DETERMINANTS OF LOW BIRTH WEIGHT AMONG LAO LOUM INFANTS IN LAO PDR

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ABSTRACT

Lao Loum is the major ethnic group in Lao PDR, comprising nearly 70 percent of the population. This study examines maternal factors and fetal factors among low birth weight Lao Loum infants and suggests certain factors as determinants of low birth weight.

The data was collected in hospitals in Vientiane: Mahosot, Setathirat, and Mother and Child hospital. The sample was 100 cases selected by purposive sampling. The data was analyzed by using binary logistic regression.

The results indicate that 20 percent of respondents drank alcohol during pregnancy. Sixty-five percent had medical care at least one time during pregnancy. More than 50 percent took pre-natal vitamins for one month or more. More than one quarter had no education or only primary education. More than 50 percent of these women worked at home as housewives and looking after children. Nearly 20 percent of the women were adolescent mothers. One quarter was shorter than 150 cm. Thirty-five percent weighed less than 45 kg. Forty-two percent were underweight (BMI<20 kg/m^2). Thirty-four percent gained less than 8kg in weight during the pregnancy. Nearly half knew their child's sex before delivery (44 percent). Some of the mothers had complications during pregnancy; 10 percent had vaginal bleeding and 8 percent had high blood pressure. Fifteen percent had previously had one or more induced abortions. For 60 percent of the women it was their first baby. Thirty-six percent of babies were born at preterm.

Having obstetric problems during pregnancy, such as urinary tract infections, having suffered traumas such as those caused by traffic accidents, giving birth at less than 37 weeks of pregnancy age, and poor maternal nutrition during pregnancy seem to be determinants of low birth weight. Having had a previous induced abortion is also a determinant of low birth weight.

Early prenatal care and contraception should be promoted. Further, the study would like to suggest that future researchers on low birth weight in Laos should investigate more by collecting and comparing similar data in other ethnic and religious groups such as Lao Soung, Lao Theung, Vietnamese, Chinese, and Christian groups

KEY WORDS: LOW BIRTH WEIGHT/ PRE-DELIVERY WEIGHT/ BODY MASS INDEX/WEIGHT GAIN/ PARITY/ ANTENATAL CARE/ HIGH BLOOD PRESSURE/ PRENATAL BLEEDING/ URINARY TRACT INFECTION/ LAOS/DEVELOPING COUNTRIES.

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CHAPTER 1
INTRODUCTION

1.1. Background

Birth weight is a powerful predictor of infant growth and survival. An infant born with a low birth weight begins life immediately at a disadvantage and faces extremely poor survival rates. Approximately every ten seconds, an infant from a developing country dies from a disease or infection that can be attributed to low birth weight (Judith & Laura, 2000).

In the neonatal period (first 28 days), infants with low birth weight are more likely to die than infants with normal birth weight; it is almost 40 times more likely for low birth weight and 200 times for very low birth weight. In the post neonatal period (after 28 days), low birth weight infants are 5 times more likely to die and very low birth weight infants are 20 times more likely to die than infants who are born with normal birth weight (Brown, 1985).

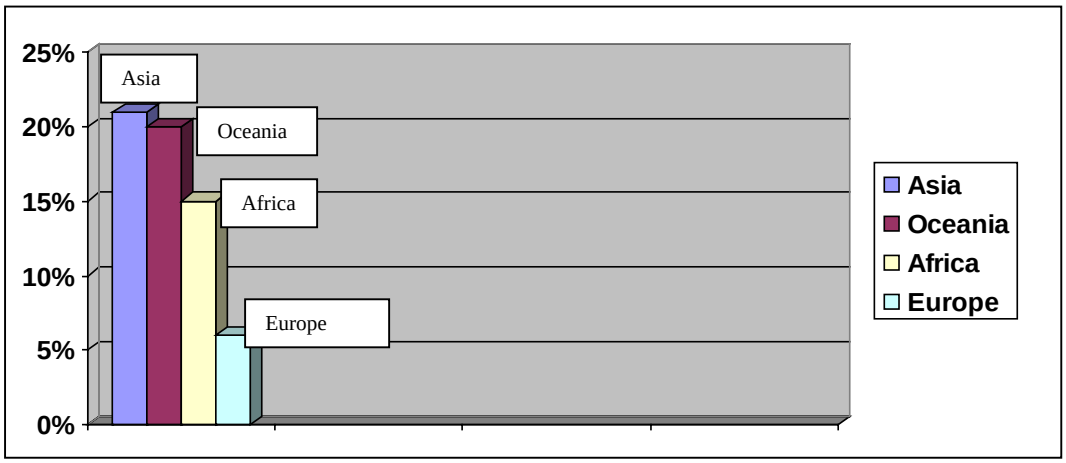
Low birth weight was found to be strongly associated with diarrhea, during the first 3 years of life (Bukenya et al, 1991). Low birth weight infants are at risk for acute diarrhea 2-4 times higher and acute respiratory infection or pneumonia 2 times higher than normal birth weight babies (Judith & Laura, 2000). Low birth weight is the main factor in the malnutrition of children, 5 years old and younger (Strufaldi et al, 2003).

Adults who were born with low birth weight are at increased risk of chronic diseases, including high blood pressure, non- insulin dependent diabetes mellitus, coronary heart disease, obstacle lung disease, and high blood cholesterol (Judith & Laura, 2000). Young adults with very low birth weight graduate from high school in lesser numbers, when compare a normal birth weight young adults (Maureen, 2002).

With regard to the average cost of survival infant care in hospitals, parents with infants with low birth weight pay more money than infants whose weight is 2,500g or over. There is a negative relationship between birth weight and cost of medical care; lower weight increases costs and higher weight decreases costs (Rachel, 1989).

Every year, at least 17 million infants are born with low birth weight in developing countries; these infants represent 16 percent of all infants born (Judith & Laura, 2000). The incidence of low birth weight varies among regions. Incidence of low birth is highest in Asia (21%), followed by Oceania (20%), Africa (15%) and Europe (6%) (Mansour et al, 2002).

Figure 1: Incidence of low birth weight by regions



Source: Mansour et al, 2002

Preterm delivery and intrauterine growth retardation (IUGR) are two main causes of low birth weight. In developing countries, majority of low birth weight is fetal intrauterine growth retardation. In industrialized countries, most of low birth weight is preterm delivery (Judith & Laura, 2000).

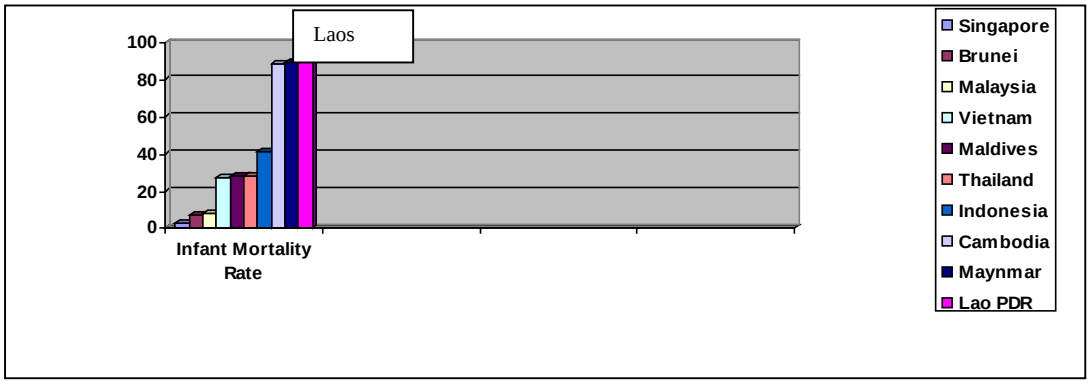
1.2. Rationale and statement of problem

Lao PDR is a small landlocked country in Southeast Asia. The country shares a border with Vietnam, China, Cambodia, Thailand and Myanmar. The area of Lao PDR is about 236,800 Km² (Country Watch, 2004). The country has divided into 17 provinces and one special zone (the map of Lao PDR). There are three cities: Vientiane, Savannakhet and Pakse. Vientiane is the capital city (Country Watch, 2004). Lao PDR has about 6,068,117 total populations. There are 4 ethnics groups. The proportion of each group such as it is about 68 percent is Lao Loum. While there are 22 percent is Lao Theung. And another 9 percent is Lao Soung and Yao. However, there are about 1 percent Vietnammes and Chinese. Most of the Lao people

are Buddhists (60 percent). The other groups are animist and others (40 percent). Lao Loum is mostly live in plain area such as Vientiane, Savannakhet, Pakse etc; almost of Loa Theung live at middle land and almost of Lao Soung live at high land. The literacy rate in Laos does not high. It is about 52.8 percent of total population who can read and write. For example, it is about 67.5 percent of the man who can read and write, while there are only 38.1 percent of female.

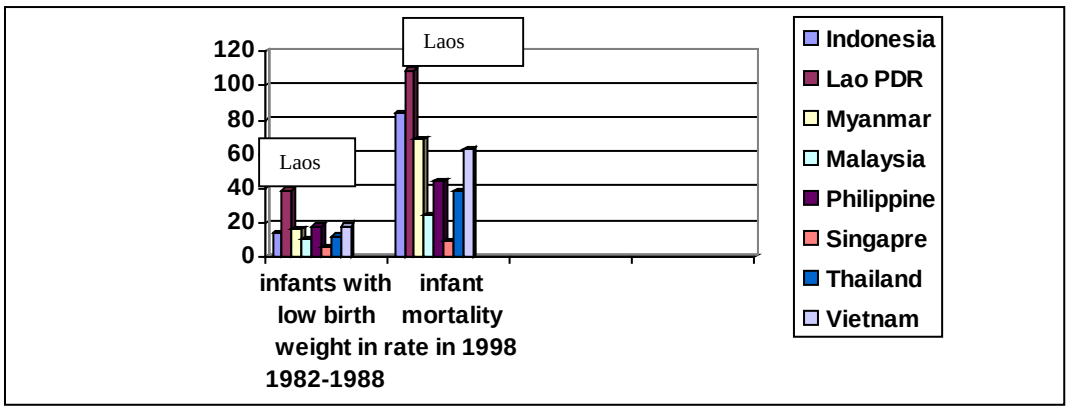
Lao PDR has the highest mortality rate of mother and child when compare with other countries. For example, in 2002, Lao PDR is the highest country of the infant mortality rate in South East Asia region (see the figure 2). Similarly, the country also has the highest incident of low birth weight when compare to other countries as we see in figure 3.

Figure 2: Infant Mortality Rate in South East Asia Countries, 2002



Source: World Development Indicators 2002, World Bank

Figure 3: Incidence of IMR and LBW of ASEAN Countries, 1998



Source: Iqbal et al, 1990

Low birth weight is a major factor of infant mortality in Lao PDR (World Food Program, 1999). Low birth weight infants need medical care and many low birth weight infants are taken care of in neonatal intensive care units. Their parents or family members have to stay with them. At least one person in the family will have to miss their work and lost income. Besides, the families must pay a lot of money for medical care (interview of Dr. Douangdao Soukaloune, Head of Pediatric Department of Mahosot Hospital, on 8 May 2004).

In Lao PDR the incidence of low birth weight was 39 percent in the period of 1982-1988 (Iqbal et al, 1990) and 18 percent in the period of 1990-1997 (World Development Indicators, 1999**).** In 2000, the incidence of low birth weight in the hospitals was 7-10 percent of all babies born (Ministry of Health, Lao PDR, 2001). In the period of 1982-1988, Lao PDR had the highest proportion of low birth weight and infant mortality in the South East Asia region, not counting Cambodia (Iqbal et al, 1990).

Malnutrition is a factor of infants and children under 5 year's mortality (Lao National Statistic Center/State Planning Committee, 2003). Regarding protein energy malnutrition of children under five years in Lao PDR, 40.0 percent are moderately underweight children (National Health Survey, 2001).

Regarding infectious diseases, pneumonia is the second cause of morbidity and mortality in Lao PDR, while diarrhea is the fourth cause of morbidity. Also, diarrhea is the third cause of mortality at the national level (WHO, 2001). The prevalence of acute respiratory infection and diarrhea of children less than five years are 1.00 percent and 6.20 percent respectively (National Health Survey, 2001).

