The University of Tampere
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WORKING IN PREGNANCY AND BIRTH OUTCOME

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Masters Thesis
Tampere School of Public health
University of Tampere, Finland
December, 2007

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LIST OF ABBREVIATION

CI	Confidence Interval
ELF	Extremely low frequency
ILO	International labor organization
IUGR	Intrauterine growth restriction
KAP	Knowledge attitude and practice
LBW	Low birth weight
OR	Odd ratios
SGA	Small gestational age
SIDS	Sudden infant death syndrome
UNICEF	United Nations international children's emergency fund
VDU	Video display unit
VLF	Very low frequency
WHO	World health organization

ABSTRACT
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Master of Health Science (Public health) Thesis
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December 2007

Background
The weight of an infant at birth is an important determinant of its survival and future health, growth and development. Birth weight is greatly influenced by the health, nutritional status, and lifestyle of the mother. Although maternal workload during pregnancy is considered as the risk factor for the birth weight and health of child, the manner and amount of load is poorly understood. In this study, maternal working, its load and status during pregnancy are examined for pregnancy outcome.

Aim
The aim of the study was to examine the relationship between maternal work during the time of pregnancy and birth outcome.

Methods
This study is based on a large prenatal care interventional study, which was conducted at 20 townships of rural China in 1999. The KAP (Knowledge, Attitude and Practices) survey was done to evaluate the intervention. All women who gave birth within 12 months of the three interview periods from 2000 to 2003 in 20 townships completed the KAP survey. During that time, about 1479 women gave birth according to the records kept by the local family planning system. The interview was conducted at the respondent's home and was based on a structured questionnaire. Three per cent of the sample was missed (refused, were out of village, for other reasons). Women with dead infants were not approached for interviews. This study analyzed only the relation of maternal workload during pregnancy to the birth outcome. Maternal age, parity and prenatal care were treated as potential confounder to study the relationship of maternal work and birth outcome.

Results
In newborns of women working less heavily, is significantly associated ($p<0.01$) with the birth weight more than 2750gm. After the adjustments with parity, maternal age and prenatal visits, maternal work during pregnancy has seems various (both positive and negative) effects on pregnancy outcome. Stopped to do either of the work have risk of having low birth weight (≤2750gm). Women of stopped group have low risk of having preterm birth, but have high risk of having cesarean delivery. Working less heavily or stopped seems to be positively impacted to the birth of healthy child.

Conclusions
Several studies have concluded that maternal work during pregnancy is associated to the higher birth weight and good health status of the child, but heavy work up to the nine month of the pregnancy might be harmful. The results of this study suggest that working less heavily during the time of pregnancy has only small risk of giving the birth of low weight child. Likewise, reduction in both household and outside work or stopped to do of the work has high risk of having preterm birth and cesarean delivery. Small reduction or working same as before, in either of the work associated with the birth of healthy child.

Key words
Pregnancy, Occupational work, birth outcomes, developing country

1. INTRODUCTION

In most developed countries, pregnancies are planned, complications are few and outcomes are generally favorable for both mother and infant. Adverse outcomes are far more frequent in the developing world. The most severe adverse outcome of pregnancy is the death of the mother or her offspring. Maternal death has become an extremely rare event in the developed world, with many countries reporting maternal mortality ratios of 5–10 per 100,000 live births. In the least developed countries, the ratios are 100 times higher (Rosen field, A. & Maine, D., 1985; Abou Zhar, C. & Wardlaw, T. 2001). Disparities in infant deaths are not quite as wide but remain substantial, ranging from 4–5 to >100 per 1000 live births (Save the Children. (2001; United Nations Children's Fund. The State of the World's Children 2003,). Wide disparities probably also exist in the rate of late fetal deaths (stillbirths), although fetal deaths in developing countries are grossly underreported (Lumbiganon, P et al.1990; McCaw-Binns, et al. 1996). Even if both the mother and infant survive, pregnancy complications or problems at delivery or during the neonatal period can lead to severe maternal or infant morbidity (Stones, W et al. 1991; Page, J. M., et al.1993).

The weight of an infant at birth is an important determinant of its survival and future health, growth and development. Birth weight is greatly influenced by the health, nutritional status and lifestyle of the mother. Poor nutrition before and during pregnancy, cigarette smoking and short maternal stature are well established as major determinants of low birth weight in both developed and developing countries (Kramer MS, 1987). Although maternal workload during pregnancy is considered as the risk factor for the birth weight and health of child, the manner and amount of load is poorly understood. In this study, maternal working load and status during pregnacy were examined for pregnancy outcome.

For the most part, previous studies investigated the effect of work activity on birth weight alone. In addition, the effects of mother’s occupation during pregnancy to the child have been widely studied, but the results have been inconclusive, with a deleterious effect being found in some studies. (Barnes DL et al. 1991; Tafari N et al. 1980; Roberts S et al. 1982; Bantije H 1983; Launer LJ et al. 1990; Alegre A et al. 1984;

Saurel-Cubizolles MJ et al 1985; McDonald AD et al 1988;Homer CJ et al. 1990; Sanjose S et al. 1981-1984). Some have found that women's behaviors during pregnancy (Cigarette smoking, snuff use, illegal drug use and receipt of prenatal care) have important effects on her child's health at birth (Rosenzwing and Schultz 1983b; Corman, Joyce and Grossman 1987; Rosenzweing and wolpin 1991; Joyce, racine and Mocan 1992; Mocan and Topyan 1995; Grossman and Joyce 1990; Frank et al., 1992).

Defects in health or health status of a baby after birth may vary from country to country. Such differences may be due to ethnic difference in the community and to the varying socioeconomic status of pregnant women. The genetic factors and environmental factors may also contribute to birth defects. Occupation of women is also varying according to their ethnic characterizes. Those who involve in more physical work (outside work) are usually from low ethnic/socioeconomic status group. In addition, the household work may vary according to ethnic groups.

1.1. Trends in maternal work

Over the last several decades, the increasing proportion of mothers moving into employment has had substantial consequences for the everyday lives of families with children. Maternal employment adds to the financial resources available to families, and is often the only source of income for families headed by single mothers — although if childcare services are purchased and unsubsidized, they may offset a substantial percentage of low-wage mothers' earnings. Maternal employment rates for all mothers with children under age 18 increased steadily from 53 percent to 63 percent between 1980 and 1990. From 1990 to 1995, rates increased at a slower pace from 63 percent to 66 percent. This pattern of increasing maternal employment was evident for all mothers, regardless of the age of their children (Trends in the well-being of America's children and youth, 1997).

The study of the impact of maternal employment has traditionally focused on child outcomes. Women who work outside the home tend to be different in several respects from those who do not; they are healthier, less fertile, and more motivated (socially and financially) to work (Joffe M., 1985), although these trends are less clear in the developing world. Women with one or more past poor pregnancy outcomes are more

likely to stop working earlier in pregnancy, but are also more likely to be in the work place than those with successful births (Joffe M., 1985; Zuckerman B S et al., 1986).
Maternal employment is associated with improved maternal health (Hottman and Young blade 1999) and, through the additional income and the social and cognitive stimulation it provides the mother, may lead to more positive interactions with children (Parcl and Menaghan 1990; Klebanov, Brooks Gunn, and Duncan 1994; Wilson Elwood, and Brooks-Gunn 1995). This evidence suggests that the movement from welfare to work may lead to improvements in mothers parenting behaviour, except homemakers.
The potential for strain from the dual demands of work and childcare is particularly acute for Chinese women. Women labor force participation rates in china are among the highest in the world (United Nations 2000). The majority of Chinese women, including mothers of young children, continue to work. In urban China approximately 90% of women aged 25-44 years are in the labor force, and estimates run even higher in rural areas (Bauer et al. 1992). Women are also responsible for most domestic work, including childcare (Honig and Hershatter 1988; Jacka 1997).

1.2. Literature search

I started to seek some existing literature mostly by topic of my research. Specifically I found the relation between pregnant woman's occupation status and its direct effect on birth outcome.

The literature, which I have used here for this thesis, was searched from different sources through internet, books and printed journal of library catalogue. First I searched literatures in database of Library catalog of University of Tampere by looking at the books that we hold at the university. Searching then through printed journals by the subject areas and then carried out by key words, which are given below. Starting from Medline and Pubmed, two popular search engines in the health research. The literatures found were not enough and were not from rural areas of developing countries searched some literatures from the publications of WHO, which are related to women's work life and health. I found some literatures in the newsletter (Asian-Pacific and African) on occupational health and safety from Finnish Institute of Occupational Health. In

addition, I found few literatures from ILO's newsletter. I searched and found some literature from Google pages too.

Key words that I used to search literature through different search engines were;
Pregnancy, Occupational work, birth outcomes, developing country.

2. LITERATURE REVIEW

2.1. Employed or not: How heavy work?

The employment status of women of reproductive age (full or part-time employment, being a homemaker, or unemployment) may have specific implications for pregnancy. The findings of a number of European and American studies indicate that occupational work in pregnancy, if performed under conditions not strenuous or hazardous to health, does not constitute a health risk factor but may even have a positive social impact. This effect was found mostly due to more favorable patterns of risk factors in the former group (Launer LJ, et al., 1990; Saurel-Cubizolles MJ et al., 1991; Henriksen TB et al., 1994; Murphy JF et al., 1984). However, the results of at least one study (Saurel-Cubizolles MJ et al., 1991) showed that this relationship could not be explained either by the women's demographic, social or personal characteristics or by their access to the health care system during pregnancy.

Women generally do not shed their housekeeping and childbearing responsibilities when they enter the workforce. It has been suggested that married employed women work substantially more hours than their partners did did and that such an increased workload is associated with exhaustion and the more frequent use of mood modifying medications (Thompson, S., 1983). Data from Finland confirm the advantage that homemakers have over women employed in physically active jobs. Women in sedentary work (administrative, managerial and clerical) did not differ from homemakers but those in physically active jobs had higher rates of spontaneous abortion (Hemminki, K. et al., 1980).

By contrast, a series of other studies suggest that workers have pregnancy outcomes which do not differ from or are favorable than those of non-working women (Grisso, J. A. et al., 1986).

Studies of working conditions and pregnancy outcomes have not always identified the same working conditions as high risk and some studies have found no relation with preterm birth (Ahlborg G Jr, Bodin L, Hogstedt C 1990; Klebanoff MA, Shiono P, Carey JC, 1990; Fortier I, Marcoux S, Brisson J, 1995).

The study done in Pune, India (Rao S et. al) shows that, increased physical activity, as measured by work, in farming or gathering water, was associated with infants of low birth weight, smaller head circumference, smaller mid-arm circumference and lower placental weight. Interestingly, the biological mechanisms underlying an association between strenuous work during pregnancy and adverse reproductive outcome usually do not include nutritional explanations.

It has been suggested, in many studies that women who are employed have a lower risk of preterm birth than women who are not employed. (Saurel-Cubizolles MJ, Kaminski M., 1986; Marbury MC, Linn S, Monson RR, et al. 1984; Murphy JF, Dauncey M, Newcombe R, et al. 1984).

In a study (Bao Y et. al, 1999) incidence rate of pregnancy-induced hypertension, low birth weight, intrauteriane growth retardation and postpartum hemorrhage were found higher in the workers than that of the average social class levels women.

Studies in developing countries suggest that hard physical work during pregnancy has adverse effects on fetal growth (Tafari N et al, 1980; Manshade J et al, 1987; Launer L et al, 1990). In industrialized nations, standing (Naeye R et al, 1982; McDonald AD et al, 1988; Nurminen T et al, 1989) carrying or lifting heavy loads (McDonald AD et al, 1988), strenous physical effort (Saurel-Cubizolles M et al, 1987; Mamelle N et al, 1984; Homer CJ et al, 1990), work on assembly lines (Saurel-Cubizolles M et al, 1987) and industrial machine (Mamelle N et al, 1984) and some occupations that involves physical effort, such as chamber maid, janitor and hospital workers (Homer CJ et al, 1990; McDonald AD et al, 1988) have been associated with the delayed fetal growth, or preterm birth or both.

2.2. Shift work

Shift work, referring to hours of work occurring outside the regular daytime schedule, has been related to early fetal loss, preterm birth, and low birth weight (Nurminen T, 1998; Mozurkewich EL et al., 2000; Scott AJ et al., 2000). Working hour is also one of the prominent factor to be considered especially by the pregnant women to keep their body healthy alert because women work harder and longer. Some traditionally female

professions such as nursing often involve rotating shifts. Irregular working hours, especially rotating shifts, may disturb normal body functions. Moreover, women shifts workers may have to face stressful living conditions in relation to the time pressures determined by the irregular work schedules and their additional domestic duties, particularly for those married with children.

Pregnant women who work a night shift between 10 p.m. to 7 a.m. have a higher risk of delivering prematurely than women who work the same number of hours during the day. It also concluded, "Physically demanding work does not seem to be associated with adverse pregnancy outcomes ... [or] increase the risk of preterm delivery" (Pompeii et al., Obstetrics & Gynecology, 12/1). The study found that pregnant women who spend more than 30 hours per week on their feet or perform heavy lifting at least 13 times each week were at no more risk for preterm or small-for-gestational-age birth than other women participating in the study. Shift work, or work during irregular working hours, has been related to several health problems (Knutsson A, 2003; Nurminen T. 1998). Few studies have suggested on association between shift work and spontaneous abortion or fetal loss (Axelsson G et al. 1984; Hemminki k et al. 1985; McDonald AD et al. 1988).

The largest study from Denmark shows an increased risk of spontaneous abortion among workers with high demand and low control (Brandt Lp. 1992), but the results suggested that the association was biased, and 2 prospective studies indicate that stressful work is not associated with an increased risk of spontaneous abortion (Ahlborg G Jr. et al. 1990; Fenster L et al. 1995). Fixed night work showed a high-risk of late fetal loss, that is both late spontaneous abortion and stillbirth. Rotating shift work was not, associated with fetal loss. Job stress, as measured in this study, was in general not associated with late fetal loss. Frequent shift changes, for instance, may make it hard for pregnant women to get the proper rest. Another study involving more than 40,000 Danish women found that shift work might have an effect on duration of pregnancy and birth weights of babies. Researchers studied women who worked during the day, evening's nights, and those who worked rotating shifts. They found no statistically significant differences in the length of pregnancy or the birth weight of the baby among women when comparing all non-daytime shifts with those who worked only during the day. However, singling out night shift workers, they found a high risk of post-term birth;

fixed evening workers had a high risk of full-term low birth weight; and shift workers as a group showed a slight excess of low-weight babies (Zhu JL et al., 2003)

The researchers concluded, "Night work may prolong the duration of pregnancy and reduce fetal growth, especially among industrial workers". (http://lifework.arizona.edu/wsw/articles/nightshift.php).

