  %</td>
<td>No  %</td>
</tr>
<tr>
<td>Know about EPI in Lao.P.D.R ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>148 87.57</td>
<td>124 75.61</td>
</tr>
<tr>
<td>- No</td>
<td>21 12.43</td>
<td>40 24.39</td>
</tr>
<tr>
<td>How many diseases preventable from E.P.I ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 6 diseases</td>
<td>143 84.62</td>
<td>104 63.41</td>
</tr>
<tr>
<td>- &lt; 6 or &gt; 6</td>
<td>26 15.38</td>
<td>60 36.59</td>
</tr>
<tr>
<td>What are they ? (answer....)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>131 77.51</td>
<td>96 58.54</td>
</tr>
<tr>
<td>- No</td>
<td>38 22.49</td>
<td>98 41.46</td>
</tr>
<tr>
<td>Why should immunize ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- To prevent</td>
<td>132 78.10</td>
<td>144 87.80</td>
</tr>
<tr>
<td>- To treat</td>
<td>37 21.90</td>
<td>20 12.20</td>
</tr>
<tr>
<td>Measles should be cause of death in children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>105 62.13</td>
<td>73 44.62</td>
</tr>
<tr>
<td>- No</td>
<td>64 37.87</td>
<td>91 55.38</td>
</tr>
</tbody>
</table>
Table 13: The knowledge and practice of mothers and immunization among vaccinated and non-vaccinate groups. (Continue)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Vaccinated (n = 169)</th>
<th>Non-vaccinate (n = 164)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>For measles vaccination how many-dose children should receive?:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- One dose</td>
<td>161</td>
<td>95.27</td>
</tr>
<tr>
<td>- More than one</td>
<td>8</td>
<td>4.73</td>
</tr>
<tr>
<td>Age of children should receive measles vaccination?:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 9-24 months</td>
<td>142</td>
<td>84.02</td>
</tr>
<tr>
<td>- &lt; 9 or &gt; 24 months</td>
<td>27</td>
<td>15.98</td>
</tr>
<tr>
<td>Immunization card?:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>164</td>
<td>97.04</td>
</tr>
<tr>
<td>- No</td>
<td>5</td>
<td>2.96</td>
</tr>
<tr>
<td>The reason why not received measles vaccine?:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Not reach age of 9 months</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Mothers busy</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- To far from site</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Doctor does not give</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Children sick</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Afraid side effect</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Table 13: The knowledge and practice of mothers and immunization among vaccinated and non-vaccinate groups. (Continue)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Vaccinated (n = 169)</th>
<th>Non-vaccinate (n = 164)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Vaccination in your village?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>159</td>
<td>94.08</td>
</tr>
<tr>
<td>- No</td>
<td>10</td>
<td>5.92</td>
</tr>
<tr>
<td>Before and after vaccination (Health education):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>142</td>
<td>84.02</td>
</tr>
<tr>
<td>- No</td>
<td>27</td>
<td>15.98</td>
</tr>
<tr>
<td>Know when children got fever?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>151</td>
<td>89.35</td>
</tr>
<tr>
<td>- No</td>
<td>18</td>
<td>10.65</td>
</tr>
<tr>
<td>Get information about EPI from</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Radio</td>
<td>6</td>
<td>3.55</td>
</tr>
<tr>
<td>- TV</td>
<td>2</td>
<td>1.18</td>
</tr>
<tr>
<td>- News paper</td>
<td>3</td>
<td>1.78</td>
</tr>
<tr>
<td>- Village head men</td>
<td>108</td>
<td>63.91</td>
</tr>
<tr>
<td>- Lao-women union</td>
<td>5</td>
<td>2.96</td>
</tr>
<tr>
<td>- Health worker</td>
<td>34</td>
<td>20.12</td>
</tr>
<tr>
<td>- Others</td>
<td>11</td>
<td>6.51</td>
</tr>
</tbody>
</table>
7. The result from observation during study:

Three fixed centers (in 2 main hospitals and 1 district hospital) and 3 outreach teams were visited to observe immunization sessions. The results showed that, in each team had enough cold-chain equipment (cold-box, vaccine carrier, ice-pack) injection equipment (steam sterilize, syringes and needles, ...), before immunization was stated they gave health education to peoples who came for receiving vaccine, method of administration of measles vaccine was correct, and appropriate time of immunization served.