Low birth weight is the main factor of infant mortality and for infant morbidity from acute pneumonia and acute diarrhea. Low birth weight infants are at a high risk of becoming children with malnutrition and chronic diseases, including high blood pressure and non-dependent insulin diabetes. In Lao PDR, there is high incidences of low birth weight infants; high prevalence of infant mortality rate, and high prevalence of children with malnutrition. Pneumonia and diarrhea are the main diseases those cause the people to get ill and die.

1.3. Research question

What are the maternal determinants of low birth weight in Lao PDR?

1.4. Research Objectives

To investigate the maternal determinants of low birth weight in Lao PDR.

CHAPTER 2
LITERATURE REVIEW

2.1. Social-Demographic Factors

2.1.1. Education

Many researchers have explained the effect of social-economics on maternal and child health. When consider on a social-economics, education is a very important factor as the studies so inform, Low birth weight has a significant association with maternal education in that women who are illiterate have more chance of having an infant with low birth weight …women with more education have less chance to have a low birth weight baby (Nayar et al, 1994). In addition, another study also found that pregnancy combined with poor education is a risk factor of low birth weight baby (Arif et al, 1998). Maternal education is an important factor for infant weight is that mothers who have had no education at school or who had education only at the primary school level are at significant risk of having low birth weight baby (Mansour et al, 2002). Lower level of maternal education was a significant factor of low birth weight infant (Silva et al, 1998).

2.1.2. Ethnicity/race

Race can be a component of social-demography; studies show that a difference in race can lead to different birth outcomes. Black American women are two times higher at risk of having low birth weight infant than white American women (Kleinman & Kessel, 1987). Another study also explains that Black women have an increased rate of low birth weight infants, especially preterm birth (Taffel, 1989). Kramer (1987) found in developing countries that the major determinants of low birth weight are racial origin. Low birth weight rate among Mexican- Americans (5.8%) was lower than Non-Hispanic whites (6.1%) (Pierre et al, 2000). A study in Nepal shows that the Indo-Aryan ethnic group had significantly lower weight infants than Tibeto-Burman and Newar groups (Acharya & Alpass, 2004).

2.1.3. Occupation

The result of many studies shows that the occupation of mothers had an effect on child weight. For example, regarding maternal occupation in Thailand it was found that mothers who were unskilled workers had the highest percentage of low birth weight infants in the Northeast, North and East regions; housewives had the highest percentage of low birth weight infants in the West and South; and among women farmers in the North had the highest percentage of low birth weight infants (Chaturachinda et al, 1983). In addition, another journal article explains that hard physical work during pregnancy was an associated factor of low birth weight suffered from fetal growth retardation (MMWR weekly August 17, 1984). A prolonged standing job group had a higher proportion of low birth weight than a sitting job group, 5.5% and 4.0% respectively (Teitelman et al, 1990). Mother's unemployment was a factor of giving birth to low birth weight baby (Silva et al, 1998).

2.1.4. Residence

Residence of mothers is an indicator of mothers' living place, crowded place or non-crowded place. Living place effects infant weight as a study informed that the proportion of low birth weight babies born from mothers who lived in the city was more than mothers who lived in a rural area (Jurjus, 1995).

2.1.5. Marital statuses

Marital status is an important factor of pregnancy; most married women might have wanted the pregnancy and most single women might not want the pregnancy. Wanted and unwanted pregnancy can give different birth outcomes as a study showed that unmarried Black American women were at higher risk of having a low birth weight infant than married women: 62.2 percent of unmarried and 37.8 percent of married (Kallan, 1993).

2.1.6. Maternal Age

Maternal age can be argued as a factor. A study found that maternal age was not significant but most studies found that maternal age was significantly associated with birth weight of the baby. The result of one study showed that maternal age was not

significantly associated with low birth weight, that women who give birth to infants with low birth weight show no difference in proportion to young or older women (Nayar et al, 1994). However, a study in Thailand in 1982, based on birth records data, demonstrated that the highest proportion of low birth weight babies were among women under 20 years and over 35 years old (Chaturachinda et al, 1983). Similarly, in Canada, woman who were over 45 years of age and less than 20 years were more likely to have low birth weight babies than women who gave birth at other ages (Globe &Mail, 1994). Nancy and Deanna (1997) showed a U-shaped relationship between maternal age and low birth weight among white women; the higher risk of a low birth weight infant were mothers who were younger than fifteen and 40 years old and over. In addition, one study in India indicates that mothers who were younger than 20 had a high risk to deliver low birth weight infant (Amin et al, 1993). Two studies, in Taiwan and Canada, found that mothers who were 35 years of age and over were higher in proportion of having low birth weight infants than mothers who were at ages less than 20 years (Lu et al., 2003; Calgary Regional Health Authority, 1998).

2.1.7. Maternal Height

Many studies found that maternal height was an indicator of birth weight of infants. For example, one study found that low birth weight had a significant association with maternal height (Nayar et al, 1994). Another study statates that short maternal stature in developing countries is the primary determinant of low birth weight. This study analyzed 895 published papers in the English and French literature from 1970-1984 (Kramer, 1987). One more study determined that mothers who were shorter than 150 cm delivered more low birth weight babies than mothers who were 150 cm or taller (Amin et al, 1993).

2.1.8. Maternal Weight

The results of previous studies showed that the weight of the mother was significantly associated with her baby's birth weight: less than 45 kg of pre-pregnancy weight of the mother was significantly associated with a low birth weight infant. This significantce occurred 2.09 times higher than maternal pre-pregnancy weight that was more than 55Kg (Rana, 1993). Pre-pregnancy body mass index (BMI) <19.8 kg/m^2

was an associated factor of low birth weight infants (Ehrenberg et al, 2003). Less than 50 Kg of maternal weight, before giving birth, was significantly associated with having a low birth weight infant (Arif et al, 1998).

2.2. Behavior factors

2.2.1 Antenatal care (ANC) registration

Many studies found that pregnancy with medical care affects the birth weight of the infant; pregnant women with medical care during pregnancy will have higher birth weight infants. The studies showed that non-registration for antenatal care was significantly associated with low birth weight (Arif et al, 1998; Taha et al, 1995; Mansour et al, 2002). Pregnant women with antenatal care visits of less than 4 times were at higher risk of having low birth weight infants, when compared to mothers with antenatal care visits 4 times and more (Rana, 1993; Silva et al, 1998). However, one study disagreed those pregnant women who received or did not receive medical antenatal care were different in the proportion of low birth weight infants (Khalid et al, 1995).

2.2.2. Nutrition

Maternal nutrition is very important for the birth weight of a baby; good maternal nutrition is a predictor of higher birth weight and poor nutrition is a predictor of lower birth weight. Wannous & Arous (2001) explain that maternal nutrition is a factor of low birth weight. In addition, Mercedes (2001) indicates that in developing countries the major determinants of intrauterine growth retardation (IUGR) were related to the mother's nutritional status (inadequate nutritional status before conception and poor nutrition during pregnancy). Kramer (1987) analyses from 895 published papers in English and French, found that the most important factor of low birth weight was maternal malnutrition in both developed countries and developing countries. Poor maternal nutrition status was associated with both premature birth and intrauterine growth retardation (Allen et al, 1998). Maternal malnutrition before and during pregnancy was the factor of intrauterine growth retardation and of infants born with low birth weight (Khor, 2003). Pregnant women, who ate more fish, had lower chances of having a premature or low birth weight infant. But pregnant women who

did not eat fish were about three times more likely to have a premature birth or a baby with low birth weight when compared to women who ate 15g of fish a day (BUPA's medical team, 2002). A study in South West England found eating fish or n3-FA intake during pregnancy may increase fetal growth rate (Rogers et al, 2004).

2.2.3. Smoking

Results of many studies showed that low birth weight was an indicator the impact of smoking cigarettes on the child's health. Pregnant women who smoked were more likely to have infants with low birth weight, when compared to women who were not smokers (Globe & Mail, 1994; Kramer, 1987). Women who smoked during pregnancy were at nearly double risk of having a low birth weight baby than non-smokers (Karin A & Bilich, 2004). Pregnant women associated with cigarette smoking were an important factor of having low birth weight baby (Dana & Lisa, 1995). Pregnant women, who had contact with an environment of tobacco smoking was 1.5-4 times at higher risk of having a low birth infant (Misra & Nguyen, 1999). Pregnant women in contact with smoking more than 12 hours per day were 3.17 times higher at risk of delivering low birth weight infant than other pregnant women with in contact with smoking less than 3 hours per day (Rana, 1993). However, some study found, smoking cigarette did not affect to birth weight, for example: in Kapilashrami et al (2000) their study explained the cigarette smoking was not a significant factor of low birth weight.

2.2.4. Caffeine

It is not certain that caffeine affects birth weight as a study found that a high caffeine intake in the third trimester of pregnancy may be a risk factor for fetal growth retardation, in particular if the fetus was a boy. This study used data from Trondheim, Bergen, Norway, and Uppsala, Sweden (Vik et al, 2003).

2.3. Current pregnancy

2.3.1. Maternal weight gain during pregnancy

The starting trimester of pregnancy weight gain and the amount of maternal weight gained during pregnancy are predictors of birth weight. For example, maternal weight that started increasing in the second (12-24 weeks of pregnancy) or third trimester (>24 weeks of pregnancy) of pregnancy, created a higher risk for having low birth weight babies than maternal weight gained in the first trimester (first 12 weeks of pregnancy) (Judith et al, 2002). In addition, Ehrenberg et al (2003) explained that an average weight gain <0.27 kg/week during pregnancy was associated with low birth weight. The total pregnant weight gain of less than 16 lbs (7.264 kg) was a risk factor of having low birth weight baby (Vermont Department of Health, 1997). Women with a total weight gain during pregnancy of 22 pound (9.988 kg) or less are significantly more likely to have low birth weight babies (Women's Health Data Book, 2000). Inadequate maternal weight gain during pregnancy was a significant risk factor of intrauterine growth retardation and low birth weight infants (Chris & Erin, 2003).

2.3.2. Abuse during pregnancy

Abuse of pregnant women is an indicator of a problem pregnancy; pregnant abuse leads to behavior, which is not good for the mother and the child's health, for example: drinking alcohol, cigarette smoking, and taking unnecessary drugs. As the study results of Parker et al (1994) showed, physical and sexual abuse during pregnancy was a significant risk factor of low birth weight baby, as well as maternal low weight gain, infection, anemia, smoking, drinking alcohol, taking unnecessary drugs and coming late to receive antenatal care. In more detail, Dickute et al (2002) explained that mothers, who had been physically abused during pregnancy, were more likely to deliver a low birth weight baby 2.7 times higher than mothers without physical abuse.

2.3.3. Malaria infection

Many studies found that an impact of malaria during pregnancy is low birth weight, but they have different explanations, such as the information of Laokirkkiat (2000) that malaria fever in pregnant women is more severe than in non-pregnant women, and the risk of preterm delivery increases. Results of many studies stated that

malaria in pregnant women was a major determinant of low birth weight (Mercedes, 2001; Taha et al, 1995; Luxemburge et al, 2001). Analysis from 895 published papers in developing countries, found that the most important factor of low birth weight was malaria (Kramer, 1987). Malaria infection during pregnancy was a significant factor of preterm delivery and intrauterine growth retardation; malaria infection in a first pregnancy was more significant than in the next pregnancy (Allen et al, 1998). The main consequences of pregnant women with Malaria infection are maternal anemia and intra-uterine growth retardation resulting in low birth weight (LBW) particularly after first pregnancies (Cot & Deloron, 2003).

2.3.4. Others infections

Beside malaria infection, others infections also have the effect an low birth weight, for example women who had periodontal infection disease are more likely to have low birth weight babies at preterm delivery than women who are without periodontal infection disease (Steven et al, 1996; Lopez et al, 2002). Pregnancies infected by N gonorrhea and syphilis are at risk of premature delivery and low birth weight infants (Donders et al, 1993). Pregnant women infected with HIV, are independently associated with the risk of low birth weight (Ticconi et al, 2003; CDC News Updates November 27th, 2002). Pregnant women, who are infected by bacterial vaginosis (BV), more often give birth to low birth weight or premature infants (Hiller et al, 1999). Genital tract infection is a risk factor of low birth weight and preterm delivery (Gray et al, 1998). Pregnant women with a urinary tract infection have more low birth weight baby than pregnant women without a urinary tract infection (Nath G et al, 1996; Schieve, 1994). Asymptomatic urinary tract infection during pregnancy is at high risk for having low birth weight infant (Uncu et al, 2002).