2.3. What is known?

2.3.1. Impacts of working and outcomes

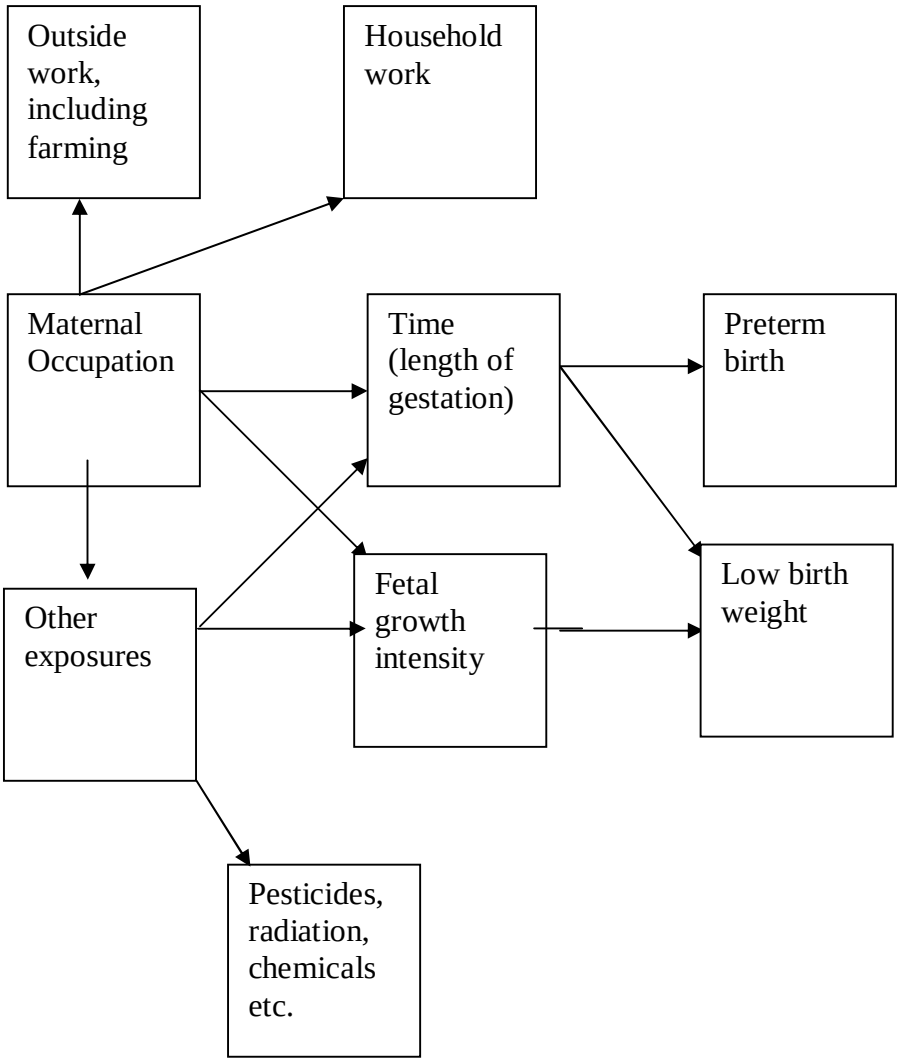
Table: - Review of studies examining relationship of maternal work and pregnancy outcome.

Author/year	Country/ sample size	Study design	Exposure	Results	Limitation
Papiernik and Kaminsky 1974	France 365	Case-control	Outside work	Protective for prematurity	No controls
Tafari et al. 1980	Ethiopia 130	Prospective cohort	Hard work Strenuous work Under- nutrition	Lowered birth weight Interaction of work and nutrition	Minimal controls, Restricted to term births
Naeye and Peters 1982	USA 7722	Case-control	Outside work, Standing work	Lowered birth weight, No effects on gestational age	No distinction of heavy and light labor, no data on household work
Berkowitz et al 1983	USA 388	Case-control	Physical exertion, Work posture Home activities, exercise	Exercise decreases risk of preterm delivery	
Alegre et al. 1984	Spain 1451	Retrospective cohort	Paid work during pregnancy, work through end of pregnancy	Lowered birth weight	Control for confounding by restriction may give unrepresentative sample
Mamelle et al. 1984	France 1928	Retrospective cohort	Occupational fatigue factors, fatigue score	Standing physical effort, increasing score decreases risk of preterm delivery	
Marbury et al. 1984	USA 7155	Retrospective cohort	Working during pregnancy	No effects on birth weight, gestational age	No data on activity level of occupation
Mc- Donald et al.	Canada 22761	Retrospective cohort	Occupation type, physical exertion	Increase in preterm and low	

			noise	birth weight infants	
Mayer and Daling 1985	USA 5822	Case- control	Usual occupational posture	No effects on birth weight	No data on actual activity during pregnancy
Zuckerman et al. 1986	USA 1690	Retrospective cohort	Standing work during third trimester	No effects on birth weight, gestational age	No home data
Homer et al. 1986	USA 2375	Historical cohort	Physical exertion of job category, amount worked during pregnancy	High physical exertion increases preterm delivery and low birth weight	
Marilia Lima et al. 1992	Brazil 958	Retrospective cohort	Heavy agricultural work over a period of at least 3 months, during second and third trimesters	Heavy agricultural work continued for 9 months reduced birth weight	
Hanke W. et al. 1996	Poland 1064	Retrospective cohort	Heavy physical work during pregnancy	Excessive risk of small for gestational age	Underestimated the work load
Eunhee Ha et al. 1996	China 1222	Prospective	Various work related physical activities during pregnancy	Prolonged standing resulted lower birth weight	
Adriana Schuler et al. 1997	Japan 2682	Case-control	Maternal leisure time physical activities or occupational activities during pregnancy	No significant association betweeen occupationa categories and pretem birth	Bias in seclection of subjects

2.3.2. Content of work and outcomes

Fig. 1 content of work and outcome



Maternal occupation is the important factor to be considered to have a healthy child during the time of pregnancy. One of the common maternal occupations in the developing world is farming among other outside work. Farming can be a dangerous business to mother. Every year, about half the worldwide 335,000-workplace fatalities occurs among agricultural workers. Millions more of the world's 1.3 billion agricultural workers suffer seriously injury in workplace accidents, or are poisoned by pesticides and other agro-chemicals each year. Together with mining and construction, agriculture is one of the three most hazardous industries, both in developing and industrialized countries (ILO, world of work, International labor conference 2000, no.35, July 2000)

Household work is the single largest category of work done by women in our society is that of unpaid work. Despite the increasing number of women who work for wages, approximately one third of married women in US are still full-time homemakers, and most wage-earning women are responsible for work in their own households. The exact number of paid household workers is very difficult to determine, however because much of this work is undocumented. Household work is thought of as “women’s work,” and is often not regarded as work at all.

Heavy maternal workload during pregnancy may reduce the growth intensity of fotes.

The biological mechanism, which underlies the length of gestaion from heavy working mother during pregnancy, also lets to preterm birth of low birthweight child. Occupational exposures like chemical hazards early in the pregnancy increase the risk to deliver offspring low birth weight as the chemical exposures reduce the fetal growth intensity.

2.4. Specific Exposures

The main area of concern in occupational reproductive toxicology is the workplace exposure to the mother during pregnancy and the likelihood of foetal abnormalities resulting from such exposures. Environmental pollutants are certainly responsible for some congenital defects (methyl mercury at Minamata Bay, japan). Other than radiation, the only occupational exposure known to carry a risk to the foetus is lead, which is known to cause spontaneous abortion and stillbirth. There is also some evidence that exposure to very high levels of lead during pregnancy may, if the foetus services, cause damage to the central nervous system.

Any jobs that expose pregnant women to substances proven harmful to a fetus, including pesticides, some cleaning solvents, lead and certain chemicals can be extremely dangerous. Industries that are considered potentially risky for pregnant women include farming, health care, some factory work, dry cleaners, printing, some craft business (such as painting and pottery glazing), highway jobs and electronic industry.

Healthcare workers may be exposed to other substances harmful to a developing baby, such as chemotherapy drugs, x-rays, organic mercury and other chemicals, as well as many viruses and bacteria.

Teacher and childcare providers are constantly exposed o many viruses and bacteria may be at risk. People in those professions can decrease their germ exposed through frequent hand washing. Likewise restaurant and bar workers who breathe in a lot of second hand smoke on the job may be putting their babies at risk (http://healthresources.caremark.com/topic/workpregnancy).

In Danish industries high estimated exposure events for carcinogens reproductive toxicants, allergens as well as neurotoxicants have been found in e.g. manufacture of fabricated metal products, personal services, cleaning and hair dressing (Brandorff et al. 1995).

2.4.1. Pesticides

Pesticides are designed to control pests, but they can also be toxic (poisonous) too desirable plants and animals, including humans. Some pesticides are so highly toxic that very small quantities can kill a person, while exposure to a sufficient amount of almost any pesticide can make a person ill.

Pesticides pose significant occupational health and environmental risk thought the world (WHO 1990, Forget 1991). Pesticides have been used since the early days of modern agriculture. They are biologically active compounds that may pose a grave risk to health during or after their use. Pesticide hazards are frequent and serve in developing countries, where pesticide use is widespread, pesticides banned elsewhere on account of their toxic carcinogenic or other properties may be used and agricultural workers together with health professionals may not be used adequately informed or trained in the reorganization and prevention of pesticide poisoning. Methods of reducing personal exposure, such as use of protective equipment, may not be available, accessible, affordable or even feasible (jeyaratnam et al. 1987; Forget 1991).

The working conditions in greenhouses might involve also indirect exposure to pesticides resulting from contact with flowers and vegetables previously treated with pesticides. While pesticides are extensively used on flowers to protect them against fungi and insects, with vegetables pesticides are used sporadically and main emphasis is on the use of biological agents.

Although pesticides are regularly used in agriculture, relatively little is know about possible adverse health effects, especially reproductive effects, due to the occupational exposure (Hanke and Jurewicz 2004). Several epidemiological studies conducted over the last two decades were focused on reproductive outcomes in populations exposed to pesticides. The analyses indicate that parental employment in agriculture could increase the risk of congenital malformations in the offspring, particularly such as musculoskeletal (Hemminki et al. 1980) and limb defects (Engel et al. 2000). The data on the effect of occupational exposure to pesticides on birth weight are inconsistent. Although most of epidemiological studies do not reveal a significantly increased risk of small-for-gestational-age birth (SGA), a slower pace of fetal development corresponding to SGA in the population of women exposed to pyrethroids has been recently reported (Hanke et al. 2003).

Occupational pesticide exposure levels can be higher than environmental exposure. Previous findings give indications of an increased risk for certain reproductive effects such as stillbirths, where as data on low birth weights have been inconsistent (Hanke et al. 2004). Occupational exposure to pesticides could also increase the risk for congenital malformations such as orofacial clefts, limb defects, musculoskeletal and nervous system defects (Garcia 1998; Hanke et al. 2004). However, no conclusion has been made due to limitation and controversial observations in the literature (Garcia 1998). Some studies also link paternal exposure to adverse pregnancy outcomes (Savitz et al. 2000; Ronda et al. 2003; regidor et al. 2004). While other studies show a negative association.

2.4.2. Radiation

Ionizing radiation, a form of electromagnetic radiation, penetrates tissues deeply and could alter the components of a living cell. Everyone is exposed to background radiation

from cosmic rays, soil, and air. Embryos usually receive less than 100 mrad during 9 months' gestation (Bentur Y., 2001).

Body tissues are easily penetrated by exposure to electromagnatic ionizing radiation, X-rays and gamma rays, and the exposure delivered to sexual organs and the fetus (Lindbohm et al 2000). Epidemiological studies have found maternal exposure to high levels of ionizing radiation in pregnancy to be associated with adverse pregnancy outcome such as congenital anomalies, growth retardation and mental retardation as indicated mainly from studies on survivors of the atomic bombs (De Santis et al 2005). Ionizing radiation from x-rays, to which health workers are exposed, can result in fetal deformity in the earliest weeks of pregnancy. Very large doses of radiation to the whole body can result in death. These effects have been observed in people exposed to radiation in a variety of situations including therapeutic x-rays, radiation accidents, and the Japanese A-bomb survivors.

Pregnant women who work may meet an environment, which may damage the fetus (Hansson, E. et al., 1980). Maternal exposure to ionizing radiation increases the risk of leukemia in the child (Delpizzo V., 1994). The production of estrogen in high dose increases the risk of vaginal cancer in the offspring. Many epidemiological studies have investigated the claim that works with video display units (VDU) is a risk factor during pregnancy (Delpizzo V., 1994). Results have been inconsistent, and in the majority of cases, the hypothesis was not supported. Overall, the studies indicate that VDU operators are not at greater risk than the general population, because very low frequency (VLF) magnetic fields do not appear to be a risk factor and extremely low frequency (ELF) magnetic field exposure is not significantly greater than that experienced in other occupational and residential environments (http://www.minerals.csiro.au).

2.4.3. Laboratory work

Laboratories constitute a diverse environment where numerous occupational hazards are present (Emery et al. 2005). Existing data on chemical exposure in laboratories have indicated that the foremost inhalation hazards are organic solvents such as benzene, toluene, xylene, ethers, dioxin and carbon disulfide, aldehydes such as formaldehyde and metal such as mercury (Dement et al. 1992).

Many laboratories analytical procedures are also involve “radio tracing”. Typical amounts of radioactive materials usually confer a risk for internal organ exposure through inhalation or ingestion (Emery et al. 2005).