At the fixed center, the transportation of vaccine was no problem because refrigerator was there or vaccine storage near vaccination site.

In the outreach team, immunization site was not the same place of vaccine storage. For transportation of vaccine to immunization site, health workers used cold-box and vaccine carrier to keep vaccine to immunization site, in controlling the temperature inside they had one thermometer in each cold-box. The duration of traveling varied from place to place from 2 to 5 hours.
CHAPTER V

DISCUSSION

This study was community-based case-control study. It was to assess the protective effect of measles vaccination of children in Vientiane Municipality used during 1994-1996. The result of the study indicated that those who did not received measles vaccination had a higher risk to become a case about 4.58 times of developing the diseases as compared to those who received measles vaccination. The protective effect of the measles vaccine is thus about 76%.

The accuracy of estimates of vaccine efficacy in the case-control study depended on the case definition, case finding, and ascertainment of vaccination status. It had some efficient since controls could be studied at the same time, location, and age as cases. This permits equal vaccination status ascertainment for cases and controls and so decreases potential information bias.

All the cases and controls were children under five years of age at the time of interviewed. Since 1982 measles vaccine was given only to infants 9 - 24 months of age, it means that vaccination among the children was carried out when they were in the first year of life. The result of these was shown the association between measles vaccination and occurrence of measles. Failure to vaccination rather than failure from vaccine management and administration was more important and significant risk factor for measles occurrence. It is ensured that children should be vaccinated at the earliest recommended age that offers the greatest chance for protection.

The effectiveness of measles vaccine was 76%. This finding was lower than the finding of Luksamijarulkul.P et al (1992) was done in Thailand, he found that the effectiveness of measles vaccination in term of seroconversion was 81.25% in children with protein-calorie malnutrition and 87.88% in normal children [48].

Some variables that were related either to measles vaccination status or the occurrence of measles were a possible factors which could lead to either underestimation or overestimation of vaccine efficacy. Orenstein et al identified potential confounding variables in assessing vaccine efficacy. Such variables included but not limited to age, sex, socio-economic status and exposed to measles.[5] In these study, sex of children, age, occupation and education of mother, number of siblings in the family, history of measles occurrence in the family, and place of receiving vaccination were used as socio-economic indicators. Adjusting by sex of children, history of measles occurrence in the family, occupation of mother, and place of receiving vaccination. Measles vaccination status (received and did not receive) still had significant association with measles. The children who were vaccinated during 1994-1996 had significant protection effect of 76%. It can be concluded that the children who were received measles vaccine had protective effect of 76% of measles after controlling for sex, history of measles occurrence in the family,
occupation of mother and place of receiving vaccination. The results from this study were higher than the results of the study which was done in Philippine 1991 [55] which showed that the vaccine efficacy only 35%.

In this study, it was found that among cases who received measles vaccine still developed measles, which was about 32.32% and those was 67.68% of measles cases who did not receive measles vaccine. Some factors affected the protective effect of measles vaccine and occurrence of diseases. The vast majority of measles cases occurred among children under 3 years of age. Measles cases occurred in Vientiane Municipality from 1994 - 1996, about 87.80% in age group under 3 years (Table 5). In total 164 cases of measles cases occurred from 1994-1996 in Vientiane Municipality, about 29 (17.68%) were children under 9 months of age, it means that before the age should be receiving measles vaccine (by WHO recommendation and from Lao.P.D.R. E.P.I schedule, children 9 months of age should receive 1 dose of measles vaccine) children already infected from measles virus.