2.3.5. Vaginal bleeding

Vaginal bleeding is the main cause of maternal and child mortality (perinatal mortality). In addition, vaginal bleeding is a factor of low birth weight as the study results of Lam & Wong (2002); Arif et al (1998); Mansour et al (2002), state that vaginal bleeding during pregnancy is a predictor of low birth weight infants.

2.3.6. Preeclampsia

Preeclampsia is a disease of pregnant women; it usually occurs in the first birth and after 20 weeks of pregnancy. We diagnose this when pregnant women have high blood pressure, positive protein in urine and edema. Most studies found that preeclampsia affects the birth weight of the baby according to the following: Arif et al (1998); Mansour et al (2002) explain that pregnant women with high blood pressure are more likely to have low birth weight infants than pregnant women who have normal blood pressure. Another study explains that when delivering at term (birth at 37-42 weeks of gestational age) infants, who were born to preeclampsia mothers have similar weights to infants who were born to mothers without preeclampsia. But delivering at preterm differs from the term delivery; infants who were born to preeclampsia mothers have weights less than infants who were born to mothers without pre-eclampsia: on average, 179-464 grams less than infants born to mother without pre-eclampsia (Xu Xiong et al, 2002).

2.4. Previous pregnancy

2.4.1. Mother with history of having low birth weight baby in previous birth

Past studies inform us that previous birth has an effect on the current birth; the mother who gave birth previously to a low birth weight baby is likely to have a low birth weight again as Arif et al (1998) conducted a study in Pakistan and found that mothers who previously had a low birth weight baby were significantly associated with giving birth to a low birth weight again. In addition, a study in Egypt also found women with a history of giving birth to low birth weight infants had a higher proportion of low birth weight (21.4 percent) than women who did not previously have infant with low birth weight (8.2 percent) (Mansour, 2002). again, a study in Rajavithi Hospital, Thailand, found that a mother delivering a low birth weight infant previously had a 2.07 times higher risk of having a low birth weight infant again than a mother who did not have a previous low birth weight baby (Rana,1993).

2.4.2. Maternal history of abortion

Previous pregnancies have a relationship with a current pregnancy. It is not only the women who had the previous low birth weight baby, but also women who ever had

an induced abortion experience a factor for having low birth weight infants. The result of a study shows woman history of two or more induced abortions were 2-2.5 times at increased risk of having low birth weight and preterm birth infants, when compared to women with without history of induced abortion (Alan, 1978).

2.5. Fetal factor

2.5.1. Parity

The number of births is significant for baby birth weight, first birth and others birth have various birth weight: many studies found that the first birth is an important risk-factor of low birth weight (Jurjus, 1995; Mansour et al, 2002; Arif et al, 1998;Amin et al,1993). Another study found that first pregnancy showed a high percentage of low birth weight among military families in India (Kapilashrami et al, 2000).

2.5.2. Gestational age

Many studies found that age at pregnancy is a main indicator of birth weight. Most babies born before 37 weeks will have less birth weight than a baby born at 37 weeks or over who will have a heavier birth weight. For example, the study results of Nayar et al (1994) and Silva et al (1998) state that low birth weight had a significant association with preterm delivery. Study results of Rana (1993) explain in more detail that infants who were born before 37 weeks of gestational age were 16 times higher at risk to be low birth weight than babies who were born at 37-42 weeks of gestational age. Mansour et al (2002) show that in singleton birth, infants who were born before gestational age of 37 weeks were of low birth weight more than babies delivered at gestational age of 37-42 weeks, 50.5 percent and 8.2 percent, respectively. The period of 1968-1997 in Calgary, Canada region, again showed low birth weight babies being born preterm more than at term delivery, 3.4 - 4.7 percent and 2.0-2.5 percent, respectively (Calgary Regional Health Authority, 1998).

2.5.3. Birth spacing

Many results of studies state that the birth interval between a previous birth and a current birth affects birth weight. Longer birth intervals influence having a higher birth

weight and shorter birth intervals influence having lower birth weight. Evidence showed by the study results of Taha et al (1995) that a short birth interval was the predictor of low birth weight, both at term and preterm delivery. More detail was given by Arif et al (1995) and Mansour et al (2002) as they explained that less than 24 months of birth interval was a risk factor of low birth weight babies.

2.5.4. Number of fetuses

Many researchers stated that the number of fetuses in a pregnancy was an indicator of infant birth weight. The evidence showed that multiple pregnancies are at higher risk of low birth weight than a singleton pregnancy (Globe & Mail, 1994; Jurjus, 1995). In addition, more than half of multiple births were low birth weight (55.1 percent) and only 10.1 percent were low birth weight among singleton birth (Mansour et al, 2002). It was not always the case that multiple births would be low birth weight more than singleton birth as Daltveit et al (1999) explained that the prevalence of low birth weight increased among single births in the period of 1979-1987 and among multiple births in the period of 1988-1995 in Norway-Sweden research.

2.5.5. Fetal sex

Studies in the past showed the same result that female babies were low birth weight more than male babies. For example, the study result of Mansour et al (2002) found that female infants were low birth weight more than male infants, 13.2 per 100 total female births and 11.2 per 100 total male births. Rana (1993) showed the similar result that infants with low birth weight were female more than male, 51.4 percent were females and 48.6 percent were males. Low birth weight infants occur in females higher than males (Jurjus, 1995). Once again a study explained that fetal sex was a factor of low birth weight is that a significant determinant of low birth weight was being of the female sex (Silva et al, 1998).

2.6. Summary of literature review

From the above literature review it has been seen that the research about low birth weight in Lao PDR was not found. The review found many factors that influence low

birth weight. Many variables are subject to argument; these variables are maternal age, occupation, antenatal care, and cigarette smoking. Therefore, it is important to investigate the determinants of low birth weight in Lao PDR and the variables subject to argument.

There are many factors that may affect low birth weight in Lao PDR including maternal, fetal, paternal, and environmental factors, but this research intends to investigate only maternal and fetal factors.

We can provide maternal factors with regard to social demography (age, height, pre-pregnant weight, body mass index, occupation, and education), current pregnancy (pre-delivery weight, pregnant weight gain, knowing fetal sex, fever, traffic accident, premature rupture of membrane, urinary tract infection, vaginal bleeding and preeclampsia), behavior (antenatal care, drinking alcohol, taking pre-natal vitamins and taking other medicines), previous pregnancy (induced abortion, low birth weight of previous baby), and fetal (pregnancy age and parity).

The prevalence of cigarette smoking is 62 percent for males, and 8 percent for females in Lao PDR (World Development Indicators, 2000). Prevalence of malaria is 759 per 100,000 people (WHO, 2002).

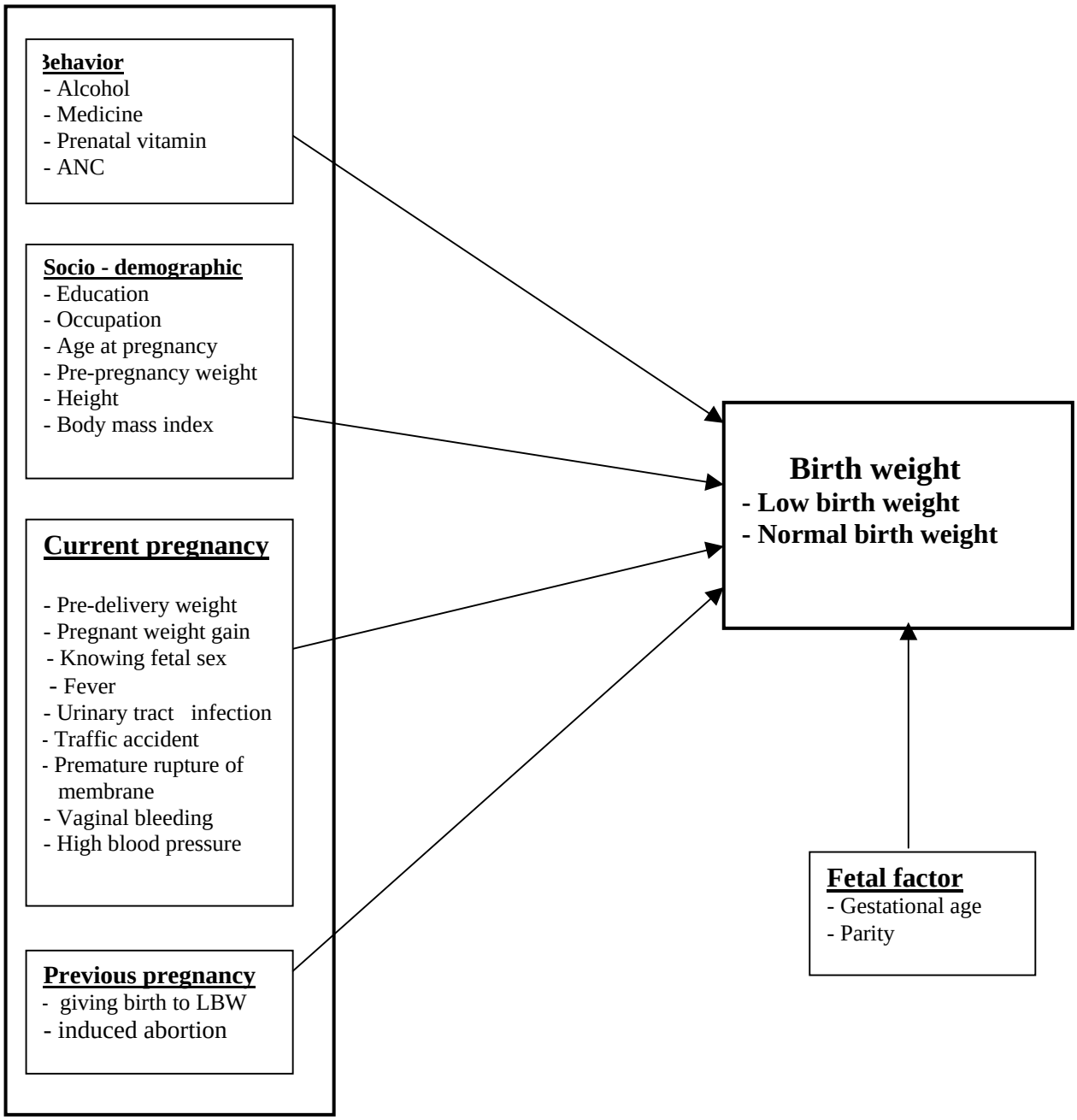
Table 1 gives the social and medical characteristics of Lao women of reproductive age.

Table1: Characteristics of Lao women of reproductive age

Characteristic	Percentage	Source
Maternal age at first birth		
19 and younger	29.6	
20-24	31.4	(UNFPA, 2001)
25 and over	10.9	
Education		
Never attended school	30.6	
Primary school	44.3	
Lower secondary school	21.5	(UNFPA, 2001)
Upper secondary school	2.9	
Higher than secondary school	0.7	
Fertility		
No child	28.0	
1 child	11.4	
2 children	13.2	
3 children	12.4	(UNFPA, 2001)
4 children	10.2	
5 children and more	24.7	
Antenatal care		
No medical antenatal care	75.8	(UNFPA, 2001)
Medical antenatal care	24.2	
Diseases during pregnancy		
Heart disease	8.5	
Kidney disease	5.2	
Liver disease	1.3	
Lung disease	2.4	(UNFPA, 2001)
Digestive disease	6.6	
Nervous condition	11.1	
Difficulties during pregnancy		
High blood pressure	2.0	
Edema	3.1	
Wrong position of fetus	2.3	
Placenta too low	0.6	(UNFPA, 2001)
Ruptured uterus	0.4	
Narrow pelvic	0.6	
Too much fluid	0.5	
Other diseases	5.1	

2.6. Conceptual framework

The conceptual framework of this thesis is illustrated by figure 4.



2.7. Working hypothesis

Low birth weight in Lao PDR will be determined by maternal social-demographic, maternal behavior, current pregnancy and previous pregnancy, and fetal factors.

CHAPTER 3
RESEARCH METHODOLOGY

The percentage of Lao children born at homes is 86.1 % and their birth weights were not known (LRHS, 2000). It is difficult to collect birth weight data in communities, birth weight data collection in the hospital is the best choice. Lao Loums who are Buddhist in religious belief are the biggest ethnic group in Lao PDR (65 percent and 68 percent). Vientiane is the capital city. The social-economic status of most people in Vientiane is better than people, who live in other provinces.