The evidence on maternal laboratory work suggests an association with adverse pregnancy outcomes, although not conclusively (Dement et al. 1992). Maternal laboratory work has been related to spontaneous abortions (Standberg et al. 1978*;* Kolmodin-Hedman et al. 1979; Lindbohm et al.1984) in some studies, while negative results have also been reported (Heidam 1984). Furthermore, a slightly increased risk for spontaneous abortions have been found for women who reported to have worked with solvents in laboratories, but the difference was not significant *(*Axelsson et al. 1984). Work with organic solvents has been associated with preterm birth (Wennberg et al. 2002).

An increased risk for major malformations and preterm birth was also recently reported by Zhu et al 2005, for laboratory technicians specially working with radioimmuno assay or radiolabelling.

2.4.4. Physical and Psychological strain

Physical strain is one of the most common occupational hazards among women (Lindbohm et al., 2000). Physically demanding work and prolonged standing have been associated with adverse pregnancy outcomes such as preterm birth and or small gestational age (Mozurkewich et al., 2000). Shift work can disturb circadian rhythm leading to hormonal disturbances and may be associated with stress (Scft, 2000). Psychosocial factors during pregnancy are important predictors of birth weight and gestational age of the newborn. Measures should be taken to reduce the impact of these factors on the product of pregnancy. Epidemiological evidence suggests that maternal psychosocial stress, strenuous physical activity and fasting are independent risk factors for preterm birth and low birth weight. Data from clinical studies consistently demonstrate that women in preterm labor have significantly elevated levels of corticotrophin-releasing hormone compared with age-matched control subjects (Hobel C et al 2003).

A growing body of empirical evidence, based on methodologically rigorous studies of pregnant women of different ethnic, socioeconomic and cultural backgrounds, supports the premise that mothers experiencing high levels of psychological or social stress during pregnancy are at significantly increased risk for preterm birth, even after the effects of other risk factors are adjusted for (Hedegaard, M., et al 1993; Rini, C. K).

There is a growing interest in the health effects of psycho logic job stress itself (Lindbohm ML. 1999). The largest study from Denmark shows an increased risk of spontaneous abortion among workers with high demand and low control (Brandt Lp. 1992), but the results suggested that the association was biased, and 2 prospective studies indicate that stressful work is not associated with an increased risk of spontaneous abortion (Ahlborg G Jr. et al. 1990; Fenster L et al. 1995).et al., 1999; McLean, M., et al., 1995).

2.4.5. Biological agents

Among health care and childcare workers, infectious agents can lead to diseases such as toxoplasmosis, listeriosis, German measles (rubella), herps, chickenpox (varicella), hepatitis B and C, cytomegalovirus infection, parvovirus infection and HIV infection (Lindbohm et al., 2000). Such biological agents could be transmitted to the offspring in the utero or at delivery. Although the fetus is rarely infected (Ekblad 1995), a serious infection may lead to developmental outcomes such as spontaneous abortions fetal death, birth defects or preterm delivery (Gilbert 2002).

Women working in laboratory animals, butchery for sick animals, veterinary work, also work including handling of soil (gardening), living at farm are under the risk of getting negative health and pregnancy outcomes. Toxoplasm oocysts from cat feces, (cow blood or meat may contain oocysts too) which become contagions in 2 days in room temperature. Incidence of toxoplasmosis in the world among pregnant women is 0.24 to 0.54%. In Finland 20% of pregnant women seropositive and transmission to fetus in 50%. Congenital toxoplasmosis damages in brain, liver and spleen, later chorioretinitis, blindness, deafness, epilepsy etc. (Taskinen H, Finnish occupational health institute).
In the rural areas, farming of animals is quite common. Usually women are involving for the taking care of farmed animals like cow, buffalo, goat etc also other pet animals like cat dog etc. and they continue such work even the time of pregnancy. If pregnant

women are working with animals, then she has increased risk of acquiring infections from animals. While maintaining safe work procedures can reduce the risk of infection, special care must be taken to prevent infections that could have serious effects on fetal development. For example, cats may harbor Toxoplasma gondii while pregnant sheep may carry Chlamydia psittaci.

2.5. Definition of outcomes

When a pregnant woman continues to work, aspects of the work environment may be harmful to her fetus. The studies that have examined the relationship between work and pregnancy outcome have yielded conflicting results because of inconsistencies in how type of work was defined, what working conditions were assessed and whether psychosocial stress was included in the explanatory model (Saurel-Cubizolles, M. J, et. al., 1986; Launer, L. et al., 1990). High proportions of women in developing countries are in hard physical work during pregnancy. The biological basis for a harmful effect on heavy work pregnancy outcome has not been definitively identified. There are theoretical reasons, however, to believe that prolonged upright posture and strenuous physical work during pregnancy decrease uterine and placental blood flow, and that the resultant reduction in fetal supply of oxygen and nutrients restricts intrauterine growth. Increased maternal energy requirements for physical activity combined with low nutrient and energy intake may reduce the supply of nutrient to the fetus. (Hytten F, leitch I., 1971; Barnes DL, Adair LS, popkin BM., 1991).

2.5.1. Birth weight and prematurity

Birth weight is the weight of a baby at its birth. It has direct links with the gestational age at which the child was born and can be estimated during the pregnancy by measuring fundal height. It is a good indicator not only of a mother's health and nutritional status but also the newborn's chances for survival, growth, long-term health and psychological development (UNICEF, 2004) (http://www.childinfo.org/areas/birthweight).

Low birth weight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams (5.5 pounds). This is based on epidemiological

observations that infants weighting less than 2,500 g are approximately 20 times more likely to die than heavier babies are. More common in developing countries, a birth weight below 2,500 g contributes to a range of poor health outcomes (UNICEF, 2004). A baby's low birth weight is either the result of preterm birth (before 37 weeks of gestation) or of restricted fetal (intrauterine) growth. About 70% of all low birth weight babies are born preterm, before 37 completed weeks of pregnancy. The infants that weight less than 2500 g or less are at a greater risk of death within the first months of life, as well as increased risk for developmental disabilities and illness throughout their life. Life long problems include chronic lung disease, adult-onset diabetes, coronary heart disease, high blood pressure, intellectual, physical and sensory disabilities, and psychological and emotional distress. Very low birth weight infants are also at higher risk for SIDS or Sudden Infant Death Syndrome.

The prevalence of low birth weight is estimated to be 15% worldwide with a range of 3.3-38% and occurs mostly in developing countries. It is a multifaceted public health problem. Low birth weight is a major determinant of mortality, morbidity and disability in neonates, infancy and childhood and has long-term impact on health outcomes in adult life. Low birth weight results in substantial costs to the health sector and imposes a significant burden on the society as a whole. Maternal size and lifestyle also determine the size of the baby at birth (http://www.who.int/nutrition/topics/feto_maternal/en/index.html).

Despite the recognized importance of mortality and severe morbidity as measures of adverse pregnancy outcome, much of the published research in the area of adverse pregnancy outcomes, especially those outcomes related to maternal nutrition, are based on proxy outcomes for mortality and severe morbidity. The most commonly studied of these proxies have been low birth weight (LBW) (Save the Children. (2001), including its constituents, preterm birth and intrauterine growth restriction (IUGR).

2.5.2. Miscarriage

A miscarriage is that where a fetus aborts before 22 weeks of pregnancy. It is also known as spontaneous abortion. It is a common problem. About 15 percent of all known

pregnancies end in miscarriage. About half of all conceptions are also believed to be lost, normally before the mother is aware she is pregnant. Most miscarriages occur before the 13th week of pregnancy. Thirty percent of miscarriages that occur before the 8th week have no embryo inside the sac. Most women who have miscarriages have a high chance of having a healthy baby when they get pregnant again. However, about one percent of women will have repeated miscarriages and need medical intervention to identify the reasons for this. Women who have had two miscarriages in a row have a 35-40 percent chance of having another miscarriage. (http://www.medic8.com/healthguide/articles/miscarriage.html)

Spontaneous abortion is the termination of pregnancy without apparent cause, and stillbirth is the birth of a dead baby. The cause of most spontaneous abortions is fetal death due to fetal genetic abnormalities, usually unrelated to the mother. Other possible causes for spontaneous abortion include: infection, physical problems the mother may have, hormone (endocrine) factors, immune responses, and serious systematic diseases of the mother (such as diabetes or thyroid problems). It is estimated that upto 50% oa all fertilized eggs and are lost (aborted) spontaneously, usually before the women knows she is pregnant. Among known pregnancies, the rate of spontaneous abortion is approximately 10% and usually occurs between the 7^{th} and 12^{th} weeks of pregnancy. The risk for spontaneous abortion is higher over age 35, in women with systematic diseases, and women with a history of 3 or more prior spontaneous abortions (http://health.allrefer.com/health/abortion-spontaneous-info.html)

3. AIMS OF THE STUDY

3.1. Main Aims

The main aim of the study is to examine the relationship between maternal work during the time of pregnancy and birth outcome.

3.2 Specific Aims

The specific aims are as follows:

1) To examine whether the maternal work (being employed, outside and household work) during pregnancy correlated with the low birth weight of the child.

2) To examine the impacts of maternal work (being employed, outside and household work) during pregnancy on timing of birth.

3) To examine the relationship between maternal work (being employed, outside and household work) and the methods of delivery.

4) To examine whether the maternal work (being employed, outside and household work) in pregnancy correlate with good/bad health status of the child.

4. MATERIALS AND METHODS

4.1. Sources of Data

This study is based on a large study, which was conducted at 20 townships of rural China. The KAP (Knowledge, Attitude and Practices) survey was a cross-sectional study; it was done among the women who had given birth within 12 months during the period of 2001 to 2003 in the 20 township, after a prenatal care intervention. The data were collected for other purposes and used for this study with permission form the Researchers. Some details of the intervention programme are explained below.

4.1.1. Purpose of the Intervention

An interventional study with the purpose of getting the support and involvement of the local government, training to township midwives and coordinating township health and family planning sectors and offering community-based prenatal care education, was conducted by the researcher of family planning station among pregnancies between 1999 and 2003.
20 out of 55 townships were selected to study and paired for similar socio-economic, demographic condition and township health facility. Investigators themselves randomized the township into 10 interventional and 10 control groups by tossing coins.

The ethics committee of the National Research and Development Center approved the intervention for Welfare and Health, Helsinki, Finland.

4.2. KAP Survey

To evaluate the intervention programme, qualitative and quantitive surveys were carried out. The qualitative survey data included observation, meeting minutes, and interview and group discussion. The quantitative survey known as KAP (Knowledge, Attitudes and Practice) survey included a household survey of mother whose child was under one year old, taken both from experimental and control township. Interviews were prompted

by the end need to understand the variations in prenatal care utilization among the different township centers.

All women who gave birth within 12 months of the three interview periods from 2000 to 2003 in 20 townships completed the KAP survey. During that time, about 1400 women gave birth according to the records kept by the local family planning system. Each township was administratively divided into 6-15 villages. In 2001, 10 per cent of the villages and in 2002 an additional 20 per cent of Villages were randomly selected to be surveyed. The remaining 70% of villages from each township were surveyed in 2003. In the villages, the mothers of infants aged 0-12 months were identified according to lists provided by the family planning system and were asked to participate in the interviews. The interview was conducted at the respondent's home and was based on a structured questionnaire. If the woman was not at home at the time of the survey, the father or some other family member responded on her behalf. However, 90% of the respondents were the women themselves. Three per cent of the sample was missed (refused, were out of village, for other reasons). Women with dead infants were not approached for interviews.

Interviewers were recruited among the local health workers at the townships. Their training was conducted by a researcher (Wu Z) from Fudan University. The structured questionnaire used in the survey included 60 questions covering infant outcomes, women's knowledge, attitudes and practices relevant to prenatal, delivery and postnatal care and health, including infant care and breastfeeding.

4.3. Measurements of some study variables

Most of the variables, in this study, have been used after some adjustments to the original dataset. Indirect measurements of some of the variables are undertaken to such adjustment. The process how I have done the combinations of two variables to form a new single variable are shown below:

4.3.1. Prenatal Visits

The total number of prenatal visits by mother during pregnancy was calculated by summing all the visits. It includes her visits to the doctor/midwife at the township hospital; the doctor's/midwife's visits to her; her visits to other practioners including family planning worker; village health worker; other township practioner, private physician and country level hospital physician/obstetrician.

4.3.2. Timing of birth

Timing of birth in this study was not collected directly in numeric form (gestational age) during data collection. However, the variable has used with making certain changes that was unavoidable to determine whether the birth was at time or not. Women were asked of the time of their birth and the following options were provided:

Was your baby born?

1. much too early in comparison to expected time
2. somewhat too early in comparison to expected time
3. at expected time or close to it
4. after expected time

In translating the numeric form to compare the gestational age at birth, normal birth time was considered as 40 weeks. According to which much too early and some how early birth were considered as 36 weeks and 38 weeks respectively with late birth 42 weeks. The new variable thus made by the combination of first two responses in one category and called preterm birth. However, in general, preterm birth is the birth of infant before 37 weeks. Other two were remained same with the category name birth at expected time and late birth respectively.

4.3.3. Combined work

Data were not collected directly for this variable combined work. To form this variable was unavoidable because it describes the women's actual workload during pregnancy. Women who had been working outside the home were also working at home. This variable was made from the combination of following two variables. The responses were as follows:

Which of the following statements describes best your working outside the house (farming work in the fields or in paid work) during pregnancy?

1. I worked the same as before pregnancy.
2. I worked less heavily than before pregnancy from_____months.
3. I stopped working completely from_____months.

Which of the following statements describes best your own working in the house (cooking, washing, cleaning etc.) during pregnancy?

1. I worked the same as before pregnancy.
2. I did less heavy work at home starting from_____months of pregnancy.
3. I stopped working completely starting at_____months of pregnancy.

The new variable created from the combination of two variables of above is shown in fig 5 and 6 in the result section. I made the new variable with the following rationales.