The results was almost similar to the study done in Thailand 1988 Achmad.C et al [51] and the study done in Pointe-Noire Congo [41]

Early studies on the waning of maternal antibody used relatively insensitive HI test, and it was initially thought that maternal antibodies were lost by 12 months of age in the USA (krugman et al. 1965) and by age 6 months in developing countries (MOH Kenya 1977). Use of more sensitive tests subsequently showed that antibodies persisted in some children for several months longer and reduced the effectiveness of immunization (Albercht et al. 1977). Maternal antibody profiles of infant vary between geographic regions. The rate of loss maternal antibody among different populations has been found to correlate inversely with socioeconomic status (Black et al. 1986). Reason for earlier loss of maternal antibody in developing countries include lower antibody level among mothers (particularly in southeast Asia), decreased efficiency of transplacental transfer of measles IgG, increased catabolism of passive antibody because of frequent infectious infancy, and loss of antibody into the intestinal lumen during diarrheal illness (Black 1989). Until recently, even are low level of maternal antibodies has inhibited successful seroconversion after immunization (MOH kenya 1977, Wilkins & Webrle 1979). Recent studies have shown that seroconversion can be achieved in the presence of maternal antibody by using higher dose of certain vaccine strains; however, seroconversion is still related to the level of maternal antibody. In many studies, including those using Edmonton Zagreb (EZ) vaccine, antibody levels have been lower after immunization of children without maternal antibody (Markowitz et al. 1990c, Tidjani et al. 1989, Wilkins & Webrle 1979).

Several studies have reported seroconversion rates at least as high in malnourished as in well-nourished children (Halsey et al. 1985, PAHO 1982) although wesley et al. (1978) reported that the response to measles immunization was delayed among malnourished children. Because of risk of severe disease and
worsening nutritional status after measles, the EPI recommends that high priority be given to the immunization of malnourished children (Expanded Programme on Immunization 1986).

Place of receiving vaccination was found to be statistically significant associated with occurrence of measles. The odds ratio was 2.35 with 95% CI 1.47 - 3.77 and P-value less than 0.001. It means that, those who received vaccination in outreach team had a higher risk 2.35 times to become a case when compared to those who received vaccination in fixed center.

Sex of children was found to be statistically significant associated with occurrence of measles. The odds ratio was 1.72 with 95% CI 1.22 - 2.66 and P-value was 0.013. It means that, boys had approximately higher risk to get disease 1.72 times when compared to girls.

History of measles occurrence in the family was statistically significant . The odds ratio was 3.46 with 95% CI 2.11 - 5.67 and P-value less than 0.001. It means that children who had history in having of measles in the family had a higher risk 3.46 times to become a case when compared to one who did not have history in having of measles in the family.

Occupation of mother was also statistically significant. The odds ratio was 1.88 with 95% CI 1.15 - 3.07 and P-value 0.012. It means that, children who had mother's occupation as working group had a higher risk 1.88 times to become a case when compared to those whose mother's occupation as house-wife.
CHAPTER VI
CONCLUSION AND RECOMMENDATION

CONCLUSION

In developing countries, it is difficult to determine how much reduction in measles morbidity and mortality has been achieved with the introduction of measles vaccine since morbidity has been usually under reported and mortality were usually reported under its complications.[3]

Though measles remained among the ten leading causes of morbidity and mortality inspite of increasing vaccine coverage, this does not reflect an ineffective vaccination program. There are several factors which could lead to this fashion. With increasing number of health facilities, people have greater access for health care, hence an increase in reported cases. In addition, precise clinical cases definition for measles and concomitants increase in surveillance will also explain such trend.

Routine immunization for Measles vaccine is safety and effective means for improving protection against Measles. The hypothesis of this study that Measles vaccination can prevent children from developing measles was accepted.

The protective effect or effectiveness of measles vaccine in Vientiane Municipality used during 1994-1996 demonstrated the odds ratio after controlling simultaneously sex of children, history of measles occurrence in the family, occupation of mother and place of receiving vaccination by logistic regression model was 0.24 with 95% CI 0.16-0.44 and P-value less than 0.001. It means that the protection of measles vaccination was 76% of risk to developing measles as compared to those who did not received. This could be attributed to improper handing and storage of live measles vaccine because of frequent brown-outs(electrical disruptions) causing unstable temperature in refrigerators, thus affecting the potency of live vaccines.