3.1. Study design and duration of data collection

This study is a quantitative, cross-sectional study. The data has been collected in the three government hospitals and only Mahosote, Mother and Child Health, and Setthathirate. These hospitals are in Vientiane, the capital city of Lao PDR. There is the largest number of clients in these hospitals for mother and child health care (pre-natal, inter-partum, and post partum care). The data was collected during 5 months, from September 1, 2003 to February 30, 2004.

3.2. Study population

The study population is mothers of low birth weight babies and mothers of normal birth weight babies who gave birth during the data collection period in the three hospitals cited. And lay in the next bed.

3.3. Sampling selection

3.3.1. Selection criteria

? Mothers who gave birth to newborn babies with weight less than 2,500g
? Mother who gave birth to newborn babies with weight 2,500-4,500g
? Married women
? Single birth
? Lao Loum
? Buddhist

? Agreed to being interviewed

3.3.2. Exclusion criteria

? Gestational age<28 weeks

? Intra-uterine fetal death

? Stillbirth

? Congenital malformation

? Unable to understand language for communication

3.4. Sampling method

Purposive sampling was used for sample selection; every mother of low birth weight infant and every mother who gave birth next to the low birth weight mother were selected to be sample.

3.5. Sample size

There are 100 cases for analysis. Among theses, 50 cases are low birth weight and the other 50 cases are normal birth weight.

3.6. Data collection

Structured questionnaires were used to collect data; the questionnaires included open-ended and closed-ended questions. The data was taken at the three hospitals in Vientiane: Mahosot, Setthathirate, and Mother and Child Health.

3. 7. Definition for measured variables in the study

Low birth weight is defined as when the weight at birth is less than 2500 grams. By contrast, the normal birth weight is 2500 grams and over.

The alcohol drinking variable refers to the alcohol drinking behavior of the mother during pregnancy. It is alcohol drinking, when she drinks at lest 250 cc of beer or 50 cc of alcohol. The data will be gotten from the two questions “Did you drink any alcohol during pregnancy? And how much did you drink during pregnancy?”

Antenatal care is defined as medical care. The pregnant woman who receives antenatal care has her personal history taken, a physical exam, and laboratory exam. Records note the last menstrual period, information of last pregnancy, blood pressure measurement, blood test, urine test, ultrasound examination. Food and nutrition, sexuality advices are given. This variable is divided into two categories, one with antenatal care and one without antenatal care. The data will be gotten from the question “Did you have antenatal care during pregnancy?”

Pre-natal vitamin refers to the vitamin given to pregnant women by the antenatal care units. The main component of this vitamin is ferrous and folic acid. Women are defined as receiving the pre-natal vitamin when she takes 30 doses of the vitamin. The data will be gotten from the question “Did you take the pre-natal vitamin during pregnancy and how much did you take?”

Medicines for this study are Paracetamol and chlorpheniramine. The data will be gotten from two questions “Did you take any medicine except the pre-natal vitamin? And what is the name of the medicine?”

Education refers to the highest class of her study in the formal school. The education of the mother can be at primary school, lower secondary school, upper secondary school or higher. For this study, education is divided into two levels: the first level is no formal education and primary school; the second level is secondary school and higher. The data will be gotten from the two questions “Have you studied in school? And what class have you completed?”

Occupation is divided into two types of work, paid labor and non-paid labor. Paid labor is the work that means receiving money from the private employer, government or customers. Non-paid labor is the housework. The data will be gotten from the question “What is your job?”

Age refers to the age of the mothers and classified into two categories of adolescent (<20 years old) and non-adolescent (= 20 or > 20 years old). The data will be gotten from the question “How old are you?”

Height is divided into two categories of <150cm and 150 cm or over. The height of mother is taken from the medical record.

Pre-pregnancy weight is weight of the women before the last pregnancy. It is divided into two categories of less than 45 kg and 45 kg or over. The data will be gotten from the question “How much did you weigh, before your last pregnancy?”

Body mass index is the nutrition measurement of the mother before the last pregnancy. For this study, the body mass index is classified into two categories of the underweight mother and of the non- underweight mother. A woman is underweight, when the value of her body mass index is lower than 20; and she is not underweight when body mass index equals to 20 or more. Normally, the body mass index is calculated by structure: weight (kg)/ height (m^2).

Pre-delivery weight is the weight of the mother on the last day of pregnancy. This weight includes the women’s weight, the fetal weight, the placenta’s weight, and the water’s weight. For this study, pre-delivery weight is divided in two categories that under 50 kg and 50 kg or over. The data will be taken from the medical record.

Pregnant weight gain is the difference between the pre-pregnancy weight of the mother and her weight on the last day of pregnancy.

Knowing fetal sex is accomplished by ultrasound examination during pregnancy. For this study, the fetal sex is divided into two categories of known fetal sex and unknown fetal sex. The data will be gotten from the questions “Did you know your baby’s sex during pregnancy? And how did you know it?”

Fever refers to the fever of flu and malaria. This variable is divided into two categories of pregnancy with fever and pregnancy without fever. The data will be gotten from the question “Did you have a fever during pregnancy?”

Urinary tract infection refers to painful and burning urine. The data will be gotten from the question “Did you have painful and burning urine, during pregnancy?”

Traffic accident refers to a motorcycle accident or fall in the bathroom. The data will be gotten from the question “Did you have an accident during pregnancy? And what kind of accident did you have?”

Premature rupture of membrane refers to breaking of amniotic water before the onset of abdominal pain (labor). This variable is divided into two categories of premature rupture of membrane and non-premature rupture of membrane. The data will be gotten from the question “When did the water break, before or after abdominal pain?”

Vaginal bleeding refers to vaginal bleeding of the mother during pregnancy. This variable is divided into two categories of vaginal bleeding pregnancy and non- vaginal bleeding during pregnancy. The data will be gotten from the question “Did you have vaginal bleeding during pregnancy?”

High blood pressure measure that the blood pressure of the mother during pregnancy is high when systolic pressure is higher than 140 mmHg and diastolic pressure is higher than 90 mmHg. This variable is divided into two categories of high blood pressure pregnancy and non-high blood pressure pregnancy. The data will be taken from the medical record.

Gestational age is pregnancy age. The pregnancy age is calculated by using the last menstrual period day and by using ultrasound. This study divides pregnancy into two categories of less than 37 weeks and 37 weeks or over. The data will be taken from the medical record.

Parity refers to the number of births, such as first baby, second baby and so on. This variable is divided into two categories of first birth and non-first birth. The data will be gotten from the question “Which birth is this baby”

Previous low birth weight baby refers to previous birth of weight at less than 2,500g. The data will be gotten from two questions “How many children do you have? And how much did they each weigh?”

Induced abortion refers to caused abortion by using medicine or medical equipment to force the fetus out. The data will be gotten from the questions “Did you have an abortion? Was it a voluntary abortion? And what did you use to cause the abortion?”

Table2. Operational variables

Name of variable	**Definition of variable**	**Measurement scale**	**Code**
Birth weight	Weight of baby at birth	Nominal scale Low birth weight Normal birth weight	 1 0
Alcohol	Alcohol drinking by the mother, during pregnancy	Nominal scale drinking non-drinking	 1 0
Antenatal care	Medical care of pregnant woman	Nominal scale Antenatal care visit No antenatal care visit	 1 0
Pre-natal vitamin	Ferrous and folic acid	Nominal scale Taking prenatal vitamin Not taking prenatal vitamin	 1 0

Table2: Operational of variables (continued)

Name of variable	**Definition of variable**	**Measurement scale**	**Code**
Medicine	Paracetamol and chlorpheniramine	Nominal scale Taking medicine Not taking medicine	 1 0
Maternal age	Age of mother	Nominal scale Less than 20 years 20 years and over	 1 0
Maternal height	Height of mother	Nominal scale < 150 Cm 150 Cm and over	 1 0
Pre-pregnancy weight	Weight before last pregnancy	Nominal scale <45 Kg 45 and over Kg	 1 0
Body mass index	Nutrition measurement before last pregnancy	Nominal scale < 20 20 and over	 1 0
Education	Level of education of mother	Nominal scale No schooling and primary school Secondary school and higher	 1 0
Occupation	Maternal occupation during pregnancy	Nominal scale Paid labor Non-paid labor	 1 0
Pre-delivery weight	Weight on the last day of pregnancy	Nominal scale <50 Kg 50 Kg and over	 1 0
Pregnant gain weight	Weight gain during pregnancy	Nominal scale <8 kg 8 kg and over	 1 0
knowing fetal sex	Fetal sex known during pregnancy	Nominal scale Known Unknown	 1 0

Table2: Operational of variables (continued)

Name of variable	**Definition of variable**	**Measurement scale**	**Code**
High blood pressure	Blood pressure of mother> 140/90 mmHg, during pregnancy	Nominal scale High blood pressure Non-high blood pressure	 1 0
Vaginal bleeding	Vaginal bleeding during pregnancy	Nominal scale Vaginal bleeding No vaginal bleeding	 1 0
Fever	Flu or malaria during pregnancy	Nominal scale Fever No fever	 1 0
Urinary tract infection (UTI)	Painful and burning urine during pregnancy	Nominal scale UTI No UTI	 1 0
Premature rupture of membrane	Breaking of amniotic fluid before labor (abdominal pain)	Nominal scale Broken Not broken	 1 0
Traffic accident	Fall from motorcycle, fall in bath room	Nominal scale Accident No accident	 1 0
Previous low birth weight infant	Low birth weight infant in previous birth	Nominal scale Low birth weight baby No low birth weight baby	 1 0
Induced abortion	Induced abortion in previous pregnancy	Nominal scale Induced abortion No induced abortion	 1 0
Parity	Number of births	Nominal scale First parity Non first parity	 1 0
Gestational age	Age of pregnancy	Nominal scale < 37 weeks 37 weeks and over	 1 0

3.8. Data analysis

The study employs logistic regression as the main statistical method. The reason for using this method is that there are two values of dependent variable: low birth weight and normal birth weight. The purpose for using this statistical methodology is to looking for the relationship between the independent variables (maternal behaviors, maternal social-demography, current pregnancy characteristics, and previous pregnancy characteristics) and the dependent variable (low birth weight). The advantage of this method is that it can predict probability of independent variables on being related to low birth weight infants.

3.9. Limitation

This study uses data collected from three hospitals in Vientiane. The sample selection is non-random sampling. The sample size is small. Infants who were born at home are not included due to the fact that most of those born at home the birth weight is not known. This is a pilot study. However, this study was designed from biased sampling because it is the first research to explore maternal determinants of low birth weight in Lao PDR.

3.10. Consent form and ethical clearance

This study did not cause any problem to post partum women, their infants and others. The researcher explained the objectives of this project to the participants before interviewing them. If they agreed to participate, the researcher asked them to write their signature on the questionnaire form. The information was kept confidential.

CHAPTER 4
RESULT OF THE STUDY

The result of this study is presented in three sections. The first section is a univariate analysis (frequency distribution of independent variables: maternal behaviors, maternal social-demography, and current pregnancy characteristic, previous birth information, and fetal factors). The second section is bivariate analysis (correlation among independent variables). The third section is multivariate analysis, which employed binary logistic regression as the statistical method.

4.1. Univariate analysis: general characteristics of the sample and some individual behaviors

Table 3 shows that twenty percent of pregnant women respondents drank alcohol during pregnancy. Drinking alcohol during pregnancy is not in line with Lao culture. The women may not know the negative impact of alcohol on their babies. A belief of some people is that beer drinking makes the skin of the baby at birth look more beautiful, without fat.

There are 65 percent of respondents, who gave birth to infants at hospitals, received medical care at least one time during their pregnancy. This contrasts greatly with data from communities in that only 24 percent of pregnant women have medical care (National Health Survey, 2001). It is possible that mothers who have antenatal care give birth more in the hospitals than mothers who do not have antenatal care.

There are more than 50 percent of respondents take the prenatal vitamins for one month or more. Every mother who receives the prenatal vitamin also receives antenatal care. Twelve percent of mothers who have antenatal care do not take vitamins (65 percent of women have antenatal care and 53 percent take the vitamin). The women may not understand the purpose of taking the vitamin during pregnancy. Twelve percent of the mothers, who do not take vitamin, are an indicator of the quality of antenatal care.