1. Women who were working both of the work (household and outside) same as before pregnancy are put into 'no change' group.
2. Women who worked one of the work same as before and less heavily another work is put into the 'some reduction' group.
3. Women who reduced their both of the work less heavily are considered as 'notable reduction' group.
4. Women, who worked less heavily one of the works and stopped completely either or both of the work is put into the 'stopped' group.

4.3.4. Birth weight

Birth weight of all children in this study was not directly collected in numeric form. The women who had given the birth at home had not measured birth weight. Those birth weights were collected by following responses:

What was the birth weight of your baby? _____grams

If not known in grams, give estimate

1. Very small
2. Somewhat small
3. Ordinary
4. Somewhat large
5. Very large

Therefore, in translating the above information into the numeric form of birth weight, the investigators reached a consensus to suppose the very small birth weight is less than 2500gm. However, very small and somewhat small birth weights are placed under different group with birth weight less than or equal to 2750 gm. The rationale to put those weights into ≤2750gm group is that, there was very little number of births with the weight less than 2500gm also, since I was interested to the fetal growth not with exactly the low birth weight, the first category has contained the weight more than low birth weight (2500gm).

Ordinary birth weight was put into the weights (2751-2999) gm group, somewhat large was put into (3000-3499) gm group and very large birth weights were put into ≥3500gm group.

4.4. Analysis

Data analyses consisted of cross tabulation of the distribution of the exposures and outcomes with certain background characteristics. In cross tabulation I carried out the analysis of some of the variables to see the association of working during pregnancy to each of the outcome, and later with socio-demographic factors like parity, maternal age and prenatal care, which are treated, as potential confounders in this study. Exposures and outcome measures are presented as number as well as percentage. Binary logistic regression was used for analyzing timing of birth, methods of delivery, healthy at birth, and healthy after birth. Since most of the variables had more than two categories, multinomial logistic regression analysis was carried out to calculate odd ratios (ORs) and 95% confidence intervals (CIs) and p-valuses for dichotomous outcome parameters such as birth weight. Data analyses were implemented with statistical package for the social sciences/pc+ version 13 (spsswin13). Potential confounders such as mothers age, prenatal visits and parity, were included in models. Logistic regression analysis could not carry out for those data in which, women who worked less heavily or stopped form the certain month during the time pregnancy, because of the less number of subjects in some of the categories. Missing values were not included in the stastical analysis of the variables, since they were few in number.

Binaray dependent can be fitted in both the binary and multinomial logistic regression options of spss, with different options and output. Multinomial procedure wills aggegate

the data, yielding different goodness of fit test. To look at the effect of the independent variables on the odds of being in, say high birth weight group compared to the maternal work, respecify the reference category to be high birth weight group by reunning the regression after making the appropriate selection with the reference category.

By this reason, multinomial logistic regression could not carry out the odd ratios for the high birth weight group, since it was supposed as a reference category group in the dependent variables.

5. RESULTS

5.1. Mother's baseline characteristics

Baseline characteristics of mother are shown in table 1. Majority of the women are of age group 25-29, followed by age group of less or equal to 24. Mothers of age group 30 and above are about quarter. Almost all women had prenatal visits during the time of pregnancy. Majority of the women were premiparaous, which is about two third, while multiparous women who have three children are about only 15%.

Table 1: Mother's base line characteristics.

Characteristics	Categories	n	%
Mother's age	≤ 24	482	32.6
	25-29	573	38.7
	≥ 30	374	25.3
	No information	50	3.4
	Total	1479	100
Time of start of	3 mo or less	620	41.9
Prenatal care	4-5 mo	455	30.7
	6 mo	182	12.3
	7-9 mo	90	6.1
	No care[1]	132	9.0
	Total	1479	100.0
Parity	1	905	61.2
	2	338	22.9
	3	236	16
	Total	1479	100
Occupation	Farmer	1217	82.3
	Non-farmer	209	14.1
	No information	53	3.6
	Total	1479	100.0

[1] Includes with no care and non-response

Table 1 also shows the maternal occupation. Majority of the women are farmers, which is about 82%. Only less than 20% women are from different occupations, and are so called non-farmers.

Majority of the women are farmer. Most of them are age group 25-29 followed by age group 24 or less (see tables 12 and 13 in the appendix). Almost all farmer and non-farmer women had prenatal visits; a very insignificant number of women did not go for prenatal visits during the time of pregnancy. Majority of the women from farmer and non-farmer group are premiparous. Multiparous women having two child are also significant both in farmer and non- farmer.

5.2. Exposures:

Table 2:- Exposure Characteristics

Characteristics	Categories		n	%	Total %
Outside work	Same as before		444		30.0
	Less heavily	0-3 mo	483	32.7	
		4-6 mo	333	22.5	
		7-9 mo	57	3.9	
		Total	881	59.6	59.6
	Stopped	0-3 mo	83	5.6	
		4-6 mo	21	1.4	
		7-9 mo	48	3.2	
		Total	148	10.0	10.0
	No information		6	0.4	0.4
	Total		1479	100.00	100.00
Household work	Same as before		764	51.7	51.9
	Less heavily	0-3 mo	299	20.2	
		4-6 mo	246	16.6	
		7-9 mo	104	7.0	
		Total	653	44.2	44.2
	Stopped	0-3 mo	22	1.5	

		4-6 mo	7	0.5	
		7-9 mo	34	2.3	
		total	63	4.3	4.3
	No information		7	0.5	0.5
	Total		1479	100.00	100.00
Combined work	No change		418		28.3
	Some reduction		576		38.9
	Notable reduction		310		21.0
	Stopped		164		11.1
	No information		11		0.7
	Total		1479		100

5.2.1. Outside work

One of the major maternal exposures in this study is outside work. Out of 1479 women, almost one-third women had done the work same as before the time of pregnancy. It shows from the table (see table 2, 14, 15) that, majority of the mothers had done outside work less heavily during the time of pregnancy which is almost about two third, followed by other group of women who did work same as before pregnancy. About 1/3 of total women started to work less heavily from 0 to 3 months. More than 1/5 women started to work less heavily from 4 to 6 months and very insignificant number of women did less heavily from the month 7 to 9. Most of them are fallen in the maternal age group of 25-29 and are preimipara. Only 10% of the total women stopped their work from the certain months. About 6% stopped in early period from 0 to 3 months. Very few women stopped at 4 to 6 months and rests were stopped from 7 to 9 months.

5.2.2. Household work

More than half of the women continued their household works same as before pregnancy. The number of mothers who did their household work less heavily than before pregnancy were slightly small and very insignificant number of mother stopped their household work (see table 2, 14, 15). About 1/5 of women started to do work less

heavily from the months 0 to 3. More than 16% of the women started to work less heavily from the months 4 to 6, and a small number of women started to work less heavily at the last time of pregnancy, i.e. from 7 to 9. Those who stopped their household work during the time of pregnancy are very few for each of the group.

5.2.3. Combined work

Outside work and household work are the major exposures in this study. Out of 1479 women who worked outside, had also done household work. Table 5 and 6, are showing the changing of workload both from outside and household work. Four new categories have made from the cross tabulation of outside work and household work. More than ¼ women did not stop their work at all until 9 months of pregnancy. Some reduction either in outside, or household work or both, were about 39%. About 1/5 women notably reduced their workload. A small number of women stopped completely their work during the time of pregnancy.

About 42% of women who reduced their work (from the combined table) were of age group 24 years or less followed by women of same working group in different age group 25-29 yrs and 30 yrs or above respectively. Women who stopped to do the work were comparatively small in number for all age group. Almost 43% of the women who reduced the work during pregnancy had three Childs followed by one child group and two. Very insignificant number of women stopped their work during pregnancy have two Childs. Majority of the women had prenatal visits, and most of them started to prenatal visit early (i.e. ≤3 months) and they reduced their work too. Women of working group ‘no changed’ had started early visits and they are about one quarter and more than one third started visits very late (i.e. 7-9 months) in the same working group of women.

5.3. Outcome Variables

Birth weight, Healthy at birth, Healthy after birth, Timing of birth and Methods of delivery are the interest of outcomes in this study.

5.3.1. Birth weight

Table 3: **Distribution of the outcome by mother's age.**

Birth Wt.	**N (%)**	**Mother's age(n=1479)**		
		<=24(n=482)	**25-29 (n=573)**	**>=30(n=374)**
≤2750	65 (4.4)	21(4.5)	35(6.3)	21(5.7)
2751-2999	320 (21.6)	90(19.1)	127(22.9)	81(22.1)
3000-3499	491 (33.2)	179(38.1)	182(32.8)	110(30.1)
≥3500	565 (38.2)	180(38.2)	211(38.0)	154(42.1)
Missing	38(2.6)			
Total	1479 (100)	470(100)	555(100)	366(100)
Time of birth				
Preterm	291 (19.1)	85(18.0)	113(20.1)	83(22.5)
Expected time	994 (67.2)	328(69.3)	380(67.5)	255(69.1)
Late	166 (11.2)	60(12.7)	70(12.4)	31(8.4)
Total	1479 (100)	473(100)	563(100)	369(100)
Delivery methods				
Spontaneous	1226 (82.9)	398(83.3)	475(83.2)	311(83.6)
Assisted breech	39 (2.6)	10(2.1)	17(3.0)	12(3.2)
Cesarean	107 (7.2)	32(6.7)	43(7.5)	27(7.3)
Other	166 (11.2)	38(7.9)	36(6.3)	22(5.9)
Total	1479 (100)	478(100)	571(100)	372(100)
Healthy at birth				
Yes	1376 (93)	458(98.9)	525(96.7)	347(96.7)
No	36 (2.4)	5(1.1)	18(3.3)	12(3.3)
Total	1479 (100)	463(100)	543(100)	359(100)
Healthy after birth				
Yes	1379 (93.2)	457(95.4)	536(94)	341(91.2)
No	92 (6.2)	22(4.6)	22(4.6)	34(6)
Total	1479 (100)	479(100)	570(100)	374(100)

Distribution of outcome variables by maternal age is shown in above table 3. Majority of the women of 24 years or less gave the birth of higher weight child and only little number of women gave the birth of small weight child. This trend is almost same to other age group of women. Weight 3000-3499 and 3500 or above of child, are equal

among the mothers of age group 24 or less. Only the few number of Childs is of low birth weight for all age groups of women. Table 18 and 19 in the appendix are showing the distribution of the outcome variables with mothers' background characteristics parity and prenatal visits. Those women who did not go to the prenatal visits during her pregnancy have the child of normal birth weight i.e. (2751-2999) gm, but those who attended prenatal visits have children of high birth weight i.e. (≥ 3500gm). A very insignificant number of women had child of low birth weight whether they were in prenatal visits or not. Nearly half of the Childs are of high birth weight from the women who have three children, this trends is similar among other women having two or one child. A very insignificant number of children had low birth weight from the multiparous mother. From the above tables it could be said that, parity and prenatal visits are the potential confounders.

5.3.2. Timing of birth

Majority of the birth of the child were at expected time for the women of all age group. About 20% of birth were preterm birth from all age groups of women, late birth was comparatively low for all age group of women (see table 3 in the result and 18 and 19 in the Appendix). Preterm birth from the mother of age group 30 or above is significantly high in comparison to other group of women. Majority of the women who did not go to the prenatal visits during the time of pregnancy give the birth at expected time rather than who went to visit. Preterm and late birth is also comparatively high among the women who went to prenatal visits during the time of pregnancy. 3/5 of women gave birth at expected time, which has three children, but it is little high among mothers having two children. About ¼ preterm birth was taken place from the mother having three children, this value is low decreasing for the women having two and single child respectively. Late birth is also comparatively more among the women having three children.

5.3.3. Methods of Delivery

The delivery was Spontaneous in most of the mothers of all age groups. Assisted breech methods of delivery had experienced by very small number of women of all age group.

Cesarean and others methods of delivery were comparatively small among the women of all age group (see table 3 in the result and 18 and 19 in the Appendix). The spontaneous methods were also high for the women who did or did not go for prenatal visit. Assisted breech methods of delivery is comparatively low. Similar trends can also be observed in the women of different parity. The methods of assisted breech delivery are significantly low among the women having three children.

5.3.4. Health at birth and after birth

Almost all the Childs were healthy at birth and even after birth, from all the age groups of women (Table 3 in the result and 18 and 19 in the Appendix). Some of the Children from the mother of age group 30 or above were not healthy at birth; this number is high in comparison to the other groups of women. Those who did or did not go for the prenatal visit during delivery and the women of different parity had healthy child at and after birth. Only the very insignificant number of child had some problem with health at birth in total. Number of Child are more, who are not healthy after birth comparison to others.

5.4. Confounders

Three potential confounders, maternal age, prenatal visits and parity, were identified in this study. These confounders were than subsequently assessed to see their association to the exposure and outcome variables. Tables in the figure 1 shows the distribution of background characteristics, tables in the appendix, 3, 14 and 15, shows the distribution of the exposures by background characteristics (confounders); and table 18, 19 and 20 shows the distribution of outcome variables by confounders. From these tables it could be said that confounders have very small effects on birth outcome in this study. Although the effects of confounders was small, they were still included and adjusted in the logistic tables (bivariate and multivariate) to glance their minimum levels of effects

5.5. Relation between exposures and the outcomes

Table 4 in the result and 21 and 22 in the appendix, showing the distribution of the outcomes by exposures. The lowest birth weight was reported by the mother in five

children with birth weight 2000 gm and highest weight was reported in only one child and the weight was 6500 gm. High birth weight (≥ 3500) is measured significantly high among those women who stopped their work in a certain months of pregnancy. In the same way high birth weight i.e. weight 3500 or more, is also reported more among those who worked same as before pregnancy and who worked less heavily during pregnancy. Almost same trend is observed in household workers, for those who worked same as before and less heavily, but those who stopped their work in a certain month have high percentage of high birth weight, which is more than one half.

Most of the births were taken place at expected time, whether the women did same work as before as or less heavily than before or stopped. This is almost the same for outside and household work, but the number is comparatively small for those women who stopped their household work. About ¼, births were preterm birth in all working groups of women for both farming and household work. Late births were measured in small number of women for all working groups.