In order to maintain potency of measles vaccine, effective cold-chain is essential to the immunization program. Storage temperature for measles vaccine is +2 - +8. C. Since it is very sensitive to heat, proper distribution, storage and handing should be observed. Training of cold-chain management, cold-chain personnel is vital to this effect. Regular temperature monitoring of refrigerators should be recorded 2 times per day (morning and afternoon). The importance point is transportation of vaccine from storage of vaccine place to vaccination site also should be observed, transport cold-box and vaccine carriers should be provided to health personnel in charge of giving vaccines.
To eliminate measles by the year 2000, with the intensive mass media campaign on measles by National Institute of Hygiene and Epidemiology, Ministry of Public Health, it will be facile to achieved an immunization coverage to more than 95 %, which will strikingly reduce the risk of measles and produce a herd effect, protecting even those who are not immunize. Linkages with non-government organizations, professional and civil organizations, the religious sector and all responsible people in Vientiane Municipality will help promote this objective of immunizing against measles.

Limitation of the study:

In order to achieved the valid assessment of the protective effect of vaccine, the follow up design especially field trial must be used. Using case-control study may produce some bias, especially recall bias, and selection bias.

RECOMMENDATION

1. This study could be only practical use as it can introduce ideas and information to immunization program managers for evaluation vaccine efficacy in their areas of responsibility in order to apply the results of research into their work.

2. This study showed effectiveness of measles vaccine in the field, so the E.P.I. vaccine coverage assessment by cluster sampling method is a valuable tool for examining immunity levels in a community. When an assessment shows that vaccination levels are low, then additional vaccination efforts are indicated.

3. The results from this study showed high significant association between protective effect of measles vaccination and occurrence of measles which can be utilized to develop Measles control measure and guideline for health personnel to develop the appropriate model in order to promote measles prevention and to elimination measles by the year 2000. The most important thing is to ensuring all children 9-24 months of age to be received measles vaccination and early recommendation as much as possible. The EPI recommends that high priority be given to the immunization of malnourished children. The extensive public information program immediately before each Mass Vaccination day, especially in the rural area, makes it possible to reach larger number of children to be vaccinated.

4. Further study:

The association between measles vaccination and occurrence of measles may be differ from one province to another province in the whole country, because the effectiveness of vaccine in the field may be influenced by many factors. Such study may be conducted in various province and compare the results to each other, in order to develop measles control program.
For further investigation, follow up studies and post vaccination among vaccinated should be undertaken, and cases should be come from incidence of the diseases.

In the future we could extend the study to other health program with the same method which are used in the study, especially in the area with high incidence of disease in order to assess effectiveness of the program.
REFERENCES

5. Orenstein WA, Bernier RH. Assessing vaccine efficacy in the field (Further observation) Epidemiology reviews 1988, 10: 212-241.
8. Macmillian M. Health and Diseases in developing countries. 163-176.


54. Lao PDR. 1995 Census report I , II Veintiane August committee for planning and cooperation, National statistical center.


57. Supanvanich S and A. Podhipak: Principle of Epidemiology, Department of Epidemiology, Faculty of Public Health, Mahidol University.
APPENDIX A: THE STUDY AREA.

Provinces of Lao P.D.R.

01 Vientiane Municipality
02 Phon Savay
03 Luang Namtha
04 Oudomxay
05 Louang Prabang
06 Huaphanh
07 Xayabouly
08 Xiengkhouang
09 Vientiane
10 Savannakhet
11 Champasak
12 Saravane
13 Sekong
14 Attapeu
15 Bouknal Phya
16 Special region

Area: 236,800 km²
Population: 4,591,776
Density: 19 p/km²
APPENDIX B : DATA COLLECTION FORM.

Date of interview day: ............../............./.............
Interviewers' name: ............................................
Identification number: ...........................................
Case [ ] ; Control [ ]

1. Name of child: ..............................................
2. Sex: ............................................................
3. Date of birth: ..............................................
4. Address: Name of Village: ................................
   Family number: ................ Group number: ...........
   District: ...................... Province: .................
   Including in Zone: ...........................................

5. Name of mother: ...........................................
6. Age of mother: ............................................
7. Education of mother: [ ]
   (1) None.
   (2) Primary school.
   (3) Secondary school.
   (4) High school.
   (5) University.
   (6) Higher than; Specify: ..................................

8. Occupation of mother: [ ]
   (1) House wife.
   (2) Teacher.
   (3) Officer.
   (4) Labor.
   (5) Saler.
   (6) Other ; Specify: ........................................

9. Number of sibling: [ ]
   (1) 1.
   (2) 2-3.
   (3) >3.
10. Immunization card:

   (1) Yes.
   (2) No.