Table3: Basic for this study sample characteristics

Variable	**Percentage**	**Frequency(N=100)**
Alcohol		
Drank	21.0	21
Didn't drink	79.0	79
Antenatal care (ANC)		
ANC	65.0	65
No ANC	35.0	35
Prenatal vitamin (PNV)		
Taking PNV	53.0	53
Not taking PNV	47.0	47
Medicine (Paracetamol, chlorpheniramine)		
Taking medicine	13.0	13
Not taking medicine	87.0	87
Education		
No education and primary school	26.0	26
Secondary school and higher	74.0	74
Occupation		
Non-paid labor	54.0	54
Paid labor	46.0	46
Maternal age		
Maternal age <20 years	17.0	17
Maternal age = 20 years and over	83.0	83
Height		
Height<150 cm	25.0	25
Height=150 and over	75.0	75
Pre-pregnancy weight(PPW)		
PPW<45 kg	35.0	35
PPW=45 kg and over	65.0	65
Body mass index (BMI)		
BMI<20kg/m²	42.0	42
BMI=20kg/m² and over	58.0	58
Pre-delivery weight (PDV)		
PDV<50 kg	17.0	17
PDV=50 kg and over	83.0	83
Gained weight		
Gained weight < 8 kg	34.0	34
Gained weight = 8 kg and over	66.0	66
Knowing fetal sex before delivery		
Yes	44.0	44
No	56.0	56
Fever		
Yes	16.0	16
No	84.0	84

Table 3: Basic for this study sample characteristics (continued)

Variable	Percentage	Frequency (N=100)
Urinary tract infection		
Yes	15.0	15
No	85.0	85
Traffic accident		
Yes	12.0	12
No	88.0	88
Premature rupture of membrane		
Yes	23.0	23
No	77.0	77
Vaginal bleeding during pregnancy		
Yes	10.0	10
No	90.0	90
Pregnancy with high blood pressure		
Yes	8.0	8
No	92.0	92
History with low birth weight baby in previous		
Yes	10.0	10
No	90.0	90
Induced abortion in a previous pregnancy		
Yes	15.0	15
No	85.0	85
Gestational age		
Gestational age<37 weeks	36.0	36.0
Gestational age =37 weeks and over	64.0	64.0
Parity		
First Parity	60.0	60.0
Second parity and over	40.0	40.0

There are 13 percent of mothers take medicines during pregnancy. These medicines are not very dangerous for the baby's health. These medicines are basic medicines that can be bought in the drug store without a prescription.

There are more than one quarter of respondents, are women who have education at the primary school level or non-educated. This is a very different proportion from the communities data, where by 75 percent of all women have education at the primary or non-educated (National Health Survey, 2001). This number is an indicator of the positive relationship between education and giving birth at a hospital, as the Lao Reproductive Health Survey (2000) showed that low education mothers are low in proportion of giving birth at hospitals, and higher education mothers are higher in proportion of giving birth at hospitals.

There are more than 50 percent of pregnant women work at home as housewives and look after children. This is common in the city, but most of the pregnant women in the rural areas go to work in agricultural fields until the last month of pregnancy.

There are nearly 20 percent of children were born from adolescent mothers. This is common in Lao society as the Lao Reproductive Health Survey (2000) showed that 18.4 percent of total adolescent females become mothers, especially in rural residences (25.5 percent). Many previous studies showed that adolescent mothers are higher risk in having a low birth weight baby.

There are one quarter of mothers are shorter than 150 cm and 35 percent weigh less than 45 kg. Forty-two percent of respondents are underweight (BMI<20 kg/m^2). Nearly 20 percent of pregnant women had a weight less than 50 kg on the last day of pregnancy. Thirty-four percent of pregnant women gained weight of less than 8 kg during pregnancy. These numbers are indicators of chronic and acute malnourished mothers. Many past studies found malnutrition of mothers was a factor for having low birth weight babies. The National Health Survey (2001) showed that 19 percent of women had body mass index of less than 18.50 kg/m^2.

There are nearly haft of the mothers knew their child's sex before delivery (44 percent). This is an indicator of mother's interest in a medically advanced service to check up on their baby. It is easy to know fetal sex for people, who live in the city, but it is difficult for the mothers who live in the country because ultrasound service is available only in the city.

There are 10 percent of pregnant women had vaginal bleeding and 8 percent of them had high blood pressure. This is higher than data for communities (LRHS,2000) where high blood pressure was 2.0 percent and 1.0 percent was third trimester vaginal bleeding. The incidence of these two factors is higher in hospitals, because most mothers who have these problems may go to see the doctor and register for antenatal care.

There are 15 percent of mothers had experiences with induced abortion. This issue may be from high fertility, low baby demand, and low contraceptive use as the survey showed a total fertility rate of 4.8, 48 percent of married women want more children, and 40.5 percent of current married women are using contraceptive (LRHS, 2000).

Table 3 shows the first birth is greater in number than other later birth, 60 percent of babies born are first births and 40 percent are second births or more. This is similar to the survey in 2000 (LRHS) that first birth was the highest proportion of mothers, who gave birth at hospitals (1st birth=19.1 percent, 2-3 rd birth = 11.7 percent, 4-5th birth= 6.2 percent, and 6th birth or over = 5.8 percent).

There are 36 percent of babies were born at preterm. The cause of preterm may be many diseases during pregnancy as 16 percent of pregnant women had fever (flu or malaria), 15 percent had urinary tract infection, 12 percent had a traffic accident or bathroom fall, and 23 percent had their water broken before abdominal pain (labor).

4.2. Binary analysis

4.2.1. Binary analysis between maternal characteristic and infant birth weight

Purpose of this method is to compare between maternal characteristics and birth weight. This method reflects effect of each variable on the birth weight.

Table 4 shows mothers who have low birth weight is high among mothers who had behaviors of drinking alcohol, antenatal care, taking prenatal vitamin and taking medicine; when compare to normal birth weight. And mothers who did not have theses behaviors during pregnancy have more proportion of normal birth weight infant than low birth weight infants.

Low social-demographic mothers (education, age, weight, height, and body mass index), have more low birth weight infant than normal birth weight infant. And high social-demographic mothers have more normal birth weight than low birth weight.

Mothers, who had low weight gain and didn't know fetal sex, have more low birth weight babies than normal birth weight babies. And mothers who gained 8 kg of weight and knew fetal sex have more normal birth weight than low birth weight infants.

Mothers who had obstetric problem have more low birth weight infants than normal birth weight infants, such as vaginal bleeding, high blood pressure, premature rupture of membrane, traffic accident, urinary tract infection, and fever. Oppositely, mothers who did not have obstetric problem have more normal birth weight than low birth weight infants.

Most of mothers, who used to have low birth weight infant and induced abortion of mothers have more low birth weight infants than normal birth weight. And mothers who did not have any low birth weight infant or induced abortion have more proportion of normal birth weight infants.

Table 4: Maternal characteristic and infant birth weight

Maternal factors	**Low birth weight (%)**	**Normal birth weight (%)**	**Total (%)**
Behavior			
Alcohol			
Drank	67 (14)	33 (7)	100 (21)
Didn't drink	46 (36)	54 (43)	100 (79)
Antenatal care (ANC)			
ANC	66 (43)	44 (22)	100 (65)
No ANC	20 (7)	80 (28)	100 (35)
Prenatal vitamin (PNV)			
Taking PNV	60 (32)	40 (21)	100 (53)
Not taking PNV	38 (18)	62 (29)	100 (47)
Medicine (Paracetamol and Chlorpheneramine)			
Taking medicine	62 (8)	38 (5)	100 (13)
Not taking medicine	48 (42)	52 (45)	100 (87)
Social-Demographic			
Education			
No education and primary school	58 (15)	42 (11)	100 (26)
Secondary school and higher	47 (35)	53 (39)	100 (74)
Occupation			
Non paid labor	48 (26)	52 (28)	100 (54)
Paid labor	52 (24)	48 (22)	100 (46)
Maternal age			
Age<20 years	53 (9)	47 (8)	100 (17)
Age=20 and over	49 (41)	51 (42)	100 (83)

Table 4: Maternal characteristic and infant birth weight (continued)

Maternal factors	**Low birth weight (%)**	**Normal birth weight (%)**	**Total (%)**
Maternal height			
Height< 150 cm	52 (13)	48 (12)	100 (25)
Height=150 cm and over	49 (37)	51 (38)	100 (75)
Pre-pregnancy weight			
weight<45 kg	66 (23)	34 (12)	100 (35)
weight = 45 kg and over	42 (27)	58 (38)	100 (65)
Body mass index (BMI)			
BMI<20 kg/m²	62 (26)	38 (16)	100 (42)
BMI = 20 kg/m² and over	41 (24)	59 (34)	100 (58)
Current pregnancy			
Pre-delivery weight			
Weight <50 kg	94 (16)	6 (1)	100 (17)
Weight = 50 kg and over	41 (34)	59 (49)	100 (83)
Pregnant gained weight			
Gained weight<8 kg	82 (28)	18 (6)	100 (34)
Gained weight = 8 kg and over	33 (22)	67 (44)	100 (66)
Knowing fetal sex before delivery			
Yes	34 (15)	66 (29)	100 (44)
No	63 (35)	37 (21)	100 (56)
Fever			
Yes	63 (10)	37 (6)	100 (16)
No	48 (40)	52 (44)	100 (84)
Urinary tract infection			
Yes	87 (13)	13 (2)	100 (15)
No	44 (37)	56 (48)	100 (85)
Traffic accident			
Yes	75 (9)	25 (3)	100 (12)
No	47 (41)	53 (47)	100 (88)
Premature rupture of membrane			
Yes	57 (13)	43 (10)	100 (23)
No	48 (37)	52 (40)	100 (77)

Table 4: Maternal characteristic and infant birth weight (continued)

Maternal factors	**Low birth weight (%)**	**Normal birth weight (%)**	**Total (%)**
Vaginal bleeding			
Yes	90 (9)	10 (1)	100 (10)
No	46 (41)	54 (49)	100 (90)
Previous pregnancy			
History with low birth weight baby in previous			
Yes	80 (8)	20 (2)	100 (10)
No	47 (42)	53 (48)	100 (90)
Induced abortion in a previous pregnancy			
Yes	73 (11)	27 (4)	100 (15)
No	46 (39)	54 (46)	100 (85)

4.2.2. Binary analysis between fetal characteristic and infant birth weight

This method is to compare fetal characteristic and infant birth weight. Table 6 shows positive relationship between parity and birth weight, first parity (first baby) seems to be more low birth weight and other parities seem to be more normal birth weight baby. And pregnancy age has positive relationship with birth weight that preterm births are more low birth weight babies and term births seem to be more normal birth weight.

Table 5: Fetal characteristic and infant birth weight

Fetal factors	**Low birth weight (%)**	**Normal birth weight (%)**	**Total (%)**
Parity			
First parity	55 (33)	45 (27)	100 (60)
Second and over	43 (17)	57 (23)	100 (40)
Pregnancy age			
Pregnancy age<37 weeks	92 (33)	7 (3)	100 (36)
Pregnancy age = 37 weeks and over	27 (17)	73 (47)	100 (64)

4.2.3. Bivariate analysis

The purpose of using bivariate analysis is to examine a correlation among independent variables. The variable is correlated with other variables, when a correlated scores equals 0.80 or greater (Blalock, 1965). When there are collinearity and multicollinearity, those variables can not be perfectly added into predicting equation. The table 6 shows that there is not any correlation between independent variables.