The result from the table 17 in the appendix shows that, most of the women are farmer, which is more than ¾, while others are non-farmers. Birth weight of the child from the women, who is farmer are mostly above or equal to 3500 gm, followed by (3000-3499) gm which is also high in non-farmers. Low birth weight is comparatively low in non-farmers. Most of the birth had taken at the expected time for both farmers and non-farmers women. The number of preterm birth is little high among non-farmers but late birth was observed less in both farmers and non-farmers.

Table 4: The distribution of the outcome by exposures (Outside work and Household work).

Birth Wt.	**N (%)**	**Outside work**			**Household work**		
		Same as before (n=444)%	**Less heavily (n=881)%**	**Stopped (n=148)%**	**Same as before (n=764)%**	**Less heavily (n=653)%**	**Stopped (n=55)%**
≤2750	65 (4.4)	29 (6.6)	36 (4.2)	13 (9.0)	46 (6.1)	28 (4.5)	4 (7.4)
2751-2999	320 (21.6)	107 (24.4)	169(19.8)	31 (21.4)	185 (24.6)	111 (17.7)	10 (18.5)
3000-3499	491 (33.2)	132 (30.1)	319 (37.4)	40 (27.6)	239 (31.8)	240 (38.2)	10 (18.5)
≥3500	565 (38.2)	171 (39.0)	328 (38.5)	61 (42.1)	282 (37.5)	249 (39.6)	30 (55.6)

Total	1479 (100)	439 (100)	852 (100)	145 (100)	752 (100)	628 (100)	54 (100)
Time of birth							
Preterm	291 (19.1)	98 (22.1)	163 (19.1)	28 (19)	154 (20.4)	122 (19.2)	14 (25.9)
Expected time	994 (67.2)	304 (68.6)	579 (67.7)	107 (72.8)	524 (69.3)	433 (68.3)	32 (59.3)
Late	166 (11.2)	41 (9.3)	113 (13.2)	12 (8.2)	78 (10.3)	79 (12.5)	8 (14.8)
Total	1479 (100)	443 (100)	855 (100)	147 (100)	756 (100)	634 (100)	54 (100)
Delivery methods							
Spontaneous	1226(82.9)	381 (86.4)	720 (82.1)	120 (81.6)	642(84.5)	532(82)	46(83.6)
Assisted breech	39 (2.6)	13(2.9)	23(2.6)	3(2)	23(3)	14(2.2)	2(3.6)
Cesarean	107 (7.2)	21(4.8)	71(8.1)	15(10.2)	47(6.2)	56(8.6)	4(7.3)
Other	99 (6.7)	26(5.9)	63(7.2)	9(6.1)	48(6.3)	47(7.2)	3(5.5)
Total	1479 (100)	441(100)	877(100)	147(100)	760(100)	649(100)	55(100)
Healthy at birth							
Yes	1376 (93)	418(97.4)	810(97.5)	142(97.3)	717(97.2)	600(97.9)	52(96.3)
No	36 (2.4)	11(2.6)	21(2.5)	4(2.7)	21(2.8)	13(2.1)	2(3.7)
Total	1479 (100)	429(100)	831(100)	146(100)	738(100)	613(100)	54(100)
Healthy after birth							
Yes	1379(93.2)	410(92.8)	830(94.9)	133(89.9)	704(92.9)	617(94.8)	51(92.7)
No	92 (6.2)	32(7.2)	45(5.1)	15(10.1)	54(7.1)	34(5.2)	4(7.3)
Total	1479 (100)	442(100)	875(100)	148(100)	758(100)	651(100)	55(100)

Relatively, all the category of women whether they worked heavily, reduction in work, notable reduction or stopped, had more numbers of high birth weights in their children, which is about 38 to 42%. Those who stopped completely their work have little high in number of low birth weight compared to other categories.

Table 5:- Distribution of the exposure (outside work by household work)

	Outside work (n=1479)		
Household work (n=1479)	**Same as before**	**Less heavily**	**Stopped**

Same as before	418 (94.1)	287 (32.7)	56 (38.1)
Less heavily	23 (5.2)	576 (65.7)	53 (36.1)
Stopped	3 (0.7)	14 (1.6)	38 (25.9)
Total	444 (100)	877 (100)	147 (100)

Table 6:- Distribution of the exposure (combination of the outside and household work)

Characteristics	**n**	**%**
No changed	418	28.3
Some reduction	576	38.9
Notable reduction	310	21.0
Stopped	164	11.1
No information	11	0.7
Total	1479	100

Table 7:- Distribution of outcomes by the combined exposure (both outside and household work).

		Maternal Work			
Birth weight	**n=1479**	**No change, n=418**	**Some reduction n=310**	**Notable reduction n=576**	**Stopped n=164**
≤2750	78 (5.3)	26 (6.3)	17 (5.6)	22 (4.0)	13 (8.1)
2751-2999	308 (20.8)	106 (25.6)	69 (22.8)	98 (17.7)	33 (20.5)
3000-3499	492 (33.3)	124 (30.0)	102 (33.8)	216 (39.0)	46 (28.6)
≥3500	563 (38.1)	158 (38.2)	114 (37.7)	218 (39.4)	69 (42.9)
Total	1479 (100)	414 (100)	302 (100)	554 (100)	161 (100)
Time of birth					
Preterm	291 (19.1)	88 (21.1)	61 (20.1)	104 (18.7)	35 (21.6)
Expected time	994 (67.2)	289 (69.3)	206 (67.8)	379 (68.0)	113 (69.8)
Late	166 (11.2)	40 (9.6)	37(12.2)	74 (13.3)	14 (8.6)
Total	1479 (100)	417 (100)	304 (100)	557 (100)	162 (100)
Delivery methods					

Spontaneous	1226 (82.9)	358 (86.3)	258 (83.5)	468 (81.7)	133 (81.6)
Assisted breech	39 (2.6)	13 (3.1)	9 (2.9)	13 (2.3)	4 (2.5)
Cesarean	107 (7.2)	20 (4.8)	20 (6.5)	50 (8.7)	17 (10.4)
Other	166 (11.2)	24 (5.8)	22 (7.1)	42 (7.3)	9 (5.5)
Total	1479 (100)	415 (100)	309 (100)	573 (100)	163 8100)
Healthy at birth					
Yes	1376 (93)	393 (97.5)	290 (96.3)	525 (97.9)	157 (97.5)
No	36 (2.4)	10 (2.5)	11(3.7)	11(2.1)	4 (2.5)
Total	1479 (100)	403 (100)	301 (100)	536 (100)	161 (100)
Healthy after birth					
Yes	1379 (93.2)	385 (92.5)	288 (94.1)	546 (95.1)	149 (90.9)
No	92 (6.2)	31 (7.5)	18 (5.9)	28 (4.9)	15 (9.1)
Total	1479 (100)	416 (100)	306 (100)	574 (100)	164 (100)

There were 69 newborns (42.9%) with heavy birth weights (≥3500) as shown in table 7. Prevalence of low birth weight was the lowest (4.0%) among the newborns of women who had notable reduction at work and the highest (8.1%) among the newborns of women who stopped their work at certain time during pregnancy and second highest among the newborns of women who did not change at work during pregnancy. Birth were mostly at expected time, but preterm birth were more among the newborns of mother who stopped the work and the lowest preterm birth was reported by the newborns of mothers who had notable reduction at work.

5.5.1. Maternal work and birth weight

Working less heavily inside home (household work) during the time of pregnancy is significantly associated (P<0.01) with the birth weight (2751-2999) gm of child, compared to mothers who worked same as before pregnancy. Stopping to do the household work during the time of pregnancy is more likely to have low birth weight (≤2750) gm. In clear term, the results from this study show that, women who worked less heavily (Household or outside or combined work) and other who worked same as before during the time of pregnancy have higher probability of giving higher birth weight child. Hence, the impact of maternal work on birth weight is a function of increased risk for higher birth weight. Heavier the work during pregnancy more likely to

give birth of higher weight child and vice-versa. Working outside home (outside work) had no significant association with the birth weight, but heavier the work during the time of pregnancy has higher probability of giving birth, child of higher weight.

5.5.2. Birth weight – distribution by outside and household work

Table 23 and table 24 in the appendix, are showing the distributions of maternal outside work and household work by birth weight. Women who worked less heavily during the time of pregnancy have only small risk of giving the birth of low weight child compared to those who worked same as before. Women who stopped their work have higher risk of giving birth of 2750 gm or less weighted child as compared to those who worked same as before pregnancy. In the same vein, women who worked less heavily have high risk of giving birth of weighted (2751-2999)gm and (3000-3499)gm than the stopped group compared to those who worked same as before, but non of them are statistically significant. Almost same trend is observed for the household workers women. Women who worked less heavily have lower risk of having 2750 gm or less weight child but higher risk of having (2751-2999) gm and (3000-3499) gm of child than those who stopped their work as compared to the women who worked same as before pregnancy. It seems that working less heavily during the time of pregnancy is significantly associated to have child of birth weight (2751-2999) gm, compared to those who worked same as before. Also in the same way, women who stopped their work during the time of pregnancy are significantly associated to have child of birth weight (3000-3499) gm, compared to those who worked same as before.

5.5.3. Birth weight – distribution by combined work

Unadjusted and adjusted logistic regressions are shown in the table 8 for the association of the maternal work (combined) and birth weight of the child. Women who have reduction in work during the time of pregnancy have 0.90 fold of risk of having child of birth weight 2750gm or less compared to those who did not change in their work. Women of the stopped group have higher risk of having child of birth weight 2750 or less, but lower risk for notable reduction group of women, compared to those who did their work same as before pregnancy. Although women who have reduction in work,

notable reduction and stopped work have increased risk of having child of birth weight (2751-2999) gm, compared to women of working same as before pregnancy, only the notable reduction group is statistically significant. Notable reduction group of women have highest risk of having child of birth weight (3000-3499) gm, compared to no changed group of women but not statistically significant.

Table 8:- OR (95% CI) and *P*-values of birth weight by combined work.

Birth weight[2]	**N=1479**	**same as before**	**% of some reduction OR (CI)**	**P-value**	**% of notable reduction OR (95% CI)**	**P-value**	**% of stopped OR (95% CI)**	**P-value**
≤2750	78	6.3	4.0		5.6		8.1	
Unadjusted		1.00	0.90 (0.47-1.74)	0.89	0.61 (0.33-1.12)	0.12	1.14 (0.55-2.36)	0.79
Adjusted [3]		1.00	0.95 (0.49-1.85)	0.84	0.61 (0.33-1.14)	0.10	1.10 (0.52-2.31)	0.80
2751-2999	307	25.6	17.7		22.8		20.5	
Unadjusted		1.00	0.90 (0.61-1.32)	0.60	0.67 (0.47-0.94)	0.02	0.71 (0.44-1.15)	0.16
Adjusted		1.00	0.94 (0.62-1.41)	0.77	0.71 (0.50-1.03)	0.07	0.66 (0.39-1.09)	0.10
3000-3499	491	30.0	39.0		33.8		28.6	
Unadjusted		1.00	1.14 (0.79-1.62)	0.47	1.26 (0.93-1.70)	0.12	0.84 (0.54-1.32)	0.46
Adjusted		1.00	1.16 (0.80-1.68)	0.42	1.17 (0.85-1.60)	0.32	0.80 (0.51-1.25)	0.34

5.5.4. Maternal work and timing of birth

[2] Birth weight group ≥3500gm is reference for the dependent variable in multinomial logistic regression model

[3] All adjusted regression analysis, were controlled for the maternal age, prenatal visits and parity

Tables 25 and 26 in the appendix, respectively showing the distribution of working habits (outside and household work) and timing of birth, with their respective odd ratios before and after adjustments.

Mothers who worked less heavily during the time of pregnancy have 1.20 risk of having preterm birth. Those who stopped their work during the time of pregnancy have also the same probability of giving preterm birth (odd ratio 1.20) with those who worked less heavily during the time of pregnancy compared to those who worked same as before. In the other word, women working same as before pregnancy have small risk of having preterm birth, although the values are statistically insignificant.

In the second table, women who worked less heavily during the time of pregnancy have small risk of having preterm birth compared to those who worked same as before, but it is statistically insignificant. Women who stopped their work have 0.73 fold of risk of giving preterm birth, compared to those who worked same as before, but it is still statistically insignificant. It means that women who stopped to do household work are more likely to have preterm birth. There seems almost no effect of confounders, after adjustment, less heavily workers has reduced their risk of having preterm birth by 4%.

5.5.5. Maternal work (combined) and timing of birth

The results for the association of the work and timing of birth are showing in the table 9 below. Some reduction group of women have 1.09 fold risk of giving preterm birth, compared to those who did work same as before, but none of the values are statistically significant. Mothers who stopped completely their work during the time of pregnancy are less likelihood to give preterm birth, compared to women who worked same as before. Those women who have some reduction at work and those who stopped to do work have more risk of having preterm birth compared to notable reduction group of women.

Table 9:- Percentage distribution of the timing of birth by combining of outside and household work with OR's, 95% CI and P-values.

	n=1479	**Combined work**			
Timing of birth		**% of same**	**% of some**	**% of**	**% of the**

		as before	reduction	notable reduction	stopped
Preterm	291	21.1	18.7	20.1	21.6
Expected time	994	69.3	68.0	67.8	69.8
Late	166	9.6	13.3	12.2	8.6
Total	1447	100	100	100	100
OR's for Preterm[4] (*unadj*)		1.00	1.09	1.20	1.03
CI			(0.68-1.75)	(0.78-1.84)	(0.66-1.60)
P-values			0.69	0.40	0.89
OR's for Preterm (*adj*)		1.00	1.20	1.27	1.12
CI			(0.74-1.94)	(0.82-1.98)	(0.71-1.77)
P-values			0.44	0.27	0.60

5.5.6. Maternal work and methods of delivery

The relationship between maternal work and methods of delivery is shown in the table 27 and 28 (appendix) with their respective odd ratios, 95% CI and p-values, respectively. The odd ratios in the table 27, is showing negative linear relationship between maternal outside work and methods of delivery. Lower the level of the work during the time of pregnancy more likelihood of having Cesarean delivery. Women who worked less heavily during the time of pregnancy have 0.56 fold risk of having Cesarean delivery compared to the women who worked same as before, which is statistically significant. Women who stopped to do work during pregnancy are more likely to have cesarean delivery, compared to women who worked less heavily. Nevertheless, in Table 28, women working less heavily inside home are more likely to have cesarean delivery.

5.5.7. Maternal work (combined) and methods of delivery

Table 10 shows the unadjusted and adjusted odd ratios for the association of the maternal work (combined) and methods of delivery. Women of notable reduction group have low probability of having cesarean delivery compared to the women who stopped

[4] For all regression analysis timing of birth has been categorized into two, preterm birth and non-preterm birth.

their work. Women who have some reduction at work during the time of pregnancy have high risk of having Cesarean delivery compared to those who had notable reduction at work. Here only the odd ratios for cesarean delivery for the women who stopped to work are highly significant.

Table 10:- Percentage distribution of the methods of delivery by combining of outside and household work with OR's, 95% CI and P-values.

Methods of delivery	**n=1479**	**work**			
		% of same as before	**% of some reduction**	**% of notable reduction**	**% of the stopped**
Spontaneous	1226	86.3	81.7	83.5	81.6
Assisted breech	39	3.1	2.3	2.9	2.5
Cesarean	107	4.8	8.7	6.5	10.4
Others	99	5.8	7.3	7.1	5.5
Total	1471	100	100	100	100
OR's for Cesarean[5] (*unadj*)		1.00	1.68	1.21	2.30
CI			(0.85-3.30)	(0.68-2.17)	(1.17-4.51)
P-values			0.13	0.50	0.01
OR's for Cesarean (*adj*)		1.00	1.63	1.27	2.55
CI			(0.82-3.23)	(0.70-2.30)	(1.26-5.15)
P-values			0.16	0.43	<0.01

5.5.8. Maternal work and health at birth and after birth

Tables 29 and 30 in the appendix, showing the percentage distribution and odd ratios for the health of child at birth and after birth. Less heavily, workers have almost no risk of having unhealthy child compared to stop group of women. Women who stopped their work have small probability of giving birth of unhealthy child, compared to those who worked same as before, but none of them is statistically significant. In the same table, women working same as before pregnancy are having less risk of getting unhealthy

[5] For all regression analysis, methods of delivery have been categorized into two, spontaneous and other, where other contains assisted breech, Cesarean and others methods of delivery.

child. Other group of women who stopped their work has higher probability of having healthy child after birth compared to those who worked same as before. Almost same trend is observed for household workers women; except for those who stopped their work during the time of pregnancy have almost same probability of having healthy child after birth with the group of women who worked same, as before, none of them is statistically significant.

Table 11:- Percentage distribution of the health at birth and after birth by working habit both outside and household work with OR's, 95% of CI and P-values.

n=1479	**work**			
Healthy at birth	**% of no change**	**% of reduction**	**% notable reduction**	**% of stopped**
Yes	1376	97.5	97.9	96.3	97.5
No	36	2.5	2.1	3.7	2.5
Total	1412	100	100	100	100
OR's for yes (*unadj*)		1.00	1.48	0.82	0.99
CI			(0.46-4.75)	(0.25-2.61)	(0.30-3.23)
P-values			0.50	0.74	0.99
OR's for yes (*adj*)		1.00	1.44	0.79	0.87
CI			(0.44-4.67)	(0.24-2.62)	(0.26-2.88)
P-values			0.54	0.71	0.82
Healthy after birth					
Yes	1379	92.5	94.1	95.1	90.9
No	92	7.5	5.9	4.9	9.1
Total	1471	100	100	100	100
OR's for yes (*unadj*)		1.00	0.50	0.62	0.80
CI			(0.26-0.97)	(0.30-1.26)	(0.42-1.52)
P-values			0.04	0.19	0.49
OR's for yes (*adj*)		1.00	0.50	0.58	0.74
CI			(0.25-0.99)	(0.28-1.21)	(0.38-1.44)
P-values			0.05	0.15	0.38

5.5.9. Maternal work (combined) and health at birth and after birth

Percentage distribution of the maternal work (combined) by health of the child at and after birth is shown in table 11. Although none of the logistic regression is significant for the healthy at birth, odd ratios in the table indicates that those women who have notable reduction at work will give the birth of unhealthy child compared to those who had some reductions and stopped to do work. In the same vein, women who stopped to do work during pregnancy have almost no risk of having unhealthy child at birth. In the same way, women who have some reduction at work during pregnancy are more likely to get unhealthy after birth, which is statistically significant too. Other group those who stopped their work have less probability of having unhealthy child after birth compared with those who had notable reduction and some reduction at work.

6. DISCUSSION

6.1. Maternal work and Birth weight

One of the aims of this study was to assess the relationship of maternal work with birth weight of child by controlling for other factors that may affect fetal growth. The results are generally consistent with those studies from developing countries but differ in some important details.

A previous study also suggests that, heavy agricultural work for 6, 7 or 8 months has no significant effect on birth weight or gestation duration. It would suggests that either fetal growth is adversely affected only in the ninth month of heavy work or, more likely, that being free from agricultural work in the ninth month permits catch-up from growth restriction occurring during 6, 7 or 8 months of heavy work (Briend A., 1980). Previous reports of the effect of agricultural work on birth weight are limited to the Gambia, Tanzania, Ethiopia and the US (Tafari N et al, 1980; Roberts S. et al, 1982; Bantje H., 1983; Fenster L. et al, 1990). In the Gambia, a significant reduction in birth weight occurs during the rainy season, which is characterized by heavy work combined with food shortage and malaria (Roberts S. et al, 1982; Paul A. et al, 1979; Prentice A. 1981). In Tanzania, with a similar seasonal cycle, no reduction in birth weight occurred in 1979 when flooding curtailed agricultural work (Bantje H., 1983). In Ethiopia, pregnant women engaged in hard physical labor had lower mean weight gain and lighter infants than homemakers with domestic help or women working in sedentary jobs with domestic help (Tafari N. et al, 1980). These study, however failed to adjust for potentially important confounder. In contrast, no reduction in birth weight was found among Hispanic women engaged in agriculture in California (Fenster L. et al, 1990). This could be due to inadequate control of confounding variables. A negative correlation was found between physical workload and growth retardation in the new born of working women in Finland (Nurminen et al., 1989).

Although this study concentrated only in the impact of maternal household work and outside work, not on the timing of the reduction in work or stopped to work, it has examined the combined effects of maternal work on birth weight. Women who worked less heavily during the time of pregnancy have only small risk of giving the birth of low

weight child compared to those who worked same as before. Women who stopped their work have higher risk of giving birth of 2750 gm or less weighted child as compared to the women, who worked same as before pregnancy. Women who stopped working(combined work) have higher risk of having child of birth weight 2750 or less, but lower risk for notable reduction group of women, compared to those who did their work same as before pregnancy. Similarly, apart from maternal outside and household work, which is a raised risk of giving birth of higher weight of child, has no significant relation with other birth weight group.

The birth weight of child was not collected in a numeric form for all the cases. Women whose delivery was not in hospital, did not measure the birth weight, however they reported the estimated birth weight of child, as very small, little small, commonly, a little big and very big, which might not give the exact information of birth weight. In order to avoid such information, women should encourage measuring the birth of child and remembering it; or possibly take help from midwives, so that midwives will measure the birth weight and remind to the mother.

6.2. Maternal work and Timing of birth

Another aim of this study was to examine the relationship of maternal work during pregnancy and timing of birth. Although with no statistical significance result, this study show that working during pregnancy either inside (household) work or outside work or combined (household and outside) work is not significantly associated to the preterm birth. However, women working same as before pregnancy have small risk of having preterm birth. Mothers who stopped completely their work during the time of pregnancy are less likelihood to give preterm birth, compared to no changed group of women. Those women who have some reduction at work and those who stopped to do work have more risk of having preterm birth compared to notable reduction group of women.

In other similar studies, two individual working conditions that were associated with preterm birth, standing and long working hours have been identified as risk factors in many other studies (Klebanoff MA. et al, 1990; Henriksen TB. et al, 1995; Luke B. et al, 1995; Mamelle N. et al, 1984; McDonald AD. et al, 1988).

No increase in preterm birth was observed in a study among women who worked rotating shifts. McDonald et al, 1988; observed almost the same level of risk (OR 1.9, P

< 0.01) among services workers (Industrial Sector 5: food and beverage servers, housekeeper, hairdressers, laundry worker, agriculture workers) exposed to shift work. In contrast to some studies (Mamelle N. et al, 1984; McDonald AD et al, 1988; Fortier I. et al, 1995; Luke B. et al, 1995), working an extended workweek resulted in a decreased risk of preterm delivery. In a study, Cavlli A. and Tanaka T., 2001; found that household work was related to preterm birth. Mothers who did half or less of their household work delivered 9.4% of the preterm babies compared with the 4.9% delivered by the mothers who completed all work.

Although the timing of birth was not measured exactly in a numeric form during data collection, it was later changed into this order by considering the early and too early birth as preterm birth. Therefore, considering of getting the exact information from the respondent like women from low-income societies, effective approaches should be done.

6.3. Maternal work and Methods of delivery

The results from this study show that working less heavily and stopped to do work, outside home is positively associated with the Cesarean delivery. Lower the level of the work during the time of pregnancy more likelihood of having Cesarean delivery. Women who worked less heavily during the time of pregnancy have less probability of having Cesarean delivery compared to the women who worked same as before. In the same study working inside home (household work) has not any significant association with the Cesarean delivery, but only the stopped to do work (combined household and outside work) is associated with cesarean delivery, which is highly significant. The findings suggest that for most women, working during pregnancy, even at it heavily as before pregnancy does not put them at greater risk for cesarean delivery rather than a spontaneous birth. The term cesarean delivery is the delivery of a fetus through a surgical incision through the abdominal wall (laparoscopy) and uterine wall (hysterectomy).

In this study, it can be observed that women who have done less work or stopped to do work during the time of pregnancy have high incidence of Cesarean delivery. Mayberry et al. (1999) showed that maternal fatigue during the second stage of labor was associated with increased caesarean and instrumental deliveries. This suggests that

fatigue during pregnancy might persist into labor, which in turn might result in more caesarean deliveries.

6.4. Maternal work and Health of child at birth and after birth

In this study, only the notable reduction in combined (household and outside) work is significantly associated with health status of child after birth. Less heavily, workers have almost no risk of having unhealthy child compared to stop group of women. Women who stopped their work have small probability of giving birth of unhealthy child, compared to those who worked same as before, but none of them is statistically significant. In the same table, women working same as before pregnancy are having less risk of getting unhealthy child. Although none of the logistic regression is significant for the healthy at birth, odd ratios in the table indicates that those women who have notable reduction at work will give the birth of unhealthy child compared to those who had some reductions and stopped to do work. No study was found to have assessed the effects of maternal work on Childs health at birth and after birth; however, it is interesting to observe that risk of having healthy baby at birth is high for those women who have some reduction and notable reduction at work and less heavily in household work during the time of pregnancy.

This study is only concerned with the health condition of child at birth and after birth not to the problem or diseases of unhealthy birth since most of the child was healthy at birth and even after birth. This study also suggest that, enough exercise like working outside or inside the home during the time pregnancy will give the healthy birth outcome. Avoiding smoking, drinking alcohol and using illicit drugs while pregnant can have serve and long lasting health effects for both mother and child and clearly been linked to poor birth outcomes.

7. LIMITATION OF THE STUDY

Several potential limitations of this study must also be considered. Exposures for this study (working as household or outside), were collected retrospectively through the structured questionnaire, most of the respondent may not give the accurate answer, recall bias may have occurred. Exposures were roughly measured. Some of the non-significant associations of exposures and outcomes might be due to lack of statistical power. Only the work same as before pregnancy, less heavily and stopped to do work, were included in the logistic regression analysis, time of starts to do less heavy work and time of stopped to do the work were excluded. Birth weight of the all children were not reported in a numeric value, since some of the women had given the birth of child at home, where they did not measure the birth weight of child. Such birth weights, which were estimated by mother and reported in word instead of numeric value, might not be true and exact for all the cases. During data collection, some women who were absent from home, data were provided by other family members. Proxy repondent may not answer correctly the questions regarding mother's situation when she was pregnant. Gestational age birth was alos not collected directly during data collection; it was converted from indirect response to obtain the timing of birth. It might not possibly estimate the correct gestational age at birth. Since, the data were collected in Chinese language in the beginning, the official language of China, and later, was translated into English; meaning of some words might not be exact to what women answered.

The methods of quantify and categories the birth time of baby are the points to note in this study. Questions initially did not ask about the gestational age of birth to categories it as preterm birth. In this sense, it would be important to know the exact gestational age of birth instead of much earlier, earlier, a little earlier, expected time and late than intended would. However, the categorization is done for the analysis in this study, by considering the much earlier, earlier and little earlier birth is in the category of preterm birth.

8. CONCLUSION

Working less heavily or same as before pregnancy do not put the baby harm, but stopped to do either household or outside work may results low birth weight baby. Working less heavily during the time of pregnancy has only small risk of giving the birth of low weight child. Likewise, reduction in both household and outside work or stopped to do of the work has high risk of having preterm birth and cesarean delivery. Small reduction or working same as before, in either of the work associated with the birth of healthy child. Maternal age, parity and prenatal visits also play the significant role to the impacts of maternal work on birth outcome.

However, the maternal work alone does not seem as factor of reducing or increasing birth weight and impacts on other birth outcome, nutritional status of mother during the time of pregnancy, other social factors, physical activities and outside work other than farming work(outside work), could also associate with the birth outcome, which requires further study, particularly in developing countries. Workload and working conditions of women has been changing all the time, comparing to the maternal work and its relation with birthoutcome before some years it may have posed a true risk to fetal growth but may not do so now in the same way. It is all because of changing the demographic characteristics with the development of new era.

9. ACKNOWLDGEMENT

This work of my thesis has been an inspiring and challenging experience to me.
This study (KAP survey) was carried out in 20 township of a provinence of rural China. Some parts of collected data were used for the Master's thesis, in Tampere school of public health.