11. History of vaccination: (Answer for each dose)  
    (Specified on Measles vaccination)

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Date/Month/Year</th>
<th>Scar</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPV 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPV 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPV 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPV 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPT 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPT 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPT 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEASLES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. Immunization status: (Measles Vaccination)

   (1) Yes.
   (2) No.

13. If the answer is “No”, what is the reason?

   (1) Not reach age of nine months.
   (2) Mothers’ busy.
   (3) Time not appropriate.
   (4) Too far from vaccination site.
   (5) Doctors does not given.
   (6) Children sick.
   (7) Afraid side effect.

14. Age at time of measles vaccinated:

   (1) 9-24 months.
   (2) Less than 9 months.
   (3) More than 24 months.
15. Age of Measles occurred: (In cases)

(1) Less than 1 year. (Specify in months:..............)
(2) 1 year.
(3) 2 years.
(4) 3 years.
(5) 4 years.

16. Clinical manifestation:

Fever: (1) None.  [  ]
(2) Yes.  [  ]

Cough: (1) None.  [  ]
(2) Yes.  [  ]

Conjunctivitis: (1) None.  [  ]
(2) Yes.  [  ]

Coryza: (1) None.  [  ]
(2) Yes.  [  ]

Rash: (1) None.  [  ]
(2) Yes.  [  ]

duration of rash:
(1) Less than 3 days.  [  ]
(2) \geq 3 days.  [  ]

17. History of measles in the family:

(1) None.  [  ]
(2) Yes.  [  ]

18. Place of vaccination administration:

(1) Hospital: Specify:...........................
(2) Mobile team.
(3) Outreach team.

19. Do you know that we have EPI program in Laos?

(1) Yes.  [  ]
(2) No.  [  ]
20. How many diseases preventable from EPI?

(1) 6 diseases.
(2) Less than 6 diseases.
(3) >6 diseases.

21. What they are?

(1) Polio, tetanus, diphtheria, pertussis, Measles, and tuberculosis.
(2) Malaria, polio, pertussis, diphtheria, tetanus.
(3) Diarrhea, pertussis, Measles, and tuberculosis.

22. Do you know is available for your child to get vaccination in your village?

(1) Yes.
(2) No.

23. Why should be immunized?

(1) To prevent the diseases.
(2) To threat the diseases.

24. For measles vaccine, how old are they should get?

(1) 9-24 months.
(2) <9 months.
(3) >24 months.

25. How many dose of measles vaccine your child should receive?

(1) One dose.
(2) More than one.

26. Could be the EPI diseases causes of death?

(1) Yes.
(2) No.

27. Do you know, EPI diseases can be prevented by immunization?

(1) Yes.
(2) No.
28. Before and after vaccination, Did health worker give Health Education to you?
   (1) Yes.
   (2) No.

29. Do you know, what to do, when your child got fever after vaccination?
   (1) Yes.
   (2) No.

30. From where did you get information about EPI?
   (1) Radio.
   (2) Television.
   (3) Newspaper.
   (4) Village head men.
   (5) Lao women union.
   (6) others: Specify: ____________________________

Signature of interviewer: ____________________________
APPENDIX C: OBSERVATION FORM.

Date of observation’s day: ……………/……………/…………………
Observer’s name: ……………………………………………………

Province:………………………………; District:…………………………
Provincial hospital [ ] ; District hospital [ ]
Mobile team [ ]
Name of village:…………………………; Zone:………………………

Vaccine keep in cold chain equipment: Yes [ ] No [ ]
Have enough ice-pack: Yes [ ] No [ ]
Have enough syringes and needles: Yes [ ] No [ ]
Have steam sterilize: Yes [ ] No [ ]
Method of administered measles vaccine:
Correct [ ] Not correct [ ]

Did the health staff give health education before vaccination session:
Yes [ ] No [ ]

Time of immunization service appropriate:
Yes [ ] No [ ]