Table 6: Correlations among independent variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Age< 20	1.00	_	_	_	_	_	_	_	_	_	_
(2) alcohol	.028	1.00	_	_	_	_	_	_	_	_	_
(3) ANC	.053	.378	1.00	_	_	_	_	_	_	_	_
(4) BMI<20	-.115	-.041	.200	1.00	_	_	_	_	_	_	_
(5) Illiteracy & primary	.096	.030	.100	.004	1.00	_	_	_	_	_	_
(6) Knowing fetal Sex	-.079	-.012	.017	.062	-.112	1.00	_	_	_	_	_
(7) Fever	-.052	.043	.092	.181	-.134	-.057	1.00	_	_	_	_
(8) First parity	.370	-.030	.043	.199	-.121	.107	.078	1.00	_	_	_
(9) Gestational Age< 37 week	.160	.023	.288	.122	.220	-.329	.127	.187	1.00	_	_
(10) Pregnant high Blood pressure	-.035	.119	.139	.048	-.091	.036	.273	-.060	.240	1.00	_
(11) Height< 150 cm	.046	.043	.036	.023	.026	-.140	-.063	.047	-.192	-.085	1.00
(12) Induced abortion	-.190	.127	.191	.040	.134	-.090	-.107	-.286	-.082	-.124	.081
(13) Medicine	-.017	.166	.221	.093	-.161	.017	.561	.012	.082	.324	-.155
(14) Non-paid labor	.044	-.017	-.130	-.190	-.139	-.233	.020	-.057	.065	-.024	-.023
(15) Previous LBW baby	-.151	.074	.175	-.014	.030	-.094	-.055	-.340	.028	-.098	.115
(16) PROM	-.121	.068	.102	-.080	.164	-.149	-.109	-.039	.184	-.161	-.096
(17) Prenatal vitamin	.053	.387	**.779**	.192	.101	.149	.083	.090	.080	-.018	.081
(18) Traffic accident	-.085	.112	.013	.122	-.008	.045	-.077	-.013	-.085	-.109	.142
(19) UTI	.034	.058	.132	.040	.198	-.147	-.183	.000	.035	-.021	.146
(20) Vaginal bleeding	.115	-.008	.245	.122	-.046	-.094	-.055	.000	.167	-.098	-.115
(21) Pregnancy weight <8 kg	.181	-.059	.350	-.055	.056	-.168	-.025	.155	.385	-.212	-.024
(22) Pre-delivery weight<50 kg	-.134	.159	.220	.478	.157	-.133	.238	.098	.215	-.133	.231
(23) Pre-pregnancy weight<45 kg	-.109	-.018	.231	**.735**	.043	-.017	.137	.128	.149	-.062	.254
Statistic											
Minimum	0	0	0	0	0	0	0	0	0	0	0
Maximum	1	1	1	1	1	1	1	1	1	1	1
Mean	.17	.21	.65	.42	.26	.44	.16	.60	.36	.08	.25
Standard error	.378	.409	.479	.496	.441	.499	.368	.492	.482	.273	.435

Table 6: Correlations among independent variables (continued)

	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
(1) Age< 20	_	_	_	_	_	_	_	_	_	_	_	_
(2) alcohol	_	_	_	_	_	_	_	_	_	_	_	_
(3) ANC	_	_	_	_	_	_	_	_	_	_	_	_
(4) BMI<20	_	_	_	_	_	_	_	_	_	_	_	_
(4) Illiteracy & primary	_	_	_	_	_	_	_	_	_	_	_	_
(6) Knowing fetal Sex	_	_	_	_	_	_	_	_	_	_	_	_
(7) Fever	_	_	_	_	_	_	_	_	_	_	_	_
(8) First parity	_	_	_	_	_	_	_	_	_	_	_	_
(9) Gestational Age< 37 week	_	_	_	_	_	_	_	_	_	_	_	_
(10) Pregnant high Blood pressure	_	_	_	_	_	_	_	_	_	_	_	_
(11) Height< 150 cm	_	_	_	_	_	_	_	_	_	_	_	_
(12) Induced abortion	1.00	_	_	_	_	_	_	_	_	_	_	_
(13) Medicine	-.079	1.00	_	_	_	_	_	_	_	_	_	_
(14) Non-paid labor	-.174	.058	1.00	_	_	_	_	_	_	_	_	_
(15) Previous LBW baby	.327	-.129	-.094	1.00	_	_	_	_	_	_	_	_
(16) PROM	.103	-.070	-.115	.293	1.00	_	_	_	_	_	_	_
(17) Prenatal vitamin	.059	.185	-.186	.047	.134	1.00	_	_	_	_	_	_
(18) Traffic accident	.190	-.051	-.091	-.123	.018	.039	1.00	_	_	_	_	_
(19) UTI	.216	-.079	-.006	.513	.303	.115	-.069	1.00	_	_	_	_
(20) Vaginal bleeding	.140	-.030	-.094	-.111	-.103	.114	-.021	-.140	1.00	_	_	_
(21) Pregnancy weight <8 kg	.171	-.026	.069	.183	.310	.253	-.070	.408	.113	1.00	_	_
(22) Pre-delivery weight<50 kg	.108	-.017	-.116	.115	.069	.213	.242	.183	.027	.293	1.00	_
(23) Pre-pregnancy weight<45 kg	.044	-.034	-.080	.035	-.052	.187	.245	-.015	.105	.004	.617	1.00
Statistic												
Minimum	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	1	1	1	1	1	1	1	1	1	1	1	1
Mean	.15	.13	.54	.10	.23	.53	.12	.15	.10	.34	.17	.35
Standard error	.359	.338	.501	.302	.423	.502	.327	.359	.302	.476	.378	.479

4.3. Multivariate analysis

The purpose of multivariate analysis is to examine the relationship between maternal factors and low birth weight infants. The multivariate analysis has divided into two parts. Part one concentrates on influence of each domain (behavior, social-demography, current pregnancy, and previous pregnancy) on low birth weight. Part two explores determinant of low birth weight. Binary logistic regression analysis is used when exploring this section. In addition, binary logistic regression analysis under the process of log likelihood ratio test is used when examine determinant of low birth weight. The confident interval is 95 percent, a = 0.05.

4.3.1. Influences of maternal behavioral factors on low birth weight

According to the statistical testing shown on the table 5, antenatal care is significant determinants of low birth weight. When compared with pregnant women without pre-natal care, mothers with pre-natal care are more likely to delivering low birth weight babies.

Pregnant women, who drank alcohol, took prenatal vitamin and took medicine (Paracetamol, chlorpheniramine) do not have a significant factor of low birth weight. Mothers with taking prenatal vitamin are negative relationship with giving low birth weight (B = -2.022).

This study measure only maternal behavior: alcohol drinking, vitamin taking and medicine taking, this study did not measure amount of alcohol, vitamin and medicine. They may be the factor of low birth weight, if mothers drink and take more.

Table 7: Binary logistic regression coefficient of low birth weight by selected maternal behavior factor variables

Maternal behavior	Coefficient	Standard error
Alcohol	0.233	0.581
ANC	3.755**	1.133
Medicine	-0.047	0.672
Prenatal vitamin	-2.022	1.088
Constant	-1.385	
Log-likelihood	112.921	
Model chi-square	25.708	
Degree of freedom	4	
Significant	0.000	

** p<.05 *** p<.001

4.3. 2. Influences of maternal social-demographic factors on low birth weight

When look only at the social-demographic factors of mothers, there is not any variable to be a significant factor of low birth weight baby as the Table 6 shows. It is not different infant birth weight between young and older mothers, thin and fat mothers, short and taller mothers, low and high education mothers, work at home and work out side mothers.

Table 8: Binary logistic regression coefficient of low birth weight by selected maternal social-demographic factor variables

Maternal social-demographic factors	**Coefficient**	**Standard error**
Illiteracy & primary school	0.382	0.482
Occupation	-0.021	0.430
Pre-pregnancy weight <45 kg	0.831	0.684
Height <150 cm	-0.158	0.516
Body mass index < 20 kg/m²	0.287	0.641
Age < 20 years	0.283	0.562
Constant	-0.501	
Log-likelihood	131.927	
Model chi-square	6.703	
Degree of freedom	6	
Significant	.349	

** p<.05 *** p<.001

4.3. 3. Influences of current pregnancy factor on low birth weight

According to the statistical testing in Table 9, the significant determinants of low birth weight are the following: Pre-delivery weight of mothers less than 50 kg, maternal weight gains during pregnancy less than 8 kg, knowing fetal sex during pregnancy, vaginal bleeding, and high blood pressure during pregnancy.

When compared to mothers with weight 50 kg and over on the last day of pregnancy, mothers whose weigh less than 50 kg are higher at risk of having a low birth weight infant. Normally, the cause of low maternal weight on the last day of pregnancy is low maternal weight before pregnancy and low pregnant weight gain. Demographic factor analysis shows that low maternal weight before pregnancy is not a factor of low birth weight. So that, there is only low maternal weight gain during

pregnancy is the cause of less than 50 kg of mother on the last day of pregnancy. The numbers show that pregnant women with weight gain of less than 8 kg are higher at risk of giving birth low birth weight, when compare to 8 kg and over of pregnant gaining weight. The low maternal weight gain may be due to inadequate nutrition, during pregnancy.

Pregnancy which has problems with vaginal bleeding is at higher risk of having a low birth weight infant, when compared to pregnancy without vaginal bleeding. The vaginal bleeding may be the cause of a preterm birth, as Andolsek (1990) explained that second and third trimester bleeding occurs in 3 percent of all pregnancies; 50 percent of bleeding is of unknown cause. Placenta previa and abruption placenta account for 50-66 percent of all diagnosed cases; 20 percent of placenta previa and 50 percent of abruption placenta are preterm birth.

High blood pressure during pregnancy is at higher risk of having a low birth weight infant, when compared to normal blood pressure during pregnancy. Thongsong (1998) confirmed that high blood pressure during pregnancy leads to preterm birth.

Knowing the fetal sex during pregnancy is in negative relationship with low birth weight (B= -1.896). Women who know fetal sex during pregnancy are less likely to have a low birth weight baby, when compared to pregnant women, who unknown fetal sex during pregnancy. Knowing the fetal sex during pregnancy is an indicator of a mother's concern for the baby. These mothers may learn knowledge from the health professional, television, radio, books and have appropriate behavior, regarding eating, drinking, exercising, and sexuality.

Having a fever during pregnancy is not a significant factor of infants with low birth weight. The reason having a fever during pregnancy is not significant might because there is no long period. The short period may not be a factor of low birth weight, and the long period of fever may be the factor of low birth weight.

When looked at as influence of current pregnancy factors, the premature rupture of membrane is not a significant factor of low birth weight. When there are other factors to be covariate variables, such as previous pregnant factor, fetal factor; it might be a significant factor of low birth weight.

Mothers who had traffic accident are not significant factor of low birth weight. This study does not consider the number of accident and hard or not hard accident. It may be the significant factor, if they have more times or heavy of accident.

Pregnant women, who have urinary tract infection, are not at risk of giving birth in low weight baby. This study does not consider about sever or moderate or severe infection. It may be the significant factor, if they have the severe infection.

Table 9: Binary logistic regression coefficient of low birth weight by selected current pregnancy factor variables

Current pregnancy	Coefficient	Standard error
Pre-delivery weight <50 kg	4.314**	1.628
Gain weight < 8 kg	3.398***	0.902
Knowing fetal sex before delivery	-1.896**	0.765
Fever	-0.802	1.149
Urinary tract infection	1.755	1.212
Traffic accident	2.246	1.055
Premature rupture of membrane	-0.085	0.850
Vaginal bleeding	4.171**	1.387
High blood pressure	5.430**	1.689
Constant	-1.786	
Log-likelihood	98.630	
Model chi-square	78.383	
Degree of freedom	9	
Significant	.000	

** p<.05 *** p<.001

4.3.4. Influences of previous pregnancy factor on low birth weight

As Table 8 shows, the mothers who used to have low birth weight baby or induced abortion in previous pregnancies are not significant factor of having a low birth weight. But they have positive relationship with low birth weight. This study did not consider number of abortion. It may be a significant factor, if mother have more abortion.

Table 10: Binary logistic regression coefficient of low birth weight by selected previous pregnancy factor variables

Previous pregnancy	Coefficient	Standard error
Previous low birth weight baby	1.224	0.848
Induced abortion	0.917	0.651
Constant	-0.233	
Log-likelihood	132.270	
Model chi-square	6.360	
Degree of freedom	2	
Significant	.042	

** p<.05 *** p<.001

4.3.5. Influences of fetal factor on low birth weight

Infants who were born before 37 weeks of gestational age show the significant factor of low birth weight, at higher risk to be low birth weight, when compared to infants who were born at 37 weeks or over of gestational age (table 9). When concentrate on number of birth, it is not predictor of low birth weight as table 9 shows the first parity is not significant factor of low birth weight.

Table 11: Binary logistic regression coefficient of low birth weight by selected fetal factor variables

Fetal factor	Coefficient	Standard error
First parity	0.037	0.522
Gestational age<37 weeks	3.408***	0.673
Constant	-1.037	
Log-likelihood	94.741	
Model chi-square	43.888	
Degree of freedom	2	
Significant	.000	

** p<.05 *** p<.001

4.3.6. Determinant of low birth weight in Lao PDR

Forward stepwise (likelihood ratio) is used for this analysis. When there is control for several factors, including the maternal behavior factor, maternal social-demographic factor, current pregnancy factor, previous pregnancy factor, and the fetal factor; some variables which are significant factors become insignificant factors of low birth weight, but some new variables become significant factors of low birth weight. When adding more variables, some significant variables increase the risk of

being low birth weight, such as pregnancy age of less than 37 weeks and pre-delivery weight less than 50 kg. Using this statistical method, we will get the most significant factors of low birth weight.

Table 10 shows that the most significant determinants of low birth weight babies among Lao Loum are: previous pregnant induced abortion, antenatal care, traffic accident during pregnancy, pregnancy with urinary tract infection, premature rupture of membrane, gestational age less than 37 weeks, and pre-delivery weight less than 50 kg.

Previous pregnancy of induced abortion is in positive relationship with low birth weight. Women who with had an induced abortion are more likely to have a low birth weight baby at the next birth, when compared to women without previously induced abortion prior to the current pregnancy. Induced abortion may be a factor of uterus and fallopian infection because induced abortion is illegal and an unsafe abortion. Wanapirak (1998) explained that infection of uterus is a factor of premature rupture of membrane, and premature rupture of membrane is the cause of preterm delivery.

Low birth weight infants are found to occur in pregnant women, who have visited the Antenatal Care Unit and, therefore antenatal care is in a positive relationship with low birth weight. Mothers with antenatal care are at higher risk of having a low birth weight infant, when compared to mothers without antenatal care. The reason is that mothers who go to see the doctors at the Antenatal Care Unit might be mothers, who have complications of pregnancy such as urinary tract infection or vaginal bleeding.

Traffic accident or bathroom fall is in a positive relationship with low birth weight, a pregnant woman with traffic accident or bathroom fall is more likely to have a low birth weight baby, when compared to a pregnant woman without an accident or fall. The accident or fall may be a cause of premature labor and preterm birth.

A urinary tract infection is in a positive relationship with low birth weight. Pregnant women with severe urinary tract infections have a greater chance of delivering low birth weight baby; with a mild urinary tract infection, they have a lower chance of having a low birth weight infant. Pregnant women with urinary tract infection are at higher risk of bearing an infant with low birth weight, when compared to mothers without the symptom of a urinary tract infection. The urinary tract infection is the factor of preterm delivery (Thongsong, 1998).

Premature rupture of the membrane is in a negative relationship with low birth weight. Women with premature rupture of membrane are less likely to have a low birth weight baby, when compared to mothers without premature rupture of membrane. This number indicates that the premature rupture of membrane is not a factor of low birth weight. This study did not consider gestational age, when amniotic is broken. The amniotic fluid might break, when pregnancy age is 37 weeks or more. It might be a significant factor of low birth weight infant, if it was break, when gestational age is less than 37 weeks. Indeed, if amniotic fluid breaks before 37 weeks of pregnancy age, it will lead to a preterm birth and low birth weight.

Under 37 weeks of Gestational age is in a positive relationship with low birth weight, women with less than 37 weeks of gestational age, are more likely to have low birth weight infants, when compared to mothers with 37 weeks and more of gestational age. The preterm delivery is delivery when pregnancy age is less than 37 weeks. Preterm birth is the main cause of low birth weight baby (Judith & Laura, 2000).

Lower than 50 kg of pre-delivery weight is in a positive relationship with low birth weight, women with weight lower 50 kg on the last day of pregnancy, are more likely to have low birth weight infants than women with weight 50 kg and over. Low pregnant gain weight is the cause of lower than 50 kg of pre-delivery weight. Low pregnant gain weight is the cause of intra-uterine growth retardation and leads to a low birth weight baby (Chris & Erin, 2003).

The pre-pregnancy weight of less than 45 kg is in a negative relationship with low birth weight. Mothers, who have lower than 45 kg of pre-pregnant weight, are less likely to have low birth weight baby, when compared to mothers who weigh 45 kg and over.

No education or primary school is in a negative relationship with low birth weight. Pregnant women, who have low or no education, are less likely to have a low birth weight baby, when compared to mothers with education at the secondary level and higher.

Table 12: Binary logistic regression coefficient of low birth weight by selecting all factors variables (maternal factors and fetal factor)

Independent variables	Coefficient	Standard error
Induced abortion	3.439**	1.630
Antenatal care	3.734**	1.604
Traffic accident	4.719**	1.979
Urinary tract infection	5.107**	2.213
Premature rupture of membrane	-2.961**	1.564
Gestational age < 37 weeks	8.498***	2.305
Pre-delivery weight <50 kg	8.567**	3.018
Pre-pregnancy weight<45 kg	-3.400	1.853
None education and primary school	-2.205	1.260
Constant	-4.980	1.249
Log likelihood	33.662	
Model chi-square	104.967	
Degree of freedom	9	
Significant	.000	

** p<.05 *** p<.001

4.4. Discussion

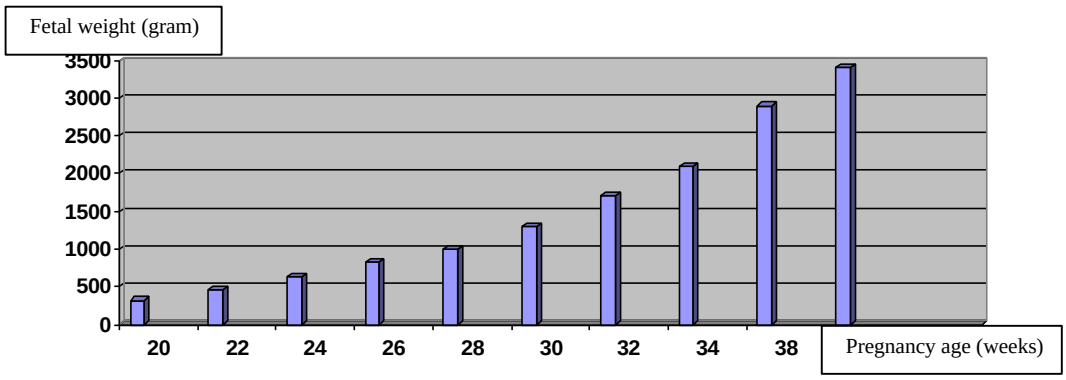
The causes of weight lower than 50 kg (weight of mother on the last day of pregnancy< 50 kg) of pre-delivery weight of mother is low pre-pregnancy weight or low pregnant weight gain or both of low pre-pregnancy weight and low pregnant weight gain as it is found in the above analysis: pregnant weight gain of less than 8 kg, is significant factors. Women with low pregnant weight gain, reflect low fetal growth or intrauterine growth retardation.

It was found that low birth weight babies were born to mothers, who had pre-natal care. Pregnant women, who went to visit an antenatal care unit, may have problems with their health for example, a urinary tract infection or traffic accident or vaginal bleeding or symptoms of high blood pressure (edema, headache) or integration of these problems. Pregnant women, who do not have any health problem during pregnancy may visit health professional fewer times, because their income is hardly

enough for living, and they know that they will have to pay for something such as medicine, medical notebook, blood test, urine test; when they use services of hospital. The antenatal care is positively related to low birth weight and a result like this was found in Egypt in research conducted by Mansour et al (2002). They explained that antenatal care visit is more frequent among mothers who have health problems.

Less than 37 weeks of pregnancy age is at high risk of being a low birth weight infant because gestational age is the main factor of fetal weight, as Thongsong (1998) showed the positive relationship between pregnancy age and fetal weight in that the gestational age is small, the fetal weight is small too; when gestational age increase, and the fetal weight is increase also (below figure).

Figure 5: relationship between pregnancy age and fetal weight



Source: Thongsong (1998)

The traffic accident or bathroom fall during pregnancy is a determinant of low birth weight. The pregnant women, who have accident, may have abdominal trauma which may be the cause of premature rupture of membrane and preterm delivery. It is especially the case that premature rupture of membrane is the main cause of preterm delivery, and preterm delivery is an important cause of low birth weight.

CHAPTER 5
CONCLUSION AND RECOMMENDATON

5.1. Conclusion of data analysis

From the analysis of statistical methods, it can be concluded that mothers who have problems of pregnancy are the main determinants of low birth weight; these include urinary tract infection, traffic accident, preterm delivery, and maternal nutrition during pregnancy. In addition to the above name an induced abortion of a previous pregnancy can also be a determinant of low birth weight infants. This study found that education and pre-pregnancy weight of mothers have a relationship with low birth weight infants.

5.2. Recommendations

The main factors of low birth weight are problems that occur in the current pregnancy and an induced abortion in the previous pregnancy, so it is necessary to advertise and make known the impact of factors, and how to prevent of low birth weight.

We should promote early antenatal care and contraception. In the Antenatal Care Unite, prevention of urinary tract infection should be first that suggest pregnant women drink more water at least 3 liters per day, have urine test for diagnosis and giving treatment if urinary tract infection is diagnosed. This activity should be started early and follow up until the end of pregnancy. Urinary tract infections (UTI) are common during pregnancy, and the most common cause is Escherichia coli. Asymptomatic bacteriuria can lead to the development of cystitis or pyelonephritis, Thirty percent of patients with untreated asymptomatic bacteriuria develop symptomatic cystitis and up to 50 percent develop pyelonephritis.

We should encourage pregnant women to increase their food intake. They should have enough food every day; the food should be meat, fish, vegetable, fruit, milk, and vitamin supplements (ferrous and folic acid). The employer or social welfare organization should give extra money for pregnant women to buy enough nutritional food. There is evidence to suggest that we can improve infant outcomes by increasing

maternal nutritional status. In 1997, Prentice and colleagues supplemented Gambian women with an extra 900 calories per day with most of the calories coming from fat in a ground nut-based biscuit. The supplement also provided calcium and iron. There was an increase in birth weight of about 136grams. Low birth weight was reduced by 35%. These women also received prenatal care, including iron-folate supplements (Ceesay et al, 1997).

We should encourage wanted pregnancies to prevent unwanted pregnancies and induced abortions by using contraceptive methods, such as pills, condoms, IUDs, and injection. The contraceptive service should be in every hospital and every health center. The price should be low or free for clients. The important thing that through advertisements educate, we should have birth control information in the post natal care units, in communities and on TV and radio.

We should give the right to pregnant women to prevent accidents during pregnancy. Within the family, community or the public sector; we should specify the lighter work conditions for pregnant women.

5.3. Recommendations for future research

I would like to suggest that future researchers on low birth weight in Lao PDR collect and compare similar data in other ethnic and religious groups such as Lao Soung, Lao Theung, Vietnamese, Chinese, and Christian groups. If it is possible, I would like to suggest the data collection of low birth weight in community.

BIBLIOGRAPHY

Acharya, PP., Alpass F.2004. Birth outcomes across ethnic groups of women in Nepal. *Health Care WomenInt*. 2004Jan;25(1):40-54.

African American teens have greater risk for low birth weight and premature babies. *Public Health News*. August 29, 2003.

Alan Guttmacher Institute. (1978). Repeated abortion increase risk of miscarriage, premature birth and low birth weight babies. *International family planning perspective and digest*, vol.4, No.4: 124-125.

Allen, S. J.,A. Raiko, A. O'Donnell, N. D. E Alexander, J B Clegg.(1998). Causes of preterm delivery and intrauterine growth retardation in a malaria endemic region of Papua New Guinea. *Arch Dis Child Fetal Neonatal* Ed 1998;79**:**135-140 (September).

Ames, Iowa. (1997). Promoting access to health care mother and child health in Iowa: a profile. *Children, youth & family trendletter*, volume 2, number 1.

Amin, N., Abel R, Sampathkumar V .(1993). Maternal factors associated with low birth weight. *Indian J pediatric*, 60(2):269-74.

Arif, MA., Qureshi Ah, Jafarey SN, Alam SE, Ariff K.(1998). maternal social-cultural status: a novel assessment of risk for the birth of small for gestational age, low birth weight infants. *J Obstret Gynaecol Res*, 24(3):215-22.

Brown, Sarah S. (1985). Can low birth weight be prevented?. *Family planning perspectives*, vol. 17, No.3: 112-118.

Bukenya,GB., Barnes T, Nwokolo N. (1991).Low birthweight and acute childhood diarrhoea: evidence of their association in an urban settlement of Papua New Guinea. *Ann Trop Paediatr*. 1991, 11(4), pp 357-62.

BUPA's medical team. (2002).Eating fish reduces premature births. *BUPA the personal health service* - 27 February 2002.

Calgary Regional Health Authority.(1998). Low birth weight. *Health Service Delivery Highlights*, Volume 3, Fall 1998:1-6

CDC news updates. November 27, 2002. Multivitamins improve weight gain in HIV-infected, pregnant women.

Ceesay SM, Prentice AM, ColeTJ, Foord F, Weaver LT, Poskitt EM, Whitehead RG**.** Effects on birth weight and perinatal mortality of maternal dietary supplements in rural Gambia: 5 year randomized controlled trial. *BMJ* 1997 Sep27;315 (7111):786-90.

Chaturachinda, K., Hiranraks A, Auamkul N, Kanchanasinith K, Amornvichet P, o-Prasertsawat P. (1993). Low birth weight in Thailand:1982. *Med Asso Thai*, 76 Suppl 1:36-9.

Chaudhari S, Otiv M, Chitale A, Pandit A, Hoge M.2004. Pune low birth weight study-cognitive abilities and educational performance at twelve years. *Indian Pediatr*. 2004 Feb;41(2):121-8.

Cot,M & Deloron P. 2003. Malaria during pregnancy: consequences and interventional perspectives. *Med Trop (Mars).* 2003;63(4-5):369-80.

Country watch (2004).

Daltveit, AK., Vollset SE, Skjaerven R, Irgens LM.(1999). Impact of multiple births and elective deliveries on the trends in low birth weight in Norway, 1967-1995. *Am J Epidemiol*. 1999 Jun 15;149(12):1128-33.

Dana, Hughes. & Lisa Simpson. (1995). The role of social change in prevention low birth weight. *the future of children*, vol. 5 No.1 spring pp. 2.

DELZELL, JOHN E and LEFEVRE, MICHAEL L. (2000).Urinary Tract Infections during Pregnancy, *American Family Physician* February 1, 2000.

Demographic statistic in Lao PDR .(1991).

Dickute J, Padaiga Z, Grabauskas V, Gaizauskiene A, Basys V, Obelenis V.2002. Do maternal social factors, health behavior and work conditions during pregnancy increase the risk of low birth weight in Lithuania?. *Medicina (Kaunas*). 2002;38 (3):321-32.

Donders,GG., J Desmyter, DH De Wet and FA Van Assche. (1993).The association of gonorrhoea and syphilis with premature birth and low birthweight. *Genitourinary Medicine*, Vol 69(2): 98-101.

Ehrenberg,HM., Dierker L, Milluzzi C, Mercer BM.(2003). Low maternal weight, failure to thrive in pregnancy, and adverse pregnancy outcomes. *Am J Obstet Gynecol*. 2003 Dec;189(6):1726-30.

Glob & Mail.(1994). Low birth weight at a Glance….*child &family CANADA*.

Harger,JH et al. (1990). Risk factors for preterm premature rupture of fetal membranes: a multicenter case-control study. *Am J Obstet Gynecol*, 163(1 pt1):130-7.

Hillier et al.(1999). Bacterial vaginosis. *Sexual transmitted disease*, 3rd edition: 563-586.

International notes update: incidence of low birth weight. *MMWR weekly*. Time, 17 August. 1984/33(32); 459-60, 465-7.

Iqbal, H et al.(1990). Breast-feeding, Infant Health and Child Survival in the Asia-Pacific Context. *Asia-pacific Population Journal*, Vol.5, No.1: 30.

Judith, E Brown., Maureen A Murtaugh, David R Jacobs, Jr and Helen C Margellos. (2002). Variation in newborn size according to pregnancy weight change by trimester .*American Journal of Clinical Nutrition*, Vol. 76, No. 1, 205-209, July 2002

Judith, Pojda & Laura Kelley .(2000). Low birth weight. *ACC/SCN Nutrition policy paper* No. 18.

Jurjus, A.R. (1995). Low birth weight in Lebanon: *a morphological parameter and a health status indicator,* volum.1, issue.2:194-200.

Kapinlashrami, MC et al. (2000). Maternal risk factors as determinants of low birth weight among armed forces families. *Medical Journal Armed forces India*, 56 (2):113-6.

Khor, GL.(2003).Update on the prevalence of malnutrition among children in Asia. *Nepal Med Coll J.* 2003 Dec;5(2):113-22.

Kleinman, JC and SS Kessel. September 17, 1987. Racial differences in low birth weight. Trends and risk factors. *The New England Journal of Medicine*, Volume 317:749-753. Number 12

Kramer, MS.(1987). Determinants of low birth weight: methodological assessment and meta-analysis. *Bull world health organ*,65 (5):663-737

Lao national statistic center/state planning committee, 2003.

Lopez, NJ., smith PC, Gutierrez J. (2002). Periodontal therapy may reduce the risk of preterm low birth weight in women with periodontal disease: a randomized controlled trial. *J periodontal*, 73(8):991-24.

Lu, TH et al.(2003). Demographic characteristics and trends in the prevalence of low birth weight from singleton pregnancies in Taiwan, 1978-1997. *J Formos Med Assoc*. 102 (5): 313-8.

Lum,CM & Wong SF. (2002). Risk factor for preterm delivery in women with placenta previa and antepartum haemorrhage: retrospective study. *Hongkong Med Journal*, 8 (3), pp.163-6.

Luxemburge, C., McGready R, Kham A, Morison L, Cho T, Chongsuphajaisiddhi T, white NJ, Nosten F.(2001). Effect of Malaria during pregnancy on infant morta in an area of low malaria transmission. *Am J Epidemiol*, 154 (5):459-65.

MacDorman, M., et al. Annual Summary of Vital Statistics: 2001. *Pediatrics*, volume 110, number 6, December 2002, pages 1037-1052.

Mansour, E., Eissa AN, Nofal LM, Kharboush I, Wagida A, Sallam I.(2002). Incidence and Factors Leading toLow Birth Weight in *Egypt.international pediatrics*,vol.17,No.4: 223-229.

Maureen Hack, M.B., Ch.B., Daniel J. Flannery, Mark Schluchter, Lydia Cartar, M.A., Elaine Borawski, and Nancy Klein. (2002).Outcomes in Young Adulthood for Very-Low-Birth-Weight Infants. *new England journal of medicine*, No.347, volume.2 :141.

McCance, D J Pettitt, R L Hanson, L T H Jacobsson, W C Knowler, P H Bennett . (1994). Birth weight and non-insulin dependent diabetes: thrifty genotype, thrifty phenotype, or surviving small baby genotype?. *BMJ* 1994;308:942-945 (9 April).

Mercedes de Onis.(2001). Intrauterine growth retardation. Health and nutrition *emerging and reemerging issue in developing countries*, brief 6 of 11.

Ministry of health in Lao PDR. (2001). Activity in third trimester of year 2000.

Misra, DP., Nguyen RH. (1999). Environmental tobacco smoke and low birth weight: a hazard in the workplace?. *Environ Health Perspect*. 1999 Dec;107 Suppl 6:897-904.

Nancy, E. Reichman and Deanna L. Pagnini.(1997). Maternal Age and Birth Outcomes: Data from New Jersey. *Family planning perspective*, Volume 29, No. 6, November/December 1997: 268–272 & 295.

Nath, G et al. (1996). Urinary tract infection during pregnancy and fetal outcome. *Indian journal of medical microbiology*, 14(3):158-60.

National health survey. (2001). Health status of the people in Lao PDR: 37-74

National Statistical Center/State Planning Committee.2003. LAO PDR"Sub-regional Mortality Level in Lao PDR". Concluding WorkshopRETA 6007: *Enhancing Social and Gender Statistics* 24-27 June 2003 Bangkok, Thailand:10.

Naya, S et al. (1994). Maternal determinants of low birth weight in rural area of Wardha. *Indian journal of maternal and child health*,5(3):80-2.

Parker B, McFarlane J, Soeken K. 1994. Abuse during pregnancy: effects on maternal complications and birth weight in adult and teenage women. Obstet Gynecol. 1994 Sep;84(3):323-8.

Pierre, Buekens., Francis Notzon, Milton Kotelchuck and Allen Wilcox. (2000).Why Do Mexican Americans Give Birth to Few Low-Birth-Weight Infants?. *American Journal of Epidemiology* Vol. 152, No. 4 : 347-351.

Rana, DIGBIJAYA SHAMSHER J.B.(1993). Low birth weight babies: a case-control study of maternal risk factors in a Bangkok maternity hospital. *Thesis in Mahidol university*.

Rechel, M. Schwartz. (1989). What price prematurity?. *Family planning perspectives*, vol.21, no.4: 170-174.

Report of a Meeting Baltimore, Maryland.(1999). *Reducing Perinatal and Neonatal Mortality*, Volume 3 Number 1.

Report on population and poverty in the Lao PDR. 2002. Presented in the 5th conference on population and poverty in the Asia pacific region Bangkok, Thailand 11-17 December 2002.

Rogers I, Emmett P, Ness A, Golding J.2004. Maternal fish intake in late pregnancy and the frequency of low birth weight and intrauterine growth retardation in a cohort of British infants. *J.EpidemiolCommunityHealth*.2004Jun;58(6):486-92.

Schieve, LA., Handler A, Hershow R, Persky V, Davis F. (1994).Urinary tract infection during pregnancy: its association with maternal morbidity and perinatal outcome. *Am J Public Health*, 84(3):405-10.

Silva, A.A.M., M.A. Barbieri, U.A. Gomes, & H. Bettiol. 1998.Trends in low birth weight: a comparison of two birth cohorts separated by a 15-year interval in Ribeirไo Preto, Brazil *Bulletin of the World Health Organization*,Volume 76, Number 1, 1998

Sohely, Yasmin., David Osrin, Elizabeth Paul, & Anthony Costello. (2001).Neonatal mortality of low-birth-weight infants in Bangladesh. *Bulletin of the World Health Organization*, 79 (7):611.

Steven et al. (1996). Periodontal infection as a possible risk factor for preterm low birth weight. *J periodontal*, vol.67, No. 10:1103-1113.

Strufaldi, MW., Puccini RF, Pedroso GC, da Silva EM, da Silva NN.(2003). Prevalence of malnutrition among children in Embu, Sao Paulo State, Brazil, 1996-1997. *Cad Saude Publica*. 2003 Mar-Apr;19(2):421-8. Epub 2003 May 15.

Taha, T.E. et al.(1995). Distribution and determinants of low birth weight in central Sudan. *Pediatric and perinatal epidemiology*, V.9 (2)pp. 185-200.

Teitelman, AM., Welch LS, Hellenbrand KG, Bracken MB. 1990.Effect of maternal work activity on preterm birth and low birth weight. *Am J Epidemiol*. 1990 Jan;131(1):104-13.

The World Fact Book (2004).

Thongsong, Theera. (1998). Urinary tract infection in pregnant women, physiology of fetal. Fourth edition Obstetric Book, department of Obstetric & Gynecology Faculty of Medicine Chiang Mai University.

Ticconi, C., Mapfumo M, Dorrucci M, Naha N, Tarira E, Pietropolli A, Rezza G. (2003). Effect of maternal HIV and malaria infection on pregnancy and perinatal outcome in Zimbabwe. *J Acquir Immune Defic Syndr*. 2003 Nov 1;34(3):289-94.

Uncu, Y., Uncu G, Esmer A, Bilgel N.2002. Should asymptomatic bacteriuria be screened in pregnancy?. *Clin Exp Obstet Gynecol*. 2002;29(4):281-5.

UNFPA .(2001).*Lao reproductive health survey* (2000).

UNFPA. improve maternal health and ARH. *Lao PDR Annual report 2001*.

UNV-Lao PDR. Lao PDR overview.

Vermont Department of Health (1997).

Vik, T., Bakketeig LS, Trygg KU, Lund-Larsen K, Jacobsen G.2003. High caffeine consumption in the third trimester of pregnancy: gender-specific effects on fetal growth. *Paediatr Perinat Epidemiol*.2003Oct;17(4):324-31.

Wanapirak, Chanane. (1998). Preterm labor and preterm birth, premature rupture of membrane. Fourth edition Obstetric Book, department of Obstetric & Gynecology Faculty of Medicine Chiang Mai University.

Wannous, S& S. Arous.(2001). Incidence and determinants of low birth weight in Syrian government hospitals. *Eastern Mediterranean Health Journal*, Volume 7, No.6:966-974.

Wells, Chris.,Erin K. Murray.2003. Weight Gain during Pregnancy: Colorado Pregnancy Risk Assessment Monitoring System (PRAMS), 1997-2000. *Health watch*, March 2003 No. 51, pp 01.

WHO.(2001). Lao people democratic republic, country health situation and trends. *Country health profiles*.

Women's Health Data Book (2002).

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Map of Lao PDR