I wish to express my sincere gratitude to Prof. Elina Hemminki, STAKES, who guided this work and helped whenever I was need. Without her help, this work would not be possible, also equally thankful for providing me the data of KAP survey. I am also indebted to the KAP survey team, especially to Zhuochun Wu, school of public health Fudan University, China who helped in some of the problem of data from China.

I wish to express my warm and sincere thanks to the prof. Clas-Håkan Nygård for his valuable support and suggestions, also for choosing me in this master's programme in Tampere school of Public Health. Special thanks to Prof. Riitta Luoto for her advice, also statistician Anna Maija Koivisto, for her invaluable help to analyze the data.

I am grateful to my colleagues whose help is valuable in this work. Equally thankful to my friend and roommate Bishwas Hamal for his constant encouragement and outstanding advice to make this thesis work successful. I would also like to thank to my sister Anupama KC for her constant support.

Finally, I would like to express my deepest gratitude for the constant support and encouragement that I received from my mother and all others of my family.

I dedicate this thesis to my late father.

November 8, 2007, Tampere

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11. APPENDICES

Appendix 1: Measurement of exposures and background characteristics.

A. Maternal occupation by background characteristics

Table 12:- Distribution of the maternal occupation by background characteristics.

	Maternal age			Parity		
	≤ 24	25-29	≥ 30	1	2	3
Maternal occupation						
Farmer	378(81.5)	474(85.9)	326(90.6)	756(85.9)	301(93.2)	160(71.7)
Non-farmer	86(18.5)	78(14.1)	34(9.4)	124(14.1)	22(6.8)	63(28.3)
Total	464(100)	552(100)	360(100)	880(100)	323(100)	223(100)

Table 13: Occupation by prenatal visits

	Prenatal visits				
Maternal occupation	**3 mo or less**	**4-5 mo**	**6 mo**	**7-9 mo**	**No care**
Farmer	536 (83.6)	239 (83.9)	117 (86.6)	193 (89.4)	132 (86.8)
Non-farmer	105 (16.4)	46 (16.1)	15 (11.4)	23 (10.6)	20 (13.2)
Total	641 (100.0)	285 (100.0)	132 (100.0)	216 (100.0)	152 (100.0)

B. Exposures by background characteristics

Table 14:- Distribution of exposures by background characteristics

Exposures	**n= 1479**	**Maternal age**			**parity**		
Outside work		<=24 (n=482),%	25-29 (n=573), %	>=30 (n=374),%	1(n=905), %	2(n=338), %	>3(n=236), %
Same as before	444(30.0)	118 (24.6)	176 (30.8)	135 (36.2)	243 (26.9)	128 (37.9)	73 (31.5)
Less heavily	881(59.6)	295 (61.6)	340 (59.5)	211 (56.6)	548 (60.7)	189 (55.9)	144 (62.1)
Stopped	148(10.0)	66(13.8)	55 (9.6)	27 (7.2)	112 (12.4)	21 (6.2)	15 (6.5)

Total	1473(99.6)	479 (100)	571 (100)	373 (100)	903 (100)	338 (100)	232 (100)
Household work							
Same as before	764(51.7)	224 (46.8)	300 (52.6)	216 (57.9)	438 (48.6)	205 (60.7)	121 (52.2)
Less heavily	653(44.2)	239 (49.9)	245 (43.0)	144 (38.6)	420 (46.6)	125 (37.0)	108 (46.6)
Stopped	55(3.7)	16 (3.3)	25 (4.4)	13 (3.5)	44 (4.9)	8 (2.4)	3 (1.3)
Total	1472(99.5)	479 (100)	570 (100)	373 (100)	902 (100)	338 (100)	232 (100)
Combined work							
No changed	418 (28.3)	109 (22.9)	166(29.2)	131(35.1)	226(25.1)	124(36.7)	68(29.6)
Reduction	576(38.9)	204(42.8)	215(37.9)	134(35.9)	363(40.3)	116(34.3)	97(42.2)
Notable reduction	310(21.0)	94(19.7)	122(21.5)	80(21.4)	186(20.7)	75(22.2)	49(21.3)
Stopped	164(11.1)	70(14.7)	65(11.4)	28(7.5)	125(13.9)	23(6.8)	16(7.0)
Total	1468(99.03)	477(100.0)	568(100.0)	373(100.0)	900(100.0)	338(100.0)	230(100.0)

Table 15:- Exposure by prenatal visits

Exposures	**n= 1479**	**Prenatal visits**				
		3 mo or less	**4-5 mo**	**6 mo**	**7-9 mo**	**No care**
Outside work						
Same as before	444(30.0)	181(27.4)	79 (26.1)	47 (34.6)	76 (34.7)	61 (39.6)
Less heavily	881(59.6)	434(65.7)	183 (60.4)	72 (52.9)	113 (51.6)	79 (51.3)
Stopped	148(10.0)	46 (7.0)	41 (13.5)	17 (12.5)	30 (13.7)	14 (9.1)
Total	1473(99.6)	661(100.0)	303(100.0)	136(100.0)	219(100.0)	154(100.0)
Household work						
Same as before	764(51.7)	306 (46.3)	151 (49.7)	86 (62.8)	129 (58.9)	92 (60.9)
Less heavily	653(44.2)	338 (51.1)	133 (43.8)	45 (32.8)	81 (37.0)	56 (37.1)
Stopped	55(3.7)	17 (2.6)	20 (6.6)	6 (4.4)	9 (4.1)	3 (2.0)
Total	1472(99.5)	661(100.0)	304(100.0)	137(100.0)	219 (100.0)	151(100.0)
Combined work						
No changed	418 (28.3)	167(25.3)	73(24.1)	47(34.6)	73(33.3)	58(38.4)
Reduction	576(38.9)	306(46.4)	115(38.0)	40(29.4)	66(30.1)	49(32.5)
Notable reduction	310(21.0)	134(20.3)	67(22.1)	31(22.8)	48(21.9)	30(19.9)
Stopped	164(11.1)	52(7.9)	48(15.8)	18(13.2)	32(14.6)	14(9.3)
Total	1468(99.03)	659(100.0)	303(100.0)	136(100.0)	219(100.0)	151(100.0)

Appendix 2: Measurement of outcome variables

A. Distribution of outcome by background characteristics.

Table 16:- Distribution of outcome variables.

Characteristics	Categories	n	%
Birth Wt.	≤2750	78	5.3
	2751-2999	308	20.8
	3000-3499	492	33.3
	≥3500	563	38.1
	No information	38	2.6
	Total	1479	100
Timing of birth	Preterm	291	19.7
	Expected time	994	67.2
	Late	166	11.2
	No information	28	1.9
	Total	1479	100
Delivery methods	Spontaneous	1226	82.9
	Assisted breech	39	2.6
	Cesarean	107	7.2
	Other	99	6.7
	No information	8	0.5
	Total	1479	100
Healthy at birth	Yes	1376	93.0
	No	36	2.4
	No information	67	4.5
	Total	1479	100
Healthy after birth	Yes	1379	93.2
	No	92	6.2
	No information	8	0.5
	Total	1479	100

Table 17: Distribution of outcome by occupations.

Birth Wt.	N (%)	Occupation	
		Farmer, n=1217(%)	Non-marmer, n=209(%)
≤2750	65 (4.4)	63(5.3)	9(4.5)
2751-2999	320 (21.6)	263(22.1)	34(16.8)
3000-3499	491 (33.2)	412(34.6)	67(33.2)
≥3500	565 (38.2)	452(38.0)	92(45.5)
Total	1479 (100)	1190(100)	202(100)
Time of birth			
Preterm	291 (19.1)	224(18.8)	53(25.7)
Expected time	994 (67.2)	835(69.9)	127(61.7)
Late	166 (11.2)	135(11.3)	26(12.6)
Total	1479 (100)	1194(100)	206(100)
Delivery methods			
Spontaneous	1226 (82.9)	1015(83.8)	165(79.7)
Assisted breech	39 (2.6)	29(2.4)	5(2.4)
Cesarean	107 (7.2)	80(6.6)	25(12.1)
Other	99 (6.7)	87(7.2)	12(5.8)
Total	1479 (100)	1211(100)	207(100)
Health at birth			
Good	1376 (93%)	1143(97.6%)	189(97.6)
Bad	36 (2.4)	28(2.4)	5(2.6)
Total	1479 (100)	1171 (100)	194 (100)
Health after birth			
Good	1379 (93.2)	1129(93.3)	201(96.6)
Bad	92 (6.2)	81(6.7)	7(3.4)
Total	1479 (100)	1210(100)	208(100)

Table 18: Distribution of the outcome by age and parity.

Birth Wt.	**N (%)**	**Parity (n=1479)**		
		1(n=905)	**2(n=338)**	**>3(n=236)**
≤2750	65 (4.4)	52(5.9)	19(5.8)	7(3.0)
2751-2999	320 (21.6)	189(21.4)	76(23.2)	43(18.6)
3000-3499	491 (33.2)	319(36.2)	99(30.2)	74(32.0)
≥3500	565 (38.2)	322(36.5)	134(40.9)	107(46.3)
Total	1479 (100)	882(100)	328(100)	231(100)
Time of birth				
Preterm	291 (19.1)	159(17.9)	74(22.1)	58(25.6)
Expected time	994 (67.2)	619(69.6)	238(71)	137(60.4)
Late	166 (11.2)	111(12.5)	23(6.9)	32(14.1)
Total	1479 (100)	889(100)	335(100)	227(100)
Delivery methods				
Spontaneous	1226 (82.9)	733(81.3)	291(86.9)	202(86.3)
Assisted breech	39 (2.6)	26(2.9)	9(2.7)	4(1.7)
Cesarean	107 (7.2)	65(7.2)	24(7.2)	18(7.7)
Other	166 (11.2)	78(8.6)	11(3.3)	10(4.3)
Total	1479 (100)	902(100)	335(100)	234(100)
Healthy at birth				
Yes	1376 (93)	846(97.7)	306(95.6)	224(99.1)
No	36 (2.4)	20(2.3)	14(4.4)	2(0.9)
Total	1479 (100)	866(100)	320(100)	226(100)
Healthy after birth				
Yes	1379 (93.2)	851(94.6)	305(91)	223(94.5)
No	92 (6.2)	49(5.4)	30(9)	13(5.5)
Total	1479 (100)	900(100)	335(100)	236(100)

Table 19: Distribution of outcome by parity

Birth Wt.	**Parity (n=1479)**		
	1(n=905)	**2(n=338)**	**>3(n=236)**
≤2750	52(5.9)	19(5.8)	7(3.0)
2751-2999	189(21.4)	76(23.2)	43(18.6)
3000-3499	319(36.2)	99(30.2)	74(32.0)
≥3500	322(36.5)	134(40.9)	107(46.3)
Total	882(100)	328(100)	231(100)
Time of birth			
Preterm	159(17.9)	74(22.1)	58(25.6)
Expected time	619(69.6)	238(71)	137(60.4)
Late	111(12.5)	23(6.9)	32(14.1)
Total	889(100)	335(100)	227(100)
Delivery methods			
Spontaneous	733(81.3)	291(86.9)	202(86.3)
Assisted breech	26(2.9)	9(2.7)	4(1.7)
Cesarean	65(7.2)	24(7.2)	18(7.7)
Other	78(8.6)	11(3.3)	10(4.3)
Total	902(100)	335(100)	234(100)
Healthy at birth			
Yes	846(97.7)	306(95.6)	224(99.1)
No	20(2.3)	14(4.4)	2(0.9)
Total	866(100)	320(100)	226(100)
Healthy after birth			
Yes	851(94.6)	305(91)	223(94.5)
No	49(5.4)	30(9)	13(5.5)
Total	900(100)	335(100)	236(100)

Table 20: Outcome by number of prenatal visits

	N (%)	Prenatal visits				
		3 mo or less	4-5 mo	6 mo	7-9 mo	No care
Birth Wt.						
≤2750	65 (4.4)	34 (5.3)	12 (4.1)	10 (7.5)	13 (6.0)	9 (5.8)
2751-2999	320 (21.6)	92 14.2)	85 (29.0)	20 (15.0)	60 (27.9)	51 (33.1)
3000-3499	491 (33.2)	251 (38.9)	91 (31.1)	30 (22.6)	71 (33.0)	49 (31.8)
≥3500	565 (38.2)	269 (41.6)	105 (35.8)	73 (54.9)	71 (33.0)	45 (29.2)
Total	1479 (100)	646 (100.0)	293(100.0)	133 (100.0)	215 (100.0)	154 (100.0)
Timing of birth						
Preterm	291 (19.1)	137 (20.7)	73 (24.0)	22 (16.1)	35 (16.0)	24 (18.8)
Expected time	994 (67.2)	449 (67.7)	200 (65.8)	82 (59.9)	171 (78.1)	92 (71.9)
Late	166 (11.2)	77 (11.6)	31 (10.2)	33 (24.1)	13 (5.9)	12 (9.4)
Total	1479 (100)	663 (100.0)	304(100.0)	137 (100.0)	219 (100.0)	128 (100.0)
Delivery methods						
Spontaneous	1226 (82.9)	547 (82.8)	252 (82.9)	111(82.2)	180 (82.9)	136 (88.3)
Assisted breech	39 (2.6)	18 (2.7)	8 (2.6)	5 (3.7)	4 (1.8)	4 (2.6)
Cesarean	107 (7.2)	48 (7.3)	24 (7.9)	7 (5.2)	17 (7.8)	11 (7.1)
Other	166 (11.2)	48 (7.3)	20 (6.6)	12 (8.9)	16 (7.4)	3 (1.9)
Total	1479 (100)	661 (100.0)	304(100.0)	135 (100.0)	217 (100.0)	154 (100.0)
Healthy at birth						
Yes	1376 (93)	611 (97.9)	283 (96.9)	130 (98.8)	210 (96.8)	142 (96.6)
No	36 (2.4)	13 (2.1)	9 (3.1)	2 (1.5)	7 (3.2)	5 (3.4)
Total	1479 (100)	624 (100.0)	292(100.0)	132 (100.0)	217 (100.0)	147 8100.0)
Healthy after birth						
Yes	1379 (93.2)	630 (95.5)	279 (92.4)	127 (92.7)	201 (92.2)	142 (92.2)
No	92 (6.2)	30 (4.5)	23 (7.6)	10 (7.3)	17 (7.8)	12 (7.8)
Total	1479 (100)	660 (100.0)	302(100.0)	137 (100.0)	218 (100.0)	154 (100.0)

B. Distribution of Outcome by exposures

Table 21: The distribution of the outcome by outside work and household work less heavily from the month.

Birth Wt.	N (%)		Outside work (less heavily from the month)			Outside work (stopped from the month)		
		Same as before, n (%)	0-3 (n=483) %	4-6 (n=21) %	7-9(n=48) %	0-3 (n=83)%	4-6 (n=333) %	7-9(n=57)%
≤2750	65 (4.4)	29 (6.6)	27(5.8)	2(9.5)	5(10.6)	6(7.4)	7(2.2)	2 (3.5)
2751-2999	320 (21.6)	107(24.4)	113(24.2)	3(14.3)	12(25.5)	17(21.0)	46(14.4)	9(15.8)
3000-3499	491 (33.2)	132(30.1)	170(36.4)	4(19.0)	15(31.9)	20(24.7)	119(37.2)	25(43.9)
≥3500	565 (38.2)	171(39.0)	157(33.6)	12(57.1)	15(31.9)	38(46.9)	148(46.3)	21(36.8)
Total	1479 (100)	439 (100)	467(100)	21(100)	47(100)	81(100)	320(100)	57(100)
Time of birth								
Preterm	291 (19.1)	98 (22.1)	89(18.9)	3(15)	11(23.4)	15(18.1)	53(16.6)	20(35.1)
Expected time	994 (67.2)	304(68.6)	332(70.6)	17(85)	32(68.1)	59(71.1)	213(66.6)	29(50.9)
Late	166 (11.2)	41 (9.3)	49(10.4)	0	4(8.5)	9(10.8)	54(16.9)	8(14.0)
Total	1479 (100)	443 (100)	470(100)	20(100)	47 (100)	83(100)	320(100)	57(100)
Delivery methods								
Spontaneous	1226(82.9)	381(86.4)	392(81.3)	20(95.2)	39(81.3)	65(79.3)	274(82.8)	45(80.4)
Assisted breech	39 (2.6)	13(2.9)	13(2.7)	0	3(6.3)	0	9(2.7)	1(1.8)
Cesarean	107 (7.2)	21(4.8)	41(8.5)	1(4.8)	4(8.3)	10(12.2)	24(7.3)	6(10.7)
Other	166 (11.2)	26(5.9)	36(7.5)	0	2(4.2)	7(8.5)	24(7.3)	4(7.1)
Total	1479 (100)	441(100)	482(100)	21(100)	9 (100)	82(100)	331 (100)	56 (100)
Healthy at birth								
Yes	1376 (93)	418(97.4)	445(96.5)	20(100)	46(95.8)	80(97.6)	301(98.4)	56(100)
No	36 (2.4)	11(2.6)	16(3.5)	0	2(4.2)	2(2.4)	5(1.6)	0
Total	1479 (100)	429(100)	461(100)	20(100)	48(100)	82(100)	306(100)	56(100)
Healthy after birth								
Yes	1379(93.2)	410(92.8)	445(92.9)	19(90.5)	43(89.6)	76(91.6)	322(97)	56(100)

No	92 (6.2)	32(7.2)	34(7.1)	2(9.5)	5(10.4)	7(8.4)	10(3.0)	0
Total	1479 (100)	442(100)	479(100)	21(100)	48(100)	83(100)	332(100)	56(100)

Table 22: The distribution of the outcome by household work (les heavily and stopped from the month).

Birth Wt.	**N (%)**		**Household work (less heavily from the month)**			**Household work (stopped from the month)**		
		Same as before (n=764)%	**0-3 (n=299) %**	**4-6 (n=246) %**	**7-9(n=104) %**	**0-3 (n=22)%**	**4-6 (n=7)%**	**7-9 (n=34)%**
≤2750	65 (4.4)	46 (6.1)	18(6.1)	8(3.4)	2(2.1)	2(9.5)	0	2 (5.9)
2751-2999	320 (21.6)	185 (24.6)	72(24.5)	28(11.9)	11(11.7)	2(9.5)	0	11(32.4)
3000-3499	491 (33.2)	239 (31.8)	95(32.3)	105(44.)	38(40.4)	1(4.8)	2(28.6)	10(29.4)
≥3500	565 (38.2)	282 (37.5)	109(37.)	95(40.3)	43(45.7)	16(76.2)	5(71.4)	11(32.4)
Total	1479 (100)	752 (100)	294(10)	236(10)	94(100)	21(100)	7(100)	34(100)
Time of birth								
Preterm	291 (19.1)	154 (20.4)	49(16.8)	46(19.5)	27(26.5)	6(27.3)	1(16.7)	11(33.3)
Expected time	994 (67.2)	524 (69.3)	222(76)	157(66.)	51(50)	12(54.5)	5(83.3)	17(51.5)
Late	166 (11.2)	78 (10.3)	21(7.2)	33(14)	24(23.5)	4(18.2)	0	5(15.2)
Total	1479 (100)	756 (100)	292(10)	236(10)	102(10)	22(100)	6(100)	33(100)
Delivery methods								
Spontaneous	1226(82.9)	642(84.5)	245(82.)	201(82)	85(82.5)	19(86.4)	5(71.4)	29(85.3)
Assisted breech	39 (2.6)	23(3)	9(3)	3(1.2)	2(1.9)	0	0	2(5.9)
Cesarean	107 (7.2)	47(6.2)	27(9.1)	19(7.8)	9(8.7)	2(9.1)	1(14.3)	2(5.9)
Other	166 (11.2)	48(6.3)	16(5.4)	22(9)	7(6.8)	1(4.5)	1(14.3)	1(2.9)
Total	1479 (100)	760(100)	297(100)	245(100)	103(100)	22(100)	7 (100)	34(100)
Healthy at								

birth								
Yes	1376 (93)	717(97.2)	287(98)	215(97.3)	94(98.9)	21(95.5)	7(100)	32(97)
No	36 (2.4)	21(2.8)	6(2)	6(2.7)	1(1.1)	1(4.5)	0	1(3)
Total	1479 (100)	738(100)	293(100)	221(100)	95(100)	22(100)	7(100)	33(100)
Healthy after birth								
Yes	1379(93.2)	704(92.9)	275(92.3)	235(95.9)	104(100)	21(95.5)	7(100)	31(91.2)
No	92 (6.2)	54(7.1)	23(7.7)	10(4.1)	0	1(4.5)	0	0
Total	1479 (100)	758(100)	298(100)	245(100)	104(100)	22(100)	7(100)	104(100)

Appendix 3: **Assessment of Potential Confounders**

Table 23:- **OR (95% CI) and p-values from multinomial logistic regression for birth weight for the outside workers compared with birth weight ≥3500 gm.**

Working Outside	**≤2750**			**2751–2999**			**3000–3499**		
	OR	**95 % CI**	**P-value**	**OR**	**95 % CI**	**P-value**	**OR**	**95 % CI**	**P-value**
Same as before	1.00	reference		1.00	reference		1.00	reference	
Less heavily									
unadjusted	0.64	0.38–1.09	0.10	0.82	0.60–1.11	0.21	1.26	0.95–1.65	0.09
adjusted	0.65	0.38–1.11	0.11	0.85	0.62–1.17	0.32	1.24	0.93–1.65	0.13
Stopped									
unadjusted	1.25	0.61–2.57	0.53	0.81	0.49–1.33	0.41	0.84	0.53–1.34	0.48
adjusted	1.12	0.53–2.38	0.75	0.83	0.50–1.38	0.47	0.80	0.50–1.28	0.36

Table 24:- **OR (95% CI) and p-values form multinomial logistic regression for birth weight for household workers compared with birth weight ≥3500 gm.**

Working Household	**≤2750**			**2751–2999**			**3000–3499**		
	OR	**95 % CI**	**P-**	**OR**	**95 % CI**	**P-**	**OR**	**95 % CI**	**P-**

			value			value			value
Same as before	1.00	reference		1.00	reference		1.00	reference	
Less heavily									
unadjusted	0.68	0.41–1.13	0.14	0.68	0.50–0.90	<0.01	1.13	0.88–1.45	0.30
adjusted	0.68	0.40–1.14	0.14	0.71	0.52–0.96	0.02	1.07	0.83–1.38	0.58
Stopped									
unadjusted	0.81	0.27–2.42	0.71	0.50	0.24–1.06	0.07	0.39	0.18–0.82	0.01
adjusted	0.75	0.25–2.27	0.61	0.46	0.21–0.98	0.04	0.37	0.18–0.79	0.01

Table 25:- Percentage distribution of the time of birth by outside work with adjusted and unadjusted OR's, 95% CI, and *P*-values.

	Outside work			
	n (1479)	**% 0f same as before**	**% less heavily**	**% stopped**
Time of birth				
preterm	291	22.1	19.1	19.0
expected time	994	68.6	67.7	72.8
late	166	9.3	13.2	8.2
Total	1447	100	100	100
OR of preterm[5] *(unadjusted)*		1.00	1.20	1.20
CI			(0.91–1.59)	(0.75–1.92)
P-values			0.19	0.43
OR of preterm (adjusted)		1.00	1.15	1.09
CI			(0.86–1.54)	(0.67–1.76)
P-values			0.34	0.71

Table 26:- Percentage distribution of the time of birth by household work with adjusted and unadjusted OR's, 95% CI, and *P*-values.

Time of birth[6]	n= 1479	Household work		
		% of Same as before	% of Less heavily	% of Stopped
Preterm	291	20.4	19.2	25.9
Expected time	994	69.3	68.3	59.3
late	166	10.3	12.5	14.8
Total	1447	100	100	100
OR's for preterm (*unadj*)		1.00	1.07	0.73
CI			(0.82-1.40)	(0.38-1.37)
P-values			0.60	0.33
OR's for preterm (*adj*)		1.00	1.07	0.69
CI			(0.81-1.41)	(0.36-1.32)
P-values			0.60	0.26

Table 27:- Percentage distribution of outside work by methods of delivery with odd ratios, 95% CI, and p-values.

Methods of delivery	n=1479	Outside work		
		% of same as before	% of less heavily	% of stopped
Spontaneous	1226	86.4	82.1	81.6
Assisted breech	39	2.9	2.6	2.0
Cesarean	107	4.8	8.1	10.2
Others	99	5.9	7.2	6.1
Total	1471	100	100	100
OR's for Cesarean [7] (*unadj*)		1.00	0.56	0.44

[6] For all regression analysis, timing of birth have been categorized into two, preterm birth and non-preterm birth, where non-preterm contains both birth at expected time and late birth

[7] For all regression analysis, methods of delivery is categorized into two, Cesarean and other, where other contains Assisted Breech, spontaneous and others methods of delivery.

CI		(0.34-0.93)	(0.22-0.87)
P-values		0.02	0.02
OR's for Cesarean (*adj*)	1.00	0.52	0.40
CI		(0.31-0.89)	(0.19-0.82)
P-values		0.01	0.01

Table 28:- Percentage distribution of the methods of delivery by household work with OR's, 95% of CI and P-values.

Methods of delivery	**n=1479**	**Household work**		
		% of same as before	**% of less heavily**	**% of stopped**
Spontaneous	1226	84.5	82.0	83.6
Assisted breech	39	3.0	2.2	3.6
Cesarean	107	6.2	8.6	7.3
Others	99	6.3	7.2	5.5
Total	1471	100	100	100
OR's for Cesarean (*unadj*)		1.00	0.69	0.84
CI			(0.46-1.04)	(0.29-2.42)
P-values			0.08	0.74
OR's for Cesarean (*adj*)		1.00	0.70	0.83
CI			(0.46-1.07)	(0.28-2.44)
P-values			0.10	0.74

Table 29:- Percentage distribution of the health at birth and health after birth by Outside work with OR's, 95% CI and P-values.

Healthy at birth	**n=1479**	**Outside work**		
		% of same as before	**% of less heavily**	**% of stopped**
Yes	1376	97.4	97.5	97.3
No	36	2.6	2.5	2.7

Total	1412	100	100	100
OR's for yes (*unadj*)		1.00	0.98	1.07
CI			(0.47-2.06)	(0.33-3.41)
P-values			0.96	0.90
OR's for yes (*adj*)		1.00	1.09	1.23
CI			(0.51-2.34)	(0.37-4.02)
P-values			0.81	0.72
Healthy after birth				
Yes	1379	92.8	94.9	89.9
No	92	7.2	5.1	10.1
Total	1471	100	100	100
OR's for yes (*unadj*)		1.00	0.69	1.44
CI			(0.43-1.11)	(0.75-2.75)
P-values			0.12	0.26
OR's for yes (*adj*)		1.00	0.72	1.52
CI			(0.44-1.16)	(0.78-2.96)
P-values			0.18	0.20

Table 30:- Percentage distribution of the health at birth and health after birth by household work with OR's, 95% CI and P-values.

Healthy at birth	**n=1479**	**Household work**		
		% of same as before	**% of less heavily**	**% of stopped**
Yes	1376	97.2	97.9	96.3
No	36	2.8	2.1	3.7
Total	1412	100	100	100
OR's for yes (*unadj*)		1.00	0.76	0.56
CI			(0.17-3.33)	(0.12-2.56)
P-values			0.71	0.45
OR's for yes (*adj*)		1.00	0.77	0.61
CI			(0.17-3.49)	(0.13-2.89)
P-values			0.73	0.53

Healthy after birth				
Yes	1379	92.9	94.8	92.7
No	92	7.1	5.2	7.3
Total	1471	100	100	100
OR's for yes (*unadj*)		1.00	0.97	0.70
CI			(0.34-2.80)	(0.24-2.05)
P-values			0.96	0.52
OR's for yes (*adj*)[8]		1.00	0.97	0.76
CI			(0.33-2.85)	(0.25-2.26)
P-values			0.96	0.62

[8] All adjusted regression analysis was controlled for mother's age, prenatal visits and parity.