Signature of observer
APPENDIX D: IMMUNIZATION SCHEDULE IN LAO.P.D.R.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Minimum age at first dose</th>
<th>Number of doses</th>
<th>Interval</th>
<th>Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>At birth</td>
<td>1</td>
<td></td>
<td>Intradermal right arm</td>
</tr>
<tr>
<td>DPT</td>
<td>6 weeks</td>
<td>3</td>
<td>4 weeks</td>
<td>Intramuscular mid-thigh</td>
</tr>
<tr>
<td>OPV</td>
<td>At birth</td>
<td>4</td>
<td>With each DPT</td>
<td>Oral</td>
</tr>
<tr>
<td></td>
<td>6 weeks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td>9 months</td>
<td>1</td>
<td></td>
<td>Subcutaneous left arm.</td>
</tr>
</tbody>
</table>
APPENDIX E : CALCULATION VACCINE EFFICACY
[2] [35]

General principal: VE is measured by calculating the incidence rate of the disease among vaccinated and unvaccinated persons and determining the percentage reduction in the incidence rate of disease among vaccinated persons compared to unvaccinated persons. The basic formula is:

\[
\frac{\text{ARU-ARV}}{\text{ARU}} \times 100
\]

\[
= \left(1 - \frac{\text{ARV}}{\text{ARU}}\right) \times 100
\]

\[
= (1 - \text{RR}) \times 100.
\]

Where: VE : Vaccine Efficacy.
ARU : Attack Rate in the Unvaccinated population.
ARV : Attack Rate in the Vaccinated population.

In case-control study, the vaccine efficacy equation can be expressed in the form of Relative Risk. The RR can be approximated by the Odds Ratio.

\[
\text{RR} = \text{Odds Ratio (OR)}
\]

\[
\text{VE(\%)} = (1 - \text{OR}) \times 100.
\]
APPENDIX F: ABBREVIATIONS.

OR  Odds Ratio.
>=  More and equal.
RR  Relative Risk.
<   Smaller.
<=  Smaller and equal.
EPI Expanded Program on Immunization.
MCH Mother and Child Health.
WHO World Health organization.
CFR Case Fatality Rate.
CI  Confidence Interval.
VE  Vaccine Efficacy.
ARU Attack Rate in the Unvaccinated population.
ARV Attack Rate in the Vaccinated population.
AFP Acquire Flaccid Paralysis.
MMR Measles Mumps and Rubella vaccine.
VM Vientiane Municipality.
EZ Edmonston-Zagreb strain of measles vaccine.
HI Hemagglutination Inhibition test.
MV Measles Vaccination.
APPENDIX G: LIST OF VARIABLES AND CODES USED IN THE STUDY.

1. Case: 0-1
2. Sex: 0-1
3. Residence (in Zone): 0-3
4. Age of mother: 0-1
5. Education of mother: 0-2
6. Occupation of mother: 0-1
7. Number of sibling: 0-2
8. Immunization status: 0-1
9. Immunization card: 0-1
10. Age at time of measles vaccinated: 0-1
11. Place of vaccination administration: 0-2
12. Age of Measles occurred: (In cases) 0-2
13. History of measles in the family: 0-1
14. Do you know that we have EPI program in Laos: 0-1
15. How many diseases preventable from EPI: 0-1
16. What they are: 0-1
17. Do you know is available for your child to get vaccination in your village: 0-1
18. Why should be immunized: 0-1
19. For measles vaccine, how old are they should get: 0-1
20. How many dose of measles vaccine your child should receive: 0-1
21. Could be the EPI diseases causes of death: 0-1
22. Do you know, EPI diseases can be prevented by Immunization: 0-1
23. Before and after vaccination, Did health worker give: 0-1
24. Do you know, what do you do, when your child got fever after vaccination: 0-1
25. From where, did you get information about EPI: 0-2
BIOGRAPHY

<table>
<thead>
<tr>
<th>Name</th>
<th>Samphanh Khamingsavath.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of birth</td>
<td>September 6, 1964.</td>
</tr>
<tr>
<td>Place of birth</td>
<td>Savannakhet, Laos.</td>
</tr>
<tr>
<td>Education</td>
<td>Vientiane University of Medicine.</td>
</tr>
<tr>
<td>Institutes attended</td>
<td>Faculty of Public Health. Mahidol University M.S.c.(Medical Epidemiology)</td>
</tr>
<tr>
<td>Grant</td>
<td>SEMEO TROPMED-D.A.A.D.</td>
</tr>
</tbody>
</